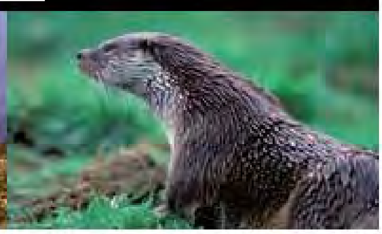
# The Status of EU Protected Habitats and Species in Ireland

Backing Documents, Article 17 forms, Maps
Volume 3



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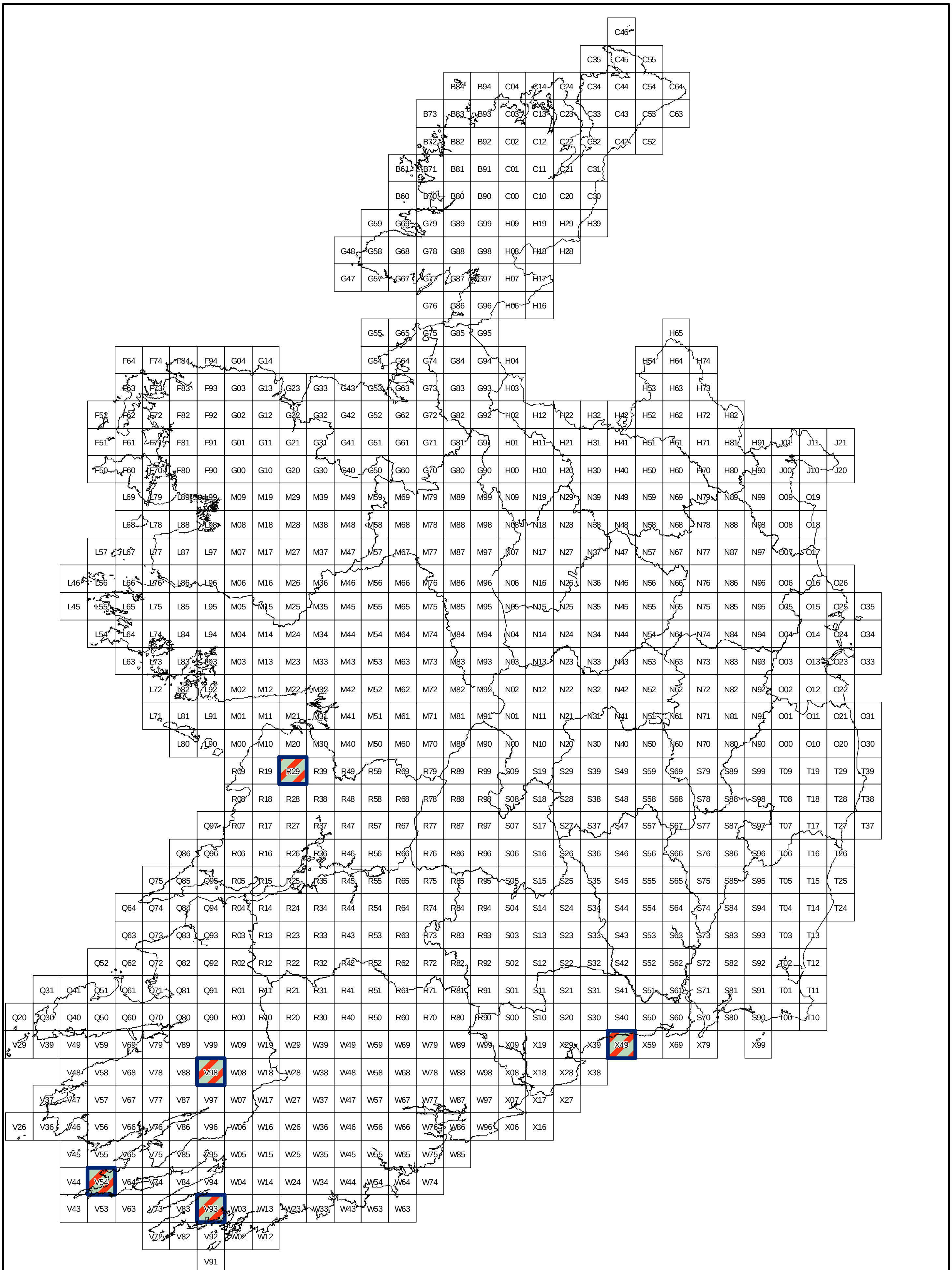
# 6130 Calaminarian grasslands of the *Violetalia calaminariae*

| National level | |
|---|---|
| **Habitat Code** | 6130 |
| **Member State** | IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Range within the country concerned |

| Biogeographic level (complete for each biogeographic region concerned) | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | Doyle, J. (1982). Minuartio-Thaspietum alpestris (Violetea calaminariae) in Ireland, *Journal of Life Sciences, Royal Dublin Society* **3**:143-146.<br>Lötschert, W. (1982). The heavy metal content of some Irish plants. *Journal of Life Sciences, Royal Dublin Society* **3**:261-266.<br>Holyoak, D.T. (2003). *The Distribution of Bryophytes in Ireland*. Broadleaf Books, Dinas Powys.<br>Holyoak, D.T. (2005). *Surveys of Rare and Threatened Bryophytes in North Co. Kerry and the South Midlands of Ireland*. Unpublished Report to National Parks and Wildlife Service, Dublin.<br>Holyoak, D.T. (2006). *Surveys of Rare and Threatened Bryophytes in South Co. Kerry and West Co. Cork*. Unpublished Report to National Parks and Wildlife Service, Dublin. |
| **Range** | In disjunct locations in the south and southwest of the country |
| Surface area | 500 km² |
| Date | 2007 |
| Quality of data | 2 = moderate |
| Trend | 0 = stable |
| Trend-Period | 1994-2007 |
| Reasons for reported trend | NA |
| **Area covered by habitat** | |
| Surface area | 0.03 (km$^2$) |
| Date | 06/07 |
| Method used | 1 = based on expert opinion |
| Quality of data | 2 = moderate |
| Trend | 0 = stable |
| Trend-Period | 1994-2007 |
| Reasons for reported trend | NA |
| Justification of % thresholds for trends | NA |
| Main pressures | 900 Erosion<br>501 Paths, tracks, cycling tracks<br>420 Discharges (covers waste disposal) |
| Threats | 900 Erosion<br>501 Paths, tracks, cycling tracks<br>420 Discharges (covers waste disposal)<br>141 Abandonment of pastoral systems |
| ***Complementary information*** | |
| **Favourable reference range** | 500 km² |
| **Favourable reference area** | 0.03 km² |
| **Typical species** | *Cephaloziella massalongi, Cephaloziella nicholsonii, Ditrichum cornubicum, Scopelophila cataractae, Cephaloziella stellulifera, Armeria maritima*, *Minuartia verna*, *Silene uniflora* |
| Typical species assessment | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | Not all typical species are present at each site.<br>A National Bryophyte survey is underway which may elucidate further areas occupied by this habitat.<br>This habitat is likely to be affected by inappropriate maintenance/reclamation in the vicinity of old mine shafts, e.g. covering with non-metal rich topsoil, there is no code to cover this threat. |

| ***Conclusions*** ***(assessment of conservation status at end of reporting period)*** | |
|---|---|
| **Range** | Favourable (FV) |
| **Area** | Favourable (FV) |
| **Specific structures and functions (incl. typical species)** | Favourable (FV) |
| **Future prospects** | Unfavourable Inadequate (U1) |
| **Overall assessment of CS** | Unfavourable Inadequate (U1) |



1:1,800,000

0 12.5 25 50 Kilometers

**Calaminarian grassland**

**6130**

Current Distribution (5 grid squares)
Current Range (5 grid squares)
Favourable Reference Range (5 grid squares)
W48 10km grid squares

Date: August 2007

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# CONSERVATION STATUS ASSESSMENT REPORT

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## 1. Habitat characteristics in Ireland

*Note: only sites supporting both the non-priority and priority (important orchid sites) variants of the habitat were selected for SAC status.

The 'Interpretation Manual of European Habitats' (2003) lists 6 or 7 Annex I grassland categories as occurring in Ireland (depending on whether or not the priority habitat is treated as a separate habitat). For the purposes of this report, the orchid-rich variant is treated as a subset of the calcareous grasslands.

Two of the 6 or 7 grassland habitats are assigned Priority Status, one of which is the category: 6210: Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites). O'Sullivan (1982) describes this grassland as occurring typically on the eskers and moraines of the Irish midlands and in the karst-dominated landscape of parts of the west of Ireland. He also notes that it grades into communities of the Centaureo-Cynosuretum galietosum in areas of a more general soil cover in the Burren and towards the base of eskers in the midlands. It is confined to shallow well-drained soils derived from Carboniferous Limestone.

The conservation status of orchid-rich grasslands is extremely difficult to assess without an intensive monitoring programme, as orchids are ephemeral species, often appearing one year and not the next. This absence of orchids in a particular year does not necessarily reflect a deterioration of site quality, but may merely be due to factors such as unfavourable weather conditions in that year. Thus, a decision was made during preparatory work for the Grassland Monitoring Project of SACs (GMP), ,in 2006 (Dwyer *et al*., 2007) that the presence or absence of orchids would not be used in the primary assessment criteria.

Therefore, in essence, the GMP conservation assessment was made on the non-priority grassland category: Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*). Whether these grasslands fall into the priority grassland category (i.e. whether they are important orchid sites[1]) is not possible to deduce without a more intensive and widespread monitoring programme. The same approach is used here in assessing the conservation status of the habitat in the entire country. Thus, unless specifically stated, the following assessment is on semi-natural dry calcareous grasslands (*Festuco-Brometalia*). Important orchid sites are a sub-set of this category.

## 2. Habitat mapping

The following data sources were used to map the known occurrences of semi-natural dry calcareous grasslands (including important orchid sites) in Ireland on a 10km square basis:

- Grassland Monitoring Project 2006 (Dwyer *et al*. 2007).
- The distribution, on a 10km square basis, of selected habitats in the Republic of Ireland (Conaghan, 2001).
- Habitat Assignment Project (NPWS, 2006) (see Appendix 2).
- NPWS Enquiry Database.

In mapping the current range, all 10km squares overlapped by an area of potential semi-natural dry calcareous grassland derived from one or more of the above sources were included. This will result in a small degree of error since SACs highlighted by the latter two sources may cover large areas (i.e. > one 10km square) while the semi-natural dry calcareous grassland within the SAC may be limited to a small area (i.e. within only one of the 10km squares). However, due to time constraints, all of the 10km squares in which the SAC occurs are included here when estimating the range of the habitat. This error does not apply to those 31 SAC sites that were surveyed by the Grassland Monitoring Project (GMP) in 2006 as the calcareous grassland within

[1] The EU Habitats Manual indicates that important orchid sites are determined on the basis of one or more of the following criteria: (1) The site hosts a rich suite of orchids, (2) The site hosts an important population of at least one orchid species considered not very common in the national territory, (3) The site hosts one or several orchid species considered to be rare, very rare, or exceptional in the national territory.

these SAC's has been digitally mapped. Thus the maps from the GMP were used to locate the areas of the habitat within these sites (further on in this report).

Additionally, since no comprehensive inventory of the national resource of semi-natural dry calcareous grasslands has been undertaken in Ireland there are likely to be further areas of the habitat present.

- Thus the 10km grid square data for each of the 28 species listed in the GMP as indicative of semi-natural dry calcareous grassland (not including the additional eight species listed as Burren and western indicator species see Section 5.2) was downloaded from the Botanical Society of the British Isles (BSBI) website (www.searchnbn.net). All records were analysed, including any of the more historic records such as those from the 19th Century. These were included in an attempt to counter-act the under-recording of species in recent years.
- Where 16 or more of the 28 species were found to occur within a 10km square and at least part of the square was composed (at least partially[2]) by limestone (assessed from the rock unit data received from the Geological Survey of Ireland), semi-natural dry calcareous grassland was considered likely to occur (or have occurred in the past). Thus, these squares were all included when mapping the current range of the habitat.

Clearly future fieldwork is required to establish whether or not semi-natural dry calcareous grassland does in fact occur within these squares.

- Furthermore, to assess the likelihood of the calcareous grassland being orchid-rich, the 10km square data for three species of orchid was also downloaded from the BSBI website. The species chosen were *Neotinea maculata*, *Ophrys apifera* and *Orchis morio* as these were considered by NPWS staff to be relatively uncommon and restricted mainly to calcareous grassland. Where any of these species had been recorded in the past within the range of semi-natural dry calcareous grassland

[2] This included the following categories listed by the GSI: Dinantian Pure Bedded Limestones, Dinantian Pure Unbedded Limestones, Dinantian Lower Impure Limestones, Dinantian Upper Impure Limestones, Dinantian Dolomitised Limestones, Dinantian Shales and Limestones, Dinantian (early) Sandstones, Shales and Limestones, and Dinantian Mixed Sandstones, Shales and Limestones.

estimated above, orchid-rich semi-natural dry calcareous grassland was considered likely to occur. In addition any 10km squares where all of the following suite of orchids have been recorded was also considered likely to support orchid-rich dry calcareous grassland: *Anacamptis pyramidalis*, *Coeloglossum viride*, *Gymnadenia conopsea* and *Listera ovata*.

Although those 10km squares highlighted above are thought more likely to be orchid-rich, the current range and the FRR of orchid-rich semi-natural dry calcareous grasslands is considered to be the same as was estimated for semi-natural dry calcareous grasslands (not orchid-rich) until such a time as more comprehensive field work has been carried out. However, although the range of the two habitats may turn out to be the same or similar, the actual extent of the orchid-rich habitat is likely to be much smaller and subset. This is because orchids will not always be present in semi-natural dry calcareous grassland and even where they are present, they can be restricted to a small proportion of a field or site in which the dominant habitat is semi-natural dry calcareous grassland.

Range was defined by mapping a minimum polygon around the identified occurrences (and likely occurrences). Breaks in the range were justified when there was a gap of greater than 2 grid squares between occurrences (not counting squares joined diagonally). Favourable reference range for both variants of the habitat, was defined as the current range as it was deemed that this was sufficient to ensure the long term viability of the habitat and that it encompassed the range of ecological variation that occurs in this habitat type in Ireland.

## 3 Habitat range

Semi-natural dry calcareous grasslands are characterised by the vegetation class Festuco-Brometea and order *Festuco-Brometalia*. These grasslands are predominantly found on the eskers and moraines of the Irish midlands and in the karst-dominated landscape of parts of the west of Ireland (O'Sullivan, 1982).

However, O Sullivan also states that it grades into communities of the Centaureo-Cynosuretum galietosum in areas of a more general soil cover in the Burren and towards the base of eskers in the midlands.

### 3.1 Conservation status of habitat range

The favourable reference range has been set as the current range therefore the status of the habitat range (both variants) is **favourable**.

**Current range of semi-natural dry grasslands and scrubland facies on calcareous substrate (Festuco-Brometalia):** 31,300km$^2$ (minimum polygon around grid cells containing habitat – 313 grid cells X 100km$^2$)
**Favourable reference range:** 31,300km$^2$ (defined as current range)

**Current range of semi-natural dry grasslands and scrubland facies on calcareous substrate (Festuco-Brometalia) (*important orchid sites):** 31,300km$^2$ (minimum polygon around grid cells containing habitat – 313 grid cells X 100km$^2$)
**Favourable reference range:** 31,300km$^2$ (defined as current range)

# 4 Habitat extent

Since no inventory of the national resource of semi-natural dry calcareous grasslands and/or orchid-rich semi-natural dry calcareous grasslands has been undertaken in Ireland, the current extent of the habitat is extremely difficult to estimate. A 'best guess' method is thus the only option and hence the extent of the habitat was estimated in the following way (it should be noted that this estimate applies to the broader category of semi-natural dry calcareous grasslands; without more comprehensive field work, the extent of orchid-rich areas were considered too difficult to estimate):

*Calcareous Grassland area estimate*

(1) Those 10km squares where the habitat was recorded or considered likely to occur in the current range map described earlier were chosen for further analysis.

(2) Within these squares, the intersection area of the appropriate geology and soils was mapped. The geological categories considered suitable to support the habitat were listed earlier (footnote No. 2) and amount to 29,466km$^2$ in extent for the Republic of Ireland. However, only 23,067 km$^2$ of this occurred within the FRR.

(3) The soils (Teagasc, 2006) used were:

- Type 22: Shallow well-drained mineral soils derived from mainly calcareous parent materials. The overall extent of this soil type in the Republic of Ireland is estimated to be 2,861km$^2$. However, only 1,956km$^2$ of this is located within those 10km squares where the habitat was recorded or considered likely to occur in the current range map described earlier.
- Type 46: Shallow, lithosolic-podzolic type soils derived from calcareous rock or gravels with/without peaty surface horizon. The overall extent of this soil type in the Republic of Ireland is estimated to be 189km$^2$. However, only 137km$^2$ of this is located within those 10km squares where the habitat was recorded or considered likely to occur in the current range map described earlier.

Another factor to consider with regard to choosing relevant soils is that, as mentioned in section 1 above, the *Festuco-Brometalia* grade into communities of the Centaureo-Cynosuretum galietosum in areas of slightly deeper soil. These communities retain some of the attributes of the *Festuco-Brometalia*. Indeed an analysis of the overlap of the semi-natural dry calcareous grassland mapped by the GMP in 2006 (discounting Slyne Head and West of Ardara Maas Road as they occur on wind-blown sand) with the underlying soils suggests that although approximately 43% is located on soil type 22 (described above) and 41% is located on soil type 46, a further ca. 8% was found to be located an soil type 12

- Type 12:

  Deep well-drained mineral soils derived from mainly calcareous parent materials. Thus for the purpose of estimating the maximum current extent of semi-natural dry calcareous grasslands, this soil type was also intersected with the geology. The overall extent of this soil type in the Republic of Ireland is estimated to be 8,358km$^2$. However, only 5,817km$^2$ of this is located within those 10km squares where the habitat was recorded or considered likely to occur in the current range map.

(4) The resultant area (7,910km$^2$) was then intersected with the level five classification: dry unimproved pasture from the Corine Land Cover Map (2000) giving an extent for the habitat of 2,395km$^2$. It is acknowledged here that the Corine layer is not very accurate or reliable (largely due to the fact that its minimum mapable unit is 25ha). However, due to a lack of alternative methods of estimation and in the belief that positive and negative errors will compensate against each other somewhat, the Corine layer is still used in the estimation of the extent of semi-natural dry calcareous grassland.

(5) Added to the area of 2,395km$^2$estimated above was any calcareous grassland mapped by the GMP in 2006, which was not included in this figure. Of the 14km$^2$ mapped (although 27km$^2$ was estimated to occur within the surveyed SAC's only 14km$^2$ of it was mapped) by the GMP, less than 1km$^2$ was found to overlap with 2,395km$^2$ mapped above. This lack of overlap was due largely to the fact that those areas mapped by the GMP were NOT categorised as dry unimproved pasture by the Corine layer, highlighting the unreliability of the

Corine data. The remaining $13km^2$ mapped by the GMP were thus added to the $2,395km^2$ giving a total extent for the habitat of $2,408km^2$.

The maximum extent of semi-natural dry calcareous grassland in Ireland can thus be estimated to be $2,408km^2$. This estimate is much higher (86%) than the $286km^2$ estimated by O'Sullivan (1982) for Brometalia erecti. However, it should be noted here that soil type 12 is much more abundant in Ireland ($8,358km^2$) than the sum of soil types 22 and 46 ($3,050km^2$). Yet soil type 12 covers a much smaller fraction (8%) of the semi-natural dry calcareous grassland mapped by the GMP in 2006 than that covered by soil types 22 and 46 combined (84%), this bearing out O' Sullivan's findings (1982). It could thus be postulated that only a small proportion of soil type 12 supports semi-natural dry calcareous grassland. Hence the above maximum estimate of extent of the habitat of **$2,408km^2$ is likely to be too high.**

As well as being likely to be too high, the above estimate also uses Corine data, which is somewhat unreliable. An alternative approach to calculating the maximum extent is to simply tally the entire areas of the two soil types most likely to support the habitat (Types 22 and 46). The sum of these two areas is equal to $3,050km^2$. This could be described as a maximum possible extent of the habitat, but as much of this is likely to have been agriculturally improved etc., the actual extent is likely to be much lower. Excluding those 10km squares where the habitat was not considered likely to occur (through using BSBI records etc., see section 3 above), the maximum extent estimate calculated in this manner **is reduced to $2,093km^2$**.

The two methods used above to calculate the maximum extent of semi-natural dry calcareous grassland in Ireland are both likely to be much higher than the actual current extent of the habitat, which is estimated by intersecting Soil types 22 and 46 with the level five classification: dry unimproved pasture from the Corine Land Cover Map (2000), resulting in an area **likely to be more in the region of $531km^2$**. However, the accuracy of this estimate is severely limited by lack of available suitable accurate high-resolution datasets.

*Orchid-rich Grassland area estimate*

As stated earlier, the extent of orchid-rich semi-natural dry calcareous grasslands is very difficult to estimate without a comprehensive orchid field survey. However, it should be noted that the extent of the orchid-rich habitat is certain to be much less than the maximum extent estimated above for semi-natural dry calcareous grasslands (not orchid-rich) as orchids will not always be present in semi-natural dry calcareous grassland and even where they are present, they can be restricted to a small proportion of a field or site in which the dominant habitat is semi-natural dry calcareous grassland.

## 4.1 Conservation status of habitat extent

The Grassland Monitoring Project conducted in 2006 (Dwyer *et al.*, 2007) evaluated the extent of semi-natural dry calcareous grassland on 31[3] out of 36 SAC's designated for the habitat comparing the current extent to that which was described from the SAC at the time of designation (ca. 10 years previously). The results of the survey indicate that the extent is declining in 21 of the sites, with a conservation assessment of unfavourable – bad for 13 of the sites (suggesting a loss of >1%/year on these sites) and an assessment of unfavourable – inadequate for 8 sites (suggesting a loss of up to 1%/year on these sites). The extent was assessed as Favourable at only 10 of the sites (32%). Thus the extent of the habitat in 68% of the SACs surveyed has been assessed as declining with 42% assessed as Unfavourable Bad.

The extent of the habitat that occurred within these SAC's when originally designated is estimated (Appendix 5) by multiplying by a factor of 1.15 for those sites that were considered to have a conservation status of Red for extent by the GMP 2006 and by a factor of 1.05 where a conservation status of amber was considered (Appendix 5). This results in a retrospective estimate of 2893.6ha for the area of the habitat in 1995 – this can be considered the minimum area present at that time and indicates a decrease of at least 5.1% over the 31 SAC sites in the last 11 years or 149 ha. This is likely to be an underestimate as there is a possibility of a >15% decline for the "Red" category.

A figure of habitat loss calculated based on the original NATURA 2000 area figures supplied in the 90s (estimated at the time and not available for all sites) is greater than 149 ha (Appendix 5).

These estimated losses have occurred within protected sites and it can be assumed that the loss in habitat extent on sites outside of designated sites is similar or even greater. Hence, since the extent of semi-natural dry calcareous grassland on designated sites is considered to be unfavourable bad, the conservation assessment of the extent of the habitat in general is considered to be **Unfavourable Bad.**

The Favourable reference area (FRA) is very difficult to define, but it "must be at least the surface area when the Directive came into force". If the 5% decline since designation in the extent of the habitat on the surveyed SAC's were to be extrapolated for the entire habitat present in Ireland, it would lead to an estimate of 559km$^2$ (based on the minimum figure for extent Section 4) for the FRA. This is probably an underestimate for the reasons outlined.

**Current area:** 531km$^2$
**Favourable reference area:** 559km$^2$ (at least the surface area present when the Habitats Directive came into force)

[3] Four of the five SAC's that were not surveyed had a "D" value for representivity in the Natura 2000 form and thus were considered low priority for the GMP survey while the fifth (000566 All Saint's Bog and Esker) was visited but the surveyors were refused access by the owner.

# 5. Structures and functions

## 5.1 Habitat structures and functions

Semi-natural dry calcareous grasslands and orchid-rich semi-natural dry calcareous grasslands are maintained by a low intensity grazing or mowing regime. Their continued existence is under threat by both agricultural intensification (fertilisation and re-seeding etc. leading to a more improved type of grassland) and agricultural abandonment (leading to invasion by scrub and bracken).

### 5.1.1. Conservation Status of Habitat Structures and Functions

The Grassland Monitoring Project (GMP) (Dwyer *et al*., 2007) evaluated the Structure and Functions of semi-natural dry calcareous grassland (and orchid-rich semi-natural dry calcareous grasslands) on 31 SAC's out of the 36 designated for the habitat. This involved evaluating the condition of the habitat by examining a number of different attributes considered to determine the habitat's correct functioning. The attributes chosen by Dwyer *et al*. to best assess the quality of calcareous grassland in Ireland were deemed to be a) herb content, b) the presence of typical positive indicator species, c) the presence of negative indicator species, and d) the percentage cover of woody species and/or Bracken. Specific targets were agreed and set for each of these four criteria and the vegetation at a number of Monitoring Stops (at each site) was examined and tested against these pre-determined targets.

The results of the survey indicate that the condition of semi-natural dry calcareous grasslands (and orchid-rich semi-natural dry calcareous grasslands) in Ireland is generally poor. Of the 31 sites assessed, the Structure and Functions of the grassland was considered favourable at only two sites (6%). In fact, the Structure and Functions at 21 of the sites (68%) were deemed to be unfavourable bad with the remaining eight sites (26%) considered unfavourable inadequate. These results refer only to the condition of the habitat within protected sites. It can be assumed that the condition of the habitat on sites outside of designated areas is likely to be even poorer. Hence, the Structure and Functions of semi-natural dry calcareous grassland (and orchid-rich semi-natural dry calcareous grasslands) in Ireland is considered to be **Unfavourable Bad.**

While orchids were not 'scored' in the assessment (for reasons outlined earlier), they were noted when observed. Orchids were thus recorded at 26 of the 31 sites surveyed. However, this does not to imply that the remaining 5 sites are not of sufficient quality to maintain an orchid population. Factors such as the timing of the survey and the fact that some of the larger sites could not be extensively surveyed, should be taken into account. *Dactylorhiza fuchsii* was the orchid recorded most often, while a Red Data Book orchid was recorded at only two sites – *Orchis morio* on Pilgrims Road Esker and Ridge Road, SW of Rapemills. However, at times, emerging or fruiting orchids could not be fully identified and examples of these were noted as occurring across 19 sites.

## 5.2. Typical Species

As the *Festuco-Brometalia* is the only order described within the class Festuco-Brometea (O'Sullivan, 1982), the species that O'Sullivan lists serve as character species of both the class and the order. A number of these correspond with the indicator species identified in the EU Habitats Manual for the habitat. These include *Anthyllis vulneraria, Carlina vulgaris, Centaurea scabiosa, Leontodon hispidus,* and *Sanguisorba minor*. White and Doyle (1982) list additional species following Westhoff and Den Held (1969), which include *Carex caryophyllea, Primula veris,* and *Camptothecium lutescens* and also add that differential species of the class include *Avenula pubescens, Hieracium pilosella, Pimpinella saxifraga, Ranunculus bulbosus,* and *Koeleria macrantha.*

Following discussion with grassland experts within the NPWS staff and analysis of the above published sources, Dwyer *et al*. (2007) compiled a list of 28 species typical of the range in variation of calcareous grassland in Ireland highlighting 15 of which were more typical of strongly calcareous situations. These are listed here with the more strongly calcareous species denoted by an asterix:

*Anacamptis pyrimidalis*, Antennaria dioica*, Anthyllis vulneraria*, Avenula pubescens, Blackstonia perfoliata*, Briza media*, Bromus erectus*, Campanula rotundifolia, Camptothecium lutescens*, Carex caryophyllea, Carex flacca, Carlina* *vulgaris*, Centaurea scabiosa*, Conopodium majus, Daucus carota*, Galium verum, Gentianella campestris*, Hieracium pilosella, Knautia arvensis*, Koeleria macrantha*, Leontodon hispidus, Linum catharticum, Lotus corniculatus, Origanum vulgare, Primula veris, Ranunculus bulbosus, Sanguisorba minor** and *Trisetum flavescens**.

An additional eight species were listed as being more typical of the Burren and western examples of the habitat. These are:

*Asperula cynanchica, Dryas octopetala, Filipendula vulgaris, Geranium sanguineum, Gentiana verna, Helianthemum canum, Neotinea maculata* and *Sesleria albicans*.

A list of 13 orchid species seen as being typical or representative of the variations observed in this habitat type was also compiled including the three species listed in the EU Manual *Ophrys apifera*, *Orchis mascula*, and *Orchis morio*.

The 13 species are: *Anacamptis pyrimidalis, Coeloglossum viride, Dactylorhiza fuchsia, Dactylorhiza maculata, Gymnadenia conopsea, Listera ovata, Neotinea maculata, Ophrys apifera, Orchis mascula, Orchis morio, Platanthera bifoliata, Platanthera chlorantha* and *Spiranthes spiralis*

Dwyer *et al*. considered these lists to cover a range of calcareous ecological conditions, reflecting the variations within and the uniqueness of the orchid-rich calcareous grassland habitat in Ireland as well as offering a variety of species, which may be visible at different times of the growing season.

### 5.2.1. Conservation Status of Habitat Typical Species

An accurate assessment of the condition of the typical species for semi-natural dry calcareous grassland (and orchid-rich semi-natural dry calcareous grasslands) is impossible to carry out in the absence of a specific monitoring programme. However, as the presence of a target number of positive indicator species was one of the attributes used to assess the Structure and Functions, the conservation status of the typical species of the habitat is in someway related to the habitats Structure and Functions, which was assessed as unfavourable bad. Furthermore, two of the 13 orchids, *Ophrys apifera* and *Orchis morio*, listed as being typical of the habitat are listed in the Red Data Book (Curtis and McGough, 1988). It is thus considered likely that the conservation status of the habitats typical species is also **Unfavourable Bad** for both habitats.

## 6. Impacts and Threats

The continued existence of semi-natural dry calcareous grasslands (and orchid-rich semi-natural dry calcareous grasslands) is under threat by both agricultural intensification (application of fertiliser and re-seeding etc. leading to a more improved type of grassland) and agricultural abandonment (leading to invasion by scrub and bracken and eventually succession to woodland).

The results of the GMP indicate that encroachment by *Pteridium aquilinum* and woody scrub species is currently the most significant threat to the habitat (Dwyer *et al*., 2007). This encroachment is a direct result of insufficient management. Other significant threats listed by Dwyer *et al*. included the application of fertiliser, abandonment of pastoral systems, insufficient grazing, and quarrying activities.

A Site Inspection Reporting (SIR) programme carried out by regional NPWS staff on a three-year cycle is also in place for designated sites. 37 entries were made against orchid-rich semi-natural dry calcareous grassland between 2001-2003 (see appendix 6). Of these, 31 were considered to have been negative impacts or threats. However, no activities or threats were recorded on some of the larger sites designated for the habitat. This is more likely to be due to such activities having been under-recorded due to under-staffing rather than a lack of actual impacts on the habitat.

Additional impacts and threats that are not discussed in detail below include animal breeding (stock feeding) and urbanised areas, human habitation. The GMP recorded these at 7 sites and one site, respectively. Both of these threats/impacts were recorded three times by the SIR programme.

### 6.1 Encroachment by *Pteridium aquilinum* and woody scrub species

Of the 31 sites surveyed by the GMP in 2006, Dwyer *et al*. noted the spread of *Pteridium aquilinum* and scrub species such as *Prunus spinosa, Crataegus monogyna*, and *Ulex* spp. at 94% of sites (29 of the 31 surveyed sites). Of these 29 sites, an intensity level of A (high influence) was noted at 6 sites (21%), an intensity level of B (medium influence) at 12 sites (41%), and an intensity level of C (low influence) at 11 sites (38%). The primary reason for the encroachment was adjudged to be the abandonment of traditional farming and the concurrent failure to put replacement management procedures in place. It was also noted that encroachment as a result of abandonment is not a new issue as numerous references were made to the problem in many of the original survey notes from the NHA surveys undertaken in the 1990's. Reference to the potential for the problem to expand was also flagged at that time. Dwyer *et al*. (2007) allude to the fact that as the rate at which farming is declining on a national level has increased in recent years, further losses in the extent and quality of semi-natural dry calcareous grassland (and orchid-rich semi-natural dry calcareous grasslands) can be expected to occur as a result of encroachment unless a focussed programme to target the issue (at least on protected sites) is put in place.

Encroachment by bracken and/or woody scrub species was recorded at only one site (in 2001 at Glenloughaun Esker, 002213) under the SIR programme, with the total area affected estimated to be 1.75ha. The GMP recorded this threat at numerous additional sites and thus it is apparent that it was significantly under-recorded by the SIR programme between 2001-2003.

On a positive note the active removal of scrub was noted at two of the sites surveyed, Castlesampson Esker (001625) and Split Hills and Long Hill Esker (001831). At Castlesampson Esker, the landowner had commenced a programme of scrub removal from calcareous grassland as part of a new Farm Plan. At Split Hills and Long Hill Esker, the NPWS had begun to remove scrub from the esker bordering the main Dublin to Galway road. This activity will undoubtedly benefit the grassland habitats at both sites.

**Encroachment trend**

From an examination of the site notes taken during the NHA surveys in the 1990s and the GMP notes taken in 2006, there is anecdotal evidence to suggest that the rate of encroachment by *Pteridium aquilinum* and scrub species such as *Prunus spinosa, Crataegus monogyna*, and *Ulex* spp. appears to be increasing.

## 6.2 Undergrazing

After encroachment by *Pteridium aquilinum* and woody scrub species, undergrazing was the next most frequent negative impact recorded by Dwyer *et al*. (2007). Parts of 26 of the 31 sites surveyed (84%) were considered undergrazed. The installation of adequate grazing pressures (often combined with the correct timing and extent of mowing) is essential for the maintenance of good quality calcareous grasslands. These conditions were noted to occur on parts of only 5 (16%) of the surveyed sites: Inishmaan Island (000212), Lough Fingall Complex (000606), Culahill Mountain (000831), Spahill and Clomantagh Hill (000849), and Glenasmole Valley (001209). The reason for undergrazing is similar to that described above for encroachment – abandonment of farming, or as is more probable in this case the scaling down to a more part-time farming set-up. If these sites are continually undergrazed, large parts of the grassland are again likely to be lost to the encroachment of scrub woodland.

Undergrazing was recorded at only one site (in 2003 at The Long Derries, 000925) under the SIR programme, with the total area affected estimated to be 5ha. The GMP recorded this threat at numerous additional sites and thus it is apparent that it was significantly under-recorded by the SIR programme between 2001-2003.

**Undergrazing trend**

Although little comparable data is available, it would seem from a comparison of the GMP site notes taken in 2006 to those notes taken during the NHA surveys in the 1990s that the problem of undergrazing is increasing.

## 6.3 The application of fertiliser

Dwyer *et al*. (2007) noted the application of fertilisers as occurring at 23 of the sites (74%). However, the relative intensity of this activity appears to be less than that resulting from invasion by scrub or *Pteridium aquilinum*. Only two sites (9%) recorded an intensity level of A (high influence) for fertilisation. One of these sites, Lough Ree (000440), records that the impact from this activity was severe enough to be accorded a value of –2, indicating 'an irreparable negative influence' has occurred. 9 other calcareous sites (39%) presented with intensity levels of B (medium influence) for fertilisation while 12 (52%) recorded a value of C (low influence). These values reflect a general perception noted by field workers on the ground, that while a degree of agricultural improvement was still occurring at grassland sites, the consequences of the reduction or even abandonment of old farming practices were much more noticeable as an impact on the current calcareous grassland quality.

Nonetheless, agricultural improvement activity was seen to result in the presence of negative indicator species in a total of 20 (65%) calcareous grassland sites. These negative indicator species included species such as *Lolium perenne*, *Rumex crispus*, *Rumex obtusifolius* and *Urtica dioica*. While all of these 20 sites recorded the presence of *Lolium perenne*, 11 (35%) of those sites recorded values of Rare (R) for the species.

The application of fertiliser was recorded at only one site (in 2003 at Glenloughaun Esker, 002213) under the SIR programme, with the total area affected estimated to be 0.36ha. The GMP recorded this threat at numerous additional sites and thus it is apparent that it was significantly under-recorded by the SIR programme between 2001-2003.

### The application of fertiliser trend

Again little comparable data is available. However, anecdotal evidence from a comparison of the GMP site notes taken in 2006 to those notes taken during the NHA surveys in the 1990s would suggest that the problem of the over-use of fertiliser application is declining, at least on the sites surveyed during the GMP. However, it should be realised that as this survey was limited to protected sites (SAC's), this trend cannot be assumed to be similar on non-protected semi-natural dry calcareous grassland sites (and orchid-rich semi-natural dry calcareous grasslands).

## 6.4 Agricultural improvement – cultivation

Agricultural improvement, usually in the form of reseeding with a *Lolium perenne* dominated grass mix coupled with the application of fertiliser was noted in parts of 18 (58%) of the sites surveyed by Dwyer *et al* (2007). This form of 'improvement' is much more detrimental than the application of fertiliser on its own as it is much more difficult to reverse. Only two sites (9%) recorded an intensity level of A (high influence) for this impact with Ballyprior Grassland (002256) probably being the worst effected. Here large areas of the western part of the site that were previously described as semi-natural grassland (NHA surveys) have been reseeded and fertilised to the extent that they would now be more readily described as improved grassland (using the Heritage Council Classification Guide, Fossitt, 2000). The impact of agricultural improvement at this site was indeed severe enough to be accorded a value of –2, indicating 'an irreparable negative influence' by the GMP. The GMP recorded a further 10 sites (32%) with intensity levels of B (medium influence) for agricultural improvement - cultivation while six (19%) were recorded with a value of C (low influence).

Agricultural improvement – cultivation was the most frequent impact recorded under the SIR programme, being recorded a total of four times between 2001-2003 (on four different sites) with the total area affected estimated to be 14.6ha including 11ha on Black Head-Poulsallagh Complex (000020).

**Agricultural improvement (cultivation) trend**

Again little comparable data is available. However, anecdotal evidence suggests that the amount of land being agriculturally improved in this manner is decreasing, at least on protected sites.

## 6.5 Abandonment of pastoral systems

The abandonment of pastoral systems was recorded at 10 of the 31 sites surveyed by Dwyer *et al* (2007). However, the 'warning signs' that this issue is going to become a bigger problem are obvious from the amount of sites where undergrazing and the encroachment of *Pteridium aquilinum* and woody species were recorded (see 6.1 and 6.2 above).

The abandonment of pastoral systems was recorded at only one site (in 2003 at Coole-Garryland Complex, 000252) under the SIR programme. The area affected was not estimated. The GMP recorded this threat at numerous additional sites and thus it is apparent that it was significantly under-recorded by the SIR programme between 2001-2003.

**Abandonment of pastoral systems trend**

Again little comparable data is available. However, anecdotal evidence suggests that the abandonment of pastoral systems is becoming more common. This can be attributed mainly to rural socio-economic factors, which are rendering many semi-natural agricultural systems relics of by-gone times.

### 6.6 Sand and gravel extraction

Although sand and gravel extraction was highlighted as a threat at five (16%) of the sites surveyed by Dwyer *et al*. (2007), active quarrying was recorded on only one of these – Split Hills and Long Hill Esker (001831). Here an active quarry operates in the north-western sector, which was inaccessible to the field surveyors during the GMP. Furthermore, illegal quarrying was also noted as having occurred in other parts of the site in recent years.

Although active quarrying is not taking place within the SAC at Barrigone (000432), a comparison of the 1995 and 2000 aerial photographs by the GMP indicated that quarrying activities had encroached (by about 0.5ha) into the SAC on the north eastern corner of the quarry. The quarry, owned by Roadstone, occurs immediately to the south of the SAC boundary. Although most of the quarrying here is taking place outside of the SAC, it is nonetheless impacting on areas of (albeit apparently abandoned) semi-natural dry calcareous grassland (and orchid-rich semi-natural dry calcareous grasslands). Indeed, part of the area now being quarried was originally within the SAC, but was appealed out by the landowner.

On a positive note, although the threat of quarrying is still present at some sites such as Castlesampson Esker (001625) and Tory Hill (00432). Planning permission to quarry these areas has been refused. The calcareous grassland at All Saint's Bog and Esker (000566) is now subject of an NPWS Farm Plan.

**Sand and gravel extraction trend**

Although, there are three sites highlighted above where permission to quarry has been refused, the future trends for quarrying are unknown. As other active quarries come to the end of their production life, pressure may increase to reactivate those quarries at Castlesampson and Tory Hill among others. Furthermore, if active quarrying can still be carried out within SACs such as at Split Hills and Long Hill Esker (001831), it must be assumed that active quarrying is ongoing on other non-designated areas of semi-natural dry calcareous grassland.

However, planning control of quarrying has improved greatly with regard to opening of new quarries and re-opening of old works since the introduction of regulations under Section 261 of the Planning and Development Act 2000.

# 7 Future Prospects

## 7.1 Negative Future Prospects

Considering that the conservation status of the Structure and Functions of 68% of the sites surveyed by Dwyer *et al*. (2007) were assessed as being unfavourable – bad, the future prospects of semi-natural dry calcareous grassland (and orchid-rich semi-natural dry calcareous grasslands) in Ireland is not good. In fact the future prospects of only four (13%) of the sites surveyed were deemed to be favourable. This is largely a result of the change from traditional farming methods and the need for farmers to choose between intensification or abandonment. This has resulted in the problems outlined in section 6 above, particularly those of abandonment and under-grazing in 26 of the 31 SAC sites surveyed (GMP, 2006).

As can be seen from the results of the GMP, simply designating a site as being a Special Area of Conservation is not enough, even if deleterious activities such as agricultural improvements and quarrying were prevented. The largest threat to the grasslands is found in merely doing nothing. Hence, a management system needs to be put in place to replace or emulate the traditional farming practices that maintained the grassland for centuries.

### 7.2 Positive Future Prospects

Although at present the future of semi-natural dry calcareous grasslands appears bleak, there are a number of factors/schemes giving some hope for their continued existence. These include

- Calcareous grassland within SACs is however protected to a degree through a list of Notifiable Actions. This lists activities, which should not be carried out on the site without consent including for example the application of fertilisers, pesticides or herbicide and re-seeding.
- The introduction of a Single Farm Payment (SFP) (FAPRI-Ireland Partnership 2003) requires farmers to keep lands in "Good Agricultural and Environmental Condition"
- The Rural Environment Protection Scheme (REPS), which is an EU-funded Department of Agriculture, Food and Forestry scheme aimed at encouraging environmentally sensitive farming that is currently entering its fourth phase (REPS IV).
- The recently funded Burren LIFE project was found by the Grassland Monitoring Project (2006) to be resulting in useful dialogues and exchanges between ecologists and local farmers and appeared to be well received within the local community.
- The National Farm Plan Scheme (launched in February 2006) operates on designated sites and commonage land and allows the Department of Agriculture to pay farmers and landowners, who are not in REPS, for losses incurred through restrictions caused by the designation of their lands as well as paying for certain actions, which are beneficial to wildlife as agreed in a Farm Plan. The scheme was already seen to be aiding the conservation of calcareous grasslands by the summer of 2006 when the GMP reported that a programme of scrub clearance

(following a Farm Plan) had begun on Castlesampson Esker with the aim being to restore the calcareous grassland.

### 7.3 Overall habitat future prospects

Despite several positive prospects, overall the habitat future prospects are **Unfavourable Bad.**

# 8 Overall Assessment of the Habitat Conservation Status

- The Favourable Reference Range (FRR) has been defined, as the current range therefore the status of the habitat range is **Favourable**.
- The current habitat extent is difficult to determine, as a complete inventory of the national resource of the habitat in Ireland is required. However, a very approximate estimate of the extent is 531km$^2$ (minimum estimate) or 2,408km$^2$ (maximum estimate). Nevertheless since the Favourable Reference Area (FRA) is required to be at least the surface area present when the Habitats Directive came into force (and 21 of the 31 sites surveyed displayed a loss in extent since designation), the status of habitat extent is **Unfavourable Bad**.

  It is very difficult to separately estimate the area of the orchid-rich subset of this habitat.
- An **Unfavourable Bad** assessment is also given to the habitat structures and functions, due mainly to agricultural abandonment, but also to agricultural improvement.
- The habitat's future prospects are deemed to be **Unfavourable Bad**. Sub-optimal grazing levels and the encroachment of scrub was recorded in parts of 84% of the sites surveyed in 2006 by the GMP and thus severely threatens the long-term existence of the habitat. Positive management actions including the removal of scrub and the implementation of adequate grazing and mowing regimes are required.

Thus, considering the **Unfavourable Bad** assessment for three of the habitats attributes the overall conservation status for semi-natural dry calcareous grassland including orchid-rich grasslands is **Unfavourable Bad**.

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**Appendix 1**: The following is a full list of Irish SAC sites for which orchid-rich semi-natural dry calcareous grassland (6210 habitat) is noted as a qualifying interest. The areas given are the areas of semi-natural dry calcareous grassland estimated to occur on each site by the Grassland Monitoring Project in 2006 (Dwyer et al, 2007).

| Site Code | Site Name | Surveyed by the GMP 2006 | Area in 2006 (ha) |
|---|---|---|---|
| 000020 | Black Head-Poulsallagh Complex | Yes | 50-100 |
| 000054 | Moneen Mountain | Yes | 600-700 |
| 000191 | St. John's Point | Yes | 14 |
| 000197 | West of Ardara/Maas Road | Yes | 4 |
| 000212 | Inishmaan Island | Yes | 160 |
| 000213 | Inishmore Island | Yes | 236 |
| 000242 | Castletaylor Complex | Yes | 9 |
| 000252 | Coole-Garryland Complex | No | N/A |
| 000268 | Galway Bay Complex | Yes | 21 |
| 000297 | Lough Corrib | Yes | 10-20 |
| 000432 | Barrigone | Yes | 12 |
| 000439 | Tory Hill | Yes | <1 |
| 000440 | Lough Ree | Yes | 20-30 |
| 000566 | All Saints Bog and Esker | No | N/A |
| 000572 | Clara Bog | Yes | 1.4 |
| 000606 | Lough Fingall Complex | Yes | 30 |
| 000625 | Bunduff Lough and Machair/Trawalua/Mullaghmore | Yes | 0.9 |
| 000714 | Bray Head | No | N/A |
| 000831 | Cullahill Mountain | Yes | 21 |
| 000849 | Spahill and Clomantagh Hill | Yes | 20 |
| 000859 | Clonaslee Eskers and Derry Bog | No | N/A |
| 000919 | Ridge Road, SW of Rapemills | Yes | 2 |
| 000925 | The Long Derries, Edenderry | Yes | 2 |
| 001209 | Glenasmole Valley | Yes | 2 |
| 001275 | Inisheer Island | Yes | 80 |
| 001571 | Urlaur Lakes | No | N/A |
| 001625 | Castlesampson Esker | Yes | 7.3 |
| 001656 | Bricklieve Mountains & Keishcorran | Yes | 45 |
| 001774 | Lough Carra/Mask Complex | Yes | 10-20 |
| 001776 | Pilgrim's Road Esker | Yes | 5 |
| 001831 | Split Hills and Long Hill Esker | Yes | 2.2 |
| 001926 | East Burren Complex | Yes | 900-1,300 |
| 002074 | Slyne Head Peninsula | Yes | 130 |
| 002213 | Glenloughaun Esker | Yes | 1 |
| 002214 | Killeglan Grassland | Yes | 47 |
| 002256 | Ballyprior Grassland | Yes | 12 |

**Appendix 2**: The following is the list of additional sites highlighted by the Habitats Assignment Project (2006) as supporting areas of orchid-rich semi-natural dry calcareous grassland (6210 habitat). The sources included NHA site files, MPSU Plans, NATURA 2000 Forms, NPWS surveys, aerial photographs and the NGO's shadow list.

| Site Code | Site Name | Designation |
|---|---|---|
| 000216 | River Shannon Callows | cSAC |
| 000222 | Suck River Callows | NHA |
| 000479 | Cloughmoyne | cSAC |
| 000560 | Lough Fea Demesne | cNHA |
| 000622 | Ballysadare Bay | cNHA |
| 000797 | Ballymoon Esker | cNHA |
| 000900 | Drumakeenan, Eagle Hill And Perry's Mill | cNHA |
| 000910 | Lough Nanag Esker | cNHA |
| 000965 | Laffansbridge | cNHA |
| 000966 | Moneypark, Fethard | cNHA |
| 001042 | Carrigshane Hill | cNHA |
| 001626 | Annaghmore Lough (Roscommon) | cSAC |
| 001683 | Liskeenan Fen | cSAC |
| 001775 | Murphy's Bridge Esker | cNHA |
| 001931* | Arklow Town Marsh | cNHA |
| 001982 | Templetney Quarry | cNHA |
| 002211 | Commons Of Carney | cNHA |
| 002467** | Derryglogher, Kenagh | cNHA |
| 002472** | T Bán | cNHA |
| 002480** | Ballytarsna Grassland | cNHA |
| 002490*** | Clonlyon Glebe Fen | cNHA |
| 002508** | Ahacronane Bridge | cNHA |
| 002541** | Glaskenny Wood | cNHA |
| 002571*** | Bunnafollistran | cNHA |
| 002577** | Boycetown Quarry | cNHA |
| 002579** | Cappagh Grassland, Kiltimagh | cNHA |
| 002653*** | Clonyrina Fen And Grassland | cNHA |
| 002705*** | Cultiafada Esker | cNHA |
| 002708** | Ballindooley Hill | cNHA |
| 002710*** | Turloughgarve | cNHA |
| 002727*** | Lullymore West | cNHA |
| 004129*** | Ballysadare Bay Spa | cSPA |

* This cNHA is not located on an area of limestone according to the Rock Unit Map (Geological Survey of Ireland) and so was thus not included in the assessment

** These sites have not yet been digitised by the NPWS and were thus not used in this assessment as their locations were not obvious from a brief search of the townlands shapefile.

***Although these sites have not yet been digitised by the NPWS, their probable locations were identified by searching through the townlands shapefile.

**Appendix 3**: The following is the list of additional sites highlighted by the NPWS Enquires Database (April 2007) as supporting areas of orchid-rich semi-natural dry calcareous grassland (6210 habitat).

| Site Code | Site Name | Designation |
|---|---|---|
| 000289 | Knockavanny Turlough | cNHA |
| 000560 | Lough Fea Demesne | cNHA |
| 000681 | Hill of Mael and the Rock of Curry | cNHA |
| 000885 | Ballyduff Esker | cNHA |
| 000896 | Derrygolan Esker | cNHA |
| 000906 | Kilcormac Esker | cNHA |
| 001074 | Rockfarm Quarry, Little Island | cNHA |
| 001319 | Summerville Lough | cNHA |
| 001341 | Church Hill, Tralee | cNHA |
| 001433 | Gorteennamrock | cNHA |
| 001526 | Quarryford Bridge | cNHA |
| 001751 | Ballycore Rath | cNHA |
| 001775 | Murphy's Bridge Esker | cNHA |
| 001814 | Lough Naneagh | cNHA |
| 001982 | Templetney Quarry | cNHA |
| 002000 | Loughshinny Coast | cNHA |

**Appendix 4:** Datasets used

### CORINE Land Cover Map (2000)

The Corine Land Cover (CLC) map is a pan-European habitat map based on the interpretation of satellite images. The project is co-ordinated by the EEA (European Environmental Agency) with the co-operation of national competent authorities in contributing states. The Environmental Protection Agency (EPA) is the national competent authority for the CLC in Ireland.

The CLC is based on a three-tier hierarchy classification system consisting of 44 land classes. For some habitats including grasslands (and bogs) there are additional hierarchy levels (level 4 and 5 and even up to level 6 for blanket bog). However, the land cover inventory was conducted at a scale of 1:100,000 and the minimum mappable unit was 25ha. Thus, the scale is very coarse with a further limitation being that ground-truthing of the satellite imagery was limited. Indeed O'Connor (2000) determined that the CLC maps cannot be regarded as accurately representing land cover classes in Ireland. Nevertheless, the dataset is useful for indicating areas of possible semi-natural dry calcareous grassland. However, these areas would need to be ground-truthed.

### Rock Unit Data

Rock Unit Data, made available by the Geological Survey of Ireland was essential in determining where semi-natural dry calcareous grassland is likely to occur in Ireland (i.e. areas composed partially or wholly of limestone). The following categories were considered to potentially support areas of the habitat: Dinantian Pure Bedded Limestones, Dinantian Pure Unbedded Limestones, Dinantian Lower Impure Limestones, Dinantian Upper Impure Limestones, Dinantian Dolomitised Limestones, Dinantian Shales and Limestones, Dinantian (early) Sandstones, Shales and Limestones, and Dinantian Mixed Sandstones, Shales and Limestones.

**National Soils and Parent Material Map**

The soils and subsoils dataset was created by Teagasc in 2006 using the Geological Survey of Ireland (GSI) data under the EPA soils and subsoils mapping project. The research utilised satellite imagery, aerial photogrammetry and ground truthing to produce a map of soil cover in Ireland. The soil types covered included those soil types most likely to support semi-natural dry calcareous grasslands (and orchid-rich semi-natural dry calcareous grasslands), which are:

Type 22: Shallow well-drained mineral soils derived from mainly calcareous parent materials.
Type 46: Shallow, lithosolic-podzolic type soils derived from calcareous rock or gravels with/without peaty surface horizon.

However, as 8% of the area mapped by the GMP in 2006 as semi-natural dry calcareous grasslands was located on the soil type 12: Deep well-drained mineral soils derived from mainly calcareous parent materials, this soil types was also considered in the assessment of the habitat.

**BSBI Data**

The data for 28 indicator species of semi-natural dry calcareous grassland (and orchid-rich semi-natural dry calcareous grassland) was downloaded from the BSBI website (www.searchnbn.net) on a 10km grid basis. The fact that this data was analysed on a 10km basis has obvious flaws as although all 28 indicator species may have been recorded in one 10km grid square, it does not necessarily imply that the 28 species (or even any two of the 28 species) occurred in close association with each other in that 10km square. Furthermore, it is likely that many species on the BSBI website have been under-recorded in Ireland. An attempt was made to compensate for this by including all records (i.e. including all pre-1970 and even pre-1900) from the BSBI. However, this may also have lead to errors when estimating the current range, as although a species may have been recorded in an area in the past, this does not imply that the species is still present in the area.

**Appendix 5:** Table listing the area of habitat 6210 estimated by the GMP in 2006 within the SAC's surveyed by the GMP. The extent of the habitat that occurred within these SAC's when originally designated is estimated here by multiplying by a factor of 1.15 for those sites that were considered to have a conservation status of Red for extent by the GMP 2006 and by a factor of 1.05 where a conservation status of amber was considered. This results in an estimate of 2893.6ha for the area of the habitat in 1995 – this can be considered the minimum area present at that time and indicates a decrease of at least 5.1% in the last 11 years. This is likely to be an underestimate as there is a possibility of a >15% decline for the "Red" category and areas outside of designated sites are likely to have suffered greater losses in area.

| Site Code | Total Site Area (Ha) | Natura 2000 Extent (ha) | 2006 Extent (ha) | 2006 Extent (ha) | CS Extent | Adjusted Natura Extent* (ha) |
|---|---|---|---|---|---|---|
| 000054 | 6094.79 | 736. | 600-700 | 650 | Amber | 682.5 |
| 000268 | 14409.49 | 3. | 21 | 21 | Amber | 22.05 |
| 000297 | 20582.86 | 92. | 10-20 | 15 | Amber | 15.75 |
| 000625 | 4351.97 | <2 | 0.9 | 1 | Amber | 1.05 |
| 000849 | 130.65 | 4.9 | 20 | 20 | Amber | 21 |
| 001625 | 34.4 | 15.2 | 7.3 | 7 | Amber | 7.35 |
| 001774 | 13608 | <50 | 10-20 | 15 | Amber | 15.75 |
| 001926 | 18672.92 | 1000 | 900-1,300 | 1,100 | Amber | 1,155 |
| 000020 | 7806.57 | 334. | 50-100. | 75 | Green | 75 |
| 000191 | 809.54 | 82.5. | 14. | 14 | Green | 14 |
| 000197 | 6513.14 | N/A | 4 | 4 | Green | 4 |
| 000212 | 792.79 | 79. | 160 | 160 | Green | 160 |
| 000242 | 137.23 | 6 | 9 | 9 | Green | 9 |
| 000606 | 579.53 | 28 | 30 | 30 | Green | 30 |
| 000831 | 54.61 | N/A | 21 | 21 | Green | 21 |
| 001656 | 1697.06 | N/A | 45 | 45 | Green | 45 |
| 002074 | 4028.25 | 40 - 80 | 130 | 130 | Green | 130 |
| 002214 | 61.97 | 41 | 47 | 47 | Green | 47 |
| 000213 | 15767.7 | 212. | 236 | 236 | Red | 271.4 |
| 000432 | 66.35 | 21. | 12 | 12 | Red | 13.8 |
| 000439 | 76.9 | 5 | <1 | 1 | Red | 1.15 |
| 000440 | 13612 | >10 | 20-30 | 25 | Red | 28.75 |
| 000572 | 852.44 | 9.9. | 1.4 | 1 | Red | 1.15 |
| 000919 | 16.75 | N/A | 2 | 2 | Red | 2.3 |
| 000925 | 30.24 | 12.4. | 2 | 2 | Red | 2.3 |
| 001209 | 149.29 | 25. | 2. | 2 | Red | 2.3 |
| 001275 | 552.13 | 67. | 80 | 80 | Red | 92 |
| 001776 | 69.76 | 17.9. | 5 | 5 | Red | 5.75 |
| 001831 | 74.99 | 6. | 2.2 | 2 | Red | 2.3 |
| 002213 | 5.63 | 7. | 1.0 | 1 | Red | 1.15 |
| 002256 | 72.34 | 37. | 12 | 12 | Red | 13.8 |
| | | | | **2745** | | **2893.6** |

**Appendix 6:** A listing, by activity code, of the impacts recorded by the Site Inspection Reporting (SIR) programme within orchid-rich semi-natural dry calcareous grassland SAC sites between 2001-2003.

| Activity code | | End of period | SAC code | Influ-ence | Area affected | Purpose | Causal agent |
|---|---|---|---|---|---|---|---|
| 100 | Cultivation | 2003 | 001831 | 0 | 4.00 | Agriculture | Owner/ Occupier |
| 103 | Cultivation: agricultural improvement | 2001 | 000020 | -1 | 11.00 | Agriculture | Owner/ Occupier |
| 103 | Cultivation: agricultural improvement | 2001 | 001776 | -1 | 0.60 | Agriculture | Third party |
| 103 | Cultivation: agricultural improvement | 2001 | 001926 | -1 | 2.50 | Agriculture | |
| 103 | Cultivation: agricultural improvement | 2003 | 000032 | -1 | 0.50 | Agriculture | Owner/ Occupier |
| 120 | Fertilisation | 2003 | 002213 | -1 | 0.36 | Agriculture | Third party |
| 140 | Grazing | 2001 | 000432 | 1 | 36.00 | Agriculture | Third party |
| 140 | Grazing | 2003 | 001683 | 1 | 60.00 | Agriculture | Owner/ Occupier |
| 141 | Grazing: abandonment of pastoral systems | 2003 | 000252 | -1 | 0.00 | Natural event | Other |
| 149 | Grazing: undergrazing | 2003 | 000925 | -2 | 5.00 | Other | Owner/ Occupier |
| 150 | Restructuring agricultural land holding | 2003 | 001774 | -2 | 4.00 | Agriculture | Owner/ Occupier |
| 150 | Restructuring agricultural land holding | 2003 | 001926 | -1 | 2.00 | Agriculture | Owner/ Occupier |
| 151 | Restructuring agricultural land holding: removal of hedges & copses | 2003 | 002213 | -1 | 0.20 | Agriculture | Owner/ Occupier |
| 152 | Restructuring agricultural land holding: removal of scrub | 2001 | 001926 | -1 | 0.00 | Agriculture | |
| 152 | Restructuring agricultural land holding: removal of scrub | 2001 | 001926 | -1 | 0.30 | Agriculture | |
| 152 | Restructuring agricultural land holding: removal of scrub | 2001 | 001926 | -1 | 0.50 | Agriculture | |
| 164 | General Forestry management: forestry clearance | 2003 | 002120 | -1 | 0.00 | Agriculture | Owner/ Occupier |
| 171 | Animal breeding: stock feeding | 2001 | 000173 | 0 | 50.00 | Agriculture | Owner/ Occupier |
| 171 | Animal breeding: stock feeding | 2003 | 000859 | -1 | 0.10 | Agriculture | Owner/ Occupier |
| 171 | Animal breeding: stock feeding | 2003 | 002214 | 1 | 0.10 | Agriculture | Un-known |
| 180 | Burning | 2003 | 002120 | -1 | 0.00 | Agriculture | Owner/ Occupier |
| 244 | Taking/Removal of fauna, general: other forms of taking fauna | 2003 | 000685 | -1 | 0.00 | Development | Third party |
| 300 | Sand & gravel extraction | 2001 | 000566 | -1 | 10.00 | Development | Owner/ Occupier |
| 400 | Urbanised areas, human habitation | 2001 | 000020 | -1 | 1.50 | Development | Owner/ Occupier |
| 403 | Urbanised areas, human habitation: dispersed habitation | 2001 | 001275 | -1 | 0.50 | Development | Owner/ Occupier |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 403 | Urbanised areas, human habitation: dispersed habitation | 2003 | 000000 | -1 | 3.50 | Development | Third party |
| 403 | Urbanised areas, human habitation: dispersed habitation | 2003 | 001774 | -1 | 0.25 | Development | Owner/ Occupier |
| 421 | Discharges: disposal of household waste | 2001 | 000939 | -1 | 0.10 | Agriculture | Owner/ Occupier |
| 501 | Communication networks: paths, tracks, cycling tracks | 2001 | 000925 | -1 | 0.50 | Development | Stautory body |
| 502 | Communication networks: routes, autoroutes | 2001 | 000606 | -1 | 0.00 | Other | Un-known |
| 607 | Sport & leisure structures: sports pitch | 2003 | 001774 | -1 | 0.25 | Recreation | Owner/ Occupier |
| 700 | Pollution | 2003 | 000000 | -1 | 0.05 | Development | Owner/ Occupier |
| 720 | Trampling, overuse | 2003 | 000859 | 0 | 2.00 | | |
| 800 | Drainage | 2001 | 000432 | -1 | 5.00 | Development | Owner/ Occupier |
| 830 | Canalisation | 2003 | 002120 | -1 | 0.00 | Agriculture | Owner/ Occupier |
| 900 | Erosion | 2001 | 001776 | -1 | 0.30 | Natural event | Other |
| 954 | Biocœnotic evolution: invasion by a species | 2001 | 002213 | -1 | 1.75 | Natural event | Other |

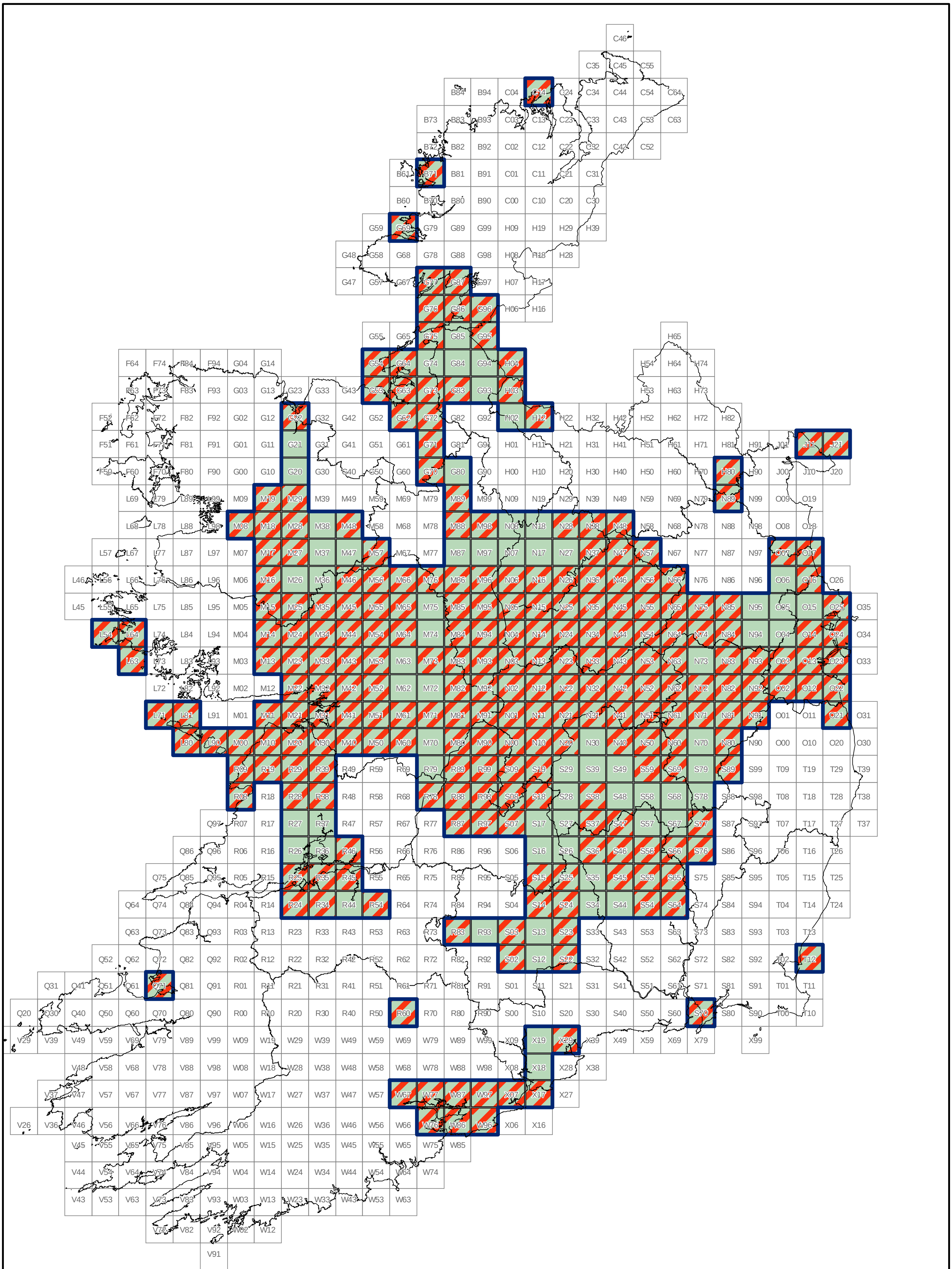
# 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (*important orchid sites – treated for the purposes of this report, as a subset of the Annexed Habitat).

| National Level | |
|---|---|
| **Habitat Code** | 6210 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | **PUBLISHED REPORTS:**<br>▪ Conaghan, J., 2001. *The distribution, on a ten–kilometre square basis, of selected habitats in the Republic of Ireland*. Enviroscope Environmental Consultancy, Galway. Report to Dúchas, The Heritage Service.<br>▪ Dwyer, R., Crowley, W. and Wilson, F. (2007) *Grassland Monitoring Project 2006*. Unpublished Report, National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.<br>▪ O'Sullivan, A.M. (1982). The Lowland Grasslands of Ireland. *Journal of Life Sciences*. Royal Dublin Society. 3, 131-142.<br>▪ White, J. and Doyle, G. (1982). The Vegetation of Ireland, a Catelogue Raisonne. *Journal of Life Sciences*. Royal Dublin Society. 3, 289-368.<br>▪ |
| **Range** | Concentrated on the eskers and moraines of the Irish midlands, the strongly calcareous soils of the midlands and in the karst-dominated landscape of parts of the west of Ireland. |
| Surface area | 31,300km² |
| Date | 06/2007 (Data sources from 1800s to 2006) |
| Quality of data | 2 = moderate (based on partial data with some extrapolation) |
| Trend | 0 = stable |
| Trend-Period | 1995 - 2006 |
| Reasons for reported trend | N/A |
| **Area covered by habitat** | |
| Surface area | Min. estimated 531km² (orchid-rich area is likely to be lower) |
| Date | 06/2007 |
| Method used | 2 = based on remote sensing data (supplemented by field data and expert judgement) |
| Quality of data | 1 = poor (based on very incomplete data or an expert judgment) |
| Trend | Decrease (-) |
| Trend magnitude | A 5% loss in extent of the habitat since designation was estimated on 31 SAC's surveyed in 2006. |
| Trend-Period | 1995 - 2006 |
| Reasons for reported trend | 3 = direct human influence (agricultural abandonment and improvement) |

| | |
|---|---|
| Justification of % thresholds for trends | The results of the Grassland Monitoring Survey (2006) on 31 SAC sites indicate that the extent is declining in 21 of the sites, with a conservation assessment of Unfavourable – Bad for 13 of the sites (suggesting a loss of >1%/year on these sites) and an assessment of unfavourable – inadequate for 8 sites (suggesting a loss of up to 1%/year on these sites). The overall loss shown above across all SACs does not accurately reflect this.<br><br>These estimated losses have occurred within protected sites and it can be assumed that the loss in habitat extent on sites outside of designated sites is similar or even greater.<br><br>Hence, since the extent of semi-natural dry calcareous grassland on designated sites is considered to be unfavourable bad, the conservation assessment of the extent of the habitat in general is considered to be **Unfavourable Bad.**<br><br>The overall 5% figure shown above was calculated across all 31 SACs as follows<br><br>• using a formula to estimate the area of the habitat in 31 SACs when originally designated (Appendix 5). This estimation of area in the past is then compared with current area in the SACs. However this figure of 5.1% is likely to be an underestimate as Unfavourable Bad was deemed to be > 15% at many of the sites<br><br>Another calculation of habitat loss using the original NATURA 2000 area figures supplied in the 90s (estimated at the time and not available for all sites) and comparing them with current area is greater than 5% (Appendix 5). |
| Main pressures | 954 Invasion by a species<br>149 Undergrazing<br>120 Fertilisation<br>103 Agricultural improvement<br>141 Abandonment of pastoral systems<br>301 Sand & gravel extraction: quarries |
| Threats | 954 Invasion by a species<br>149 Undergrazing<br>120 Fertilisation<br>103 Agricultural improvement<br>141 Abandonment of pastoral systems<br>301 Sand & gravel extraction: quarries |
| ***Complementary information*** | |
| **Favourable reference range** | 31,300 km² (= current range) |
| **Favourable reference area** | 559km² (at least the national surface area present when the Habitats Directive came into force) |
| **Typical species** | Vascular plants: *Anacamptis pyrimidalis, Antennaria dioica, Anthyllis vulneraria, Avenula pubescens, Blackstonia perfoliata, Briza media, Bromus erectus, Campanula rotundifolia, Carex caryophyllea, Carex flacca, Carlina vulgaris, Centaurea scabiosa, Conopodium majus, Daucus carota, Galium verum, Gentianella campestris, Hieracium pilosella, Knautia arvensis, Koeleria macrantha, Leontodon hispidus, Linum catharticum, Lotus corniculatus, Origanum vulgare, Primula veris, Ranunculus bulbosus, Sanguisorba minor* and *Trisetum flavescens.*<br><br>Bryophtyes: *Camptothecium lutescens.*<br><br>Burren and western species: *Asperula cynanchica, Dryas octopetala, Filipendula vulgaris, Geranium sanguineum, Gentiana verna, Helianthemum canum, Neotinea maculata* and *Sesleria albicans.*<br><br>Orchids: *Anacamptis pyrimidalis, Coeloglossum viride, Dactylorhiza fuchsia, Dactylorhiza maculate, Gymnadenia conopsea, Listera ovata, Neotinea maculata, Ophrys apifera, Orchis mascula, Orchis morio, Platanthera bifoliata, Platanthera chlorantha* and *Spiranthes spiralis.*<br><br>Methods – All of the above are characteristic of semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometea) (*important orchid sites) in Ireland (Dwyer *et al.*, 2007). |

| | |
|---|---|
| Typical species assessment | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | • The conservation assessment in this report applies principally to the non-priority grassland category: semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*). Whether the entire of these grasslands fall into the priority grassland category (i.e. whether they are important orchid sites) is not possible to deduce without a more intensive and widespread monitoring programme. Thus, unless specifically stated, the following assessment relates to semi-natural dry calcareous grasslands (*Festuco-Brometalia*).<br>• Important orchid sites are a sub-set of this category. Orchid-rich grassland is treated as a subset of the Annexed Habitat.<br>• Information on habitat condition is based on a survey of the habitat in 31 SACs in 2006. |
| ***Conclusions*<br>*(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable – Range stable and not below favourable reference range |
| **Area** | Bad (U2) – Losses have occurred since the Habitats Directive came into force. |
| **Specific structures and functions (incl. typical species)** | Bad (U2) – Structures and functions were assessed at 31 designated SAC sites by the Grassland Monitoring Project (GMP) in 2006 and the overall assessment was bad |
| **Future prospects** | Bad (U2) |
| **Overall assessment of CS** | Bad (U2) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Semi-natural dry grasslands and scrubland facies on calcareous substrates *(Festuco-Brometalia)* 6210**

- Current Distribution (248 cells)
- Current Range (313 cells)
- Favourable Reference Range (313 cells)
- W48 10km grid cells

Date: August 2007

# **6230** Species-rich *Nardus* grasslands on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)

## CONSERVATION STATUS ASSESSMENT REPORT

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## 1. Habitat characteristics in Ireland

The 'Interpretation Manual of European Habitats' (2003) lists six or seven Annex I grassland categories as occurring in Ireland (depending on whether or not orchid-rich grassland qualifies as a separate calcareous habitat). Two of these are assigned Priority Status, one of which is the category: 6230: Species-rich *Nardus* grasslands on siliceous substrates in mountain areas (and submountain areas, in Continental Europe). This is semi-natural grassland of upland areas that is typically found on sloping, acidic soils. It is believed to be a secondary habitat in most places, derived from the grazing of upland heath and is thus often found in a mosaic with dry heath. It essentially occurs in a narrow band above the upper limit of enclosed farmland on hills and mountains and below areas of heathland. However, a satisfactory vegetation classification of this type of heathy-grassland occurring in an Irish context has so far proved elusive. Indeed O'Sullivan (1982) argues that such a classification may, in fact, never be resolved due mainly to the species poverty of this type of grassland, the broad ecological amplitude of the species that do occur, and the use of fire, which can burn with varied intensity and duration, leading to major, if temporary, botanical changes.

The distribution of good quality species-rich *Nardus* grassland in Ireland is currently unclear as there has been no comprehensive vegetation survey of the uplands in the country. Nonetheless, there are ten SAC's designated for the habitat, eight of which are in (or partly within) County Tipperary. The remaining two are in (a) the Wicklow Mountains (SAC 2122), and (b) the Cuilcagh-Anierin Uplands (SAC 584) bordering Counties Cavan and Leitrim. The Grassland Monitoring Project 2006 (Dwyer *et al.*, 2007) found, in general, that the species-rich *Nardus* grassland surveyed in the Tipperary region occurred at an altitude of between 200-400m. However, it is likely to occur at higher altitudes in the south and the east of the country and may occur at lower altitudes in the north and west due to climatic variations.

## 2. Habitat mapping

The following data sources were used to map the known occurrences of species-rich *Nardus* grasslands in Ireland on a 10km square basis using ArcView GIS 3.2:

- Grassland Monitoring Project 2006 (Dwyer *et al*. 2007).
- Habitat Assignment Project (NPWS, 2006).
- Coillte Biodiversity Database.

In mapping the current range, all 10km squares in which areas of the habitat mapped by the GMP 2006 or by Coillte were included. In addition SACs highlighted by the Habitat Assignment Project as supporting the habitat were assessed by elevation and geology to determine where within the SAC, the habitat was likely to occur. Within these SACs only those 10km squares which contained suitable elevations (200-400m) overlaying an area of suitable geology (siliceous rock) were included when mapping the current extent of the habitat.

Additionally, since no comprehensive inventory of the national resource of species-rich *Nardus* grasslands has yet been undertaken in Ireland there are undoubtedly further areas of the habitat present. Thus

- the contours data (from the Ordnance Survey of Ireland) and
- the geology data (from the Geological Survey of Ireland) were intersected to establish where additional areas of the habitat might occur.

All the non-limestone geology categories were chosen and these were intersected with contour lines of between 200-400m.

- Following this, the 10km grid square data for each of the following eight species listed by Dwyer *et al*. (2007) as indicative of species-rich *Nardus* grassland was downloaded from the BSBI (Biological Society of the British Isles) website (www.searchnbn.net): *Agrostis capillaris, Danthonia decumbens, Galium saxatile, Hypericum maculatum, Lathyrus montanus, Pedicularis sylvatica, Nardus stricta* and *Succisa pratensis.* A ninth species, *Veronica officinalis* was added to this list. This is included in the

'Interpretation Manual of European Habitats', but was removed from the final list compiled by the GMP. All records were analysed, including any of the more historic records such as those from the 19th Century. These were included in an attempt to counter-act the under-recording of species in recent years.

Where all nine species were found to occur within a 10km square and at least part of the square was composed of suitable geology overlaying an area with suitable elevation (200-400m), species-rich *Nardus* grassland was considered likely to occur (or at least have occurred in the past). Thus, these squares were all included when mapping the current range of the habitat. Clearly future fieldwork is required to establish whether or not species-rich *Nardus* grassland does in fact occur within these squares.

- In addition the 10km grid square data for *Pseudorchis albida* was downloaded from the BSBI website (and the NPWS records of the species imported into ArcView), The 10km squares in which it occurred were investigated in order to determine whether or not there were areas within the 10km square where the desired geology (for species-rich *Nardus* grassland) was found to be overlaying areas of the desired elevation. Where such areas were found, the squares were also included when mapping the current range of the habitat. This species is deemed by NPWS to be highly important to this habitat in an Irish context. Again future fieldwork is required to establish whether or not species-rich *Nardus* grassland does in fact occur within these squares.

The map of the **Current Range** of species-rich *Nardus* grassland was then produced in the following manner. Range was defined by mapping a minimum polygon around the identified occurrences (and likely occurrences). Breaks in the range were justified when there was a gap of greater than 2 grid squares between occurrences (not counting squares joined diagonally). **Favourable Reference Range** was defined as the current range as it was deemed that this is sufficient to ensure the long term viability of the habitat and that it encompassed the range of ecological variation that occurs in this habitat type in Ireland.

## 3 Habitat range

Species-rich *Nardus* grasslands are predominantly found on acidic soils on sloping ground in upland areas of Ireland. They generally occur in a narrow band between 200-400m in elevation, above more agriculturally improved types of grassland and below areas of heathland. However, the distribution of good quality species-rich *Nardus* grassland in Ireland is currently unclear as there has been no comprehensive vegetation survey of the uplands in the country.

### 3.1 Conservation status of habitat range

The favourable reference range has been defined, as the current range therefore the status of the habitat range is **favourable**.

**Current range:** 17,800km$^2$ (minimum polygon around grid cells containing habitat)
**Favourable reference range:** 17,800km$^2$ (defined as current range)

## 4 Habitat extent

The extent of species-rich *Nardus* grasslands in Ireland is unknown and is likely to remain so until such time as a comprehensive vegetation survey of the uplands of the country is undertaken. However, O'Sullivan (1982) estimated that *Nardetalia* grasslands covered approximately 2,000km$^2$. O'Sullivan acknowledged that a proportion of this area would have been planted with coniferous trees by the then Forest and Wildlife Service and that other areas within commonage would have suffered from poor management (undergrazing and overgrazing). It can be assumed that much more areas were planted with forestry since O'Sullivan's paper (25 years ago) and that because of the E.U. Headage payments scheme (which was an integral part of Irish farming particularly in the west of Ireland throughout the 1980's and early 1990's) further areas of *Nardetalia* grasslands have been degraded because of overgrazing. Keeping these factors in mind together with the fact that the Interpretation Manual states that areas irreversibly degraded through overgrazing should be excluded, the current extent of species-rich *Nardus* grassland can be expected to be much lower than 2,000km$^2$.

### 4.1 Conservation status of habitat extent

The Grassland Monitoring Project conducted in 2006 (Dwyer *et al*., 2007) evaluated the extent of species-rich *Nardus* grassland on seven out of 10 SAC's designated for the habitat comparing the current extent to that which was described from the SAC at the time of designation (ca. 10 years previously). The results of the survey indicate that the extent is declining in four (57%) of the sites, with a conservation assessment of unfavourable – bad on each of these four sites. The extent was assessed as Favourable at the remaining three sites though the amount of the habitat present at one of these (Keeper Hill, 001197) sites was considered negligible to the extent that it is doubtful whether the habitat present there truly represents species-rich *Nardus* grassland at all.

Of the four sites in which a decline in extent was recorded, a decline of ca. 50% or over was estimated in three of them with a decline of up to 25% estimated in the fourth. Despite the fact that the site with by far the largest extent (ca. 300ha) of species-rich *Nardus* grassland (Galtee Mountains, 000646) being assessed as favourable under habitat extent, there was still approximately an 11% loss in extent of the habitat over these seven sites since designation, with ca. 43ha being lost from an original area of ca. 389ha (see appendix 1). The most significant loss took place at Kilduff, Devilsbit Mountain (000934) where an area described as having possibly been the best example of species-rich *Nardus* grassland in the country (O'Criodáin, pers. comm.) and which was also known from NPWS Rare Plant Survey (Fitzgerald 1991) to contain a significant population of *Pseudorchis albida* was lost to agricultural improvement in the form of reseeding and fertilising.

All these losses took place within designated sites. It can thus be assumed that the loss in habitat extent on sites outside of designated areas is likely to be similar or even greater. Hence, since the extent of species-rich Nardus grassland on designated sites is considered to be unfavourable bad, the conservation assessment of the extent of the habitat in general is considered to be **Unfavourable Bad.**

The area, in the absence of National data can be said to be on the decline and less than 2000 $km^2$ There are recent area.figures available for the 7 SACs visited by GMP (2006) and for the 35 sites mapped by Coillte. The areas respectively are 346 and 285 ha yielding a total of 631 ha.

**Current area:** Unknown (much less than 2,000$km^2$)
**Favourable reference area:** Unknown (much less than 2,000$km^2$ but > than current)

## 5. Structures and functions

### 5.1 Habitat structures and functions

Species-rich *Nardus* grasslands are maintained by a low intensity grazing regime. Their continued existence is under threat from agricultural intensification (overgrazing and/or the application of fertilisation and re-seeding etc. leading to a more improved type of grassland), agricultural abandonment (undergrazing leading to invasion by scrub, bracken and heathland) and afforestation, which is likely to have resulted in significant losses in the extent of this habitat in the last number of decades.

#### 5.1.1. Conservation Status of Habitat Structures and Functions

The Grassland Monitoring Project (Dwyer *et al*., 2007) evaluated the Structure and Functions of species-rich *Nardus* grassland on 7 of the 10 SAC's designated for the habitat. This involved evaluating the condition of the habitat by examining a number of different attributes that determine the habitat's correct functioning. The four attributes chosen by Dwyer *et al*. to best assess the quality of species-rich *Nardus* grassland in Ireland were a) herb content, b) the presence of typical positive indicator species, c) the presence of negative indicator species, and d) the percentage cover of woody species and/or Bracken. Specific targets were agreed and set for each of these four criteria and the vegetation was examined at a number of Monitoring Stops at each site and tested against these pre-determined targets.

The results of the survey indicate that the condition of species-rich *Nardus* grassland in Ireland is generally poor. In fact, the Structure and Functions of the grassland was considered unfavourable – bad at all 7 sites. However, at one of these sites, Keeper Hill (001197), the assessment was problematic since it is doubtful whether the habitat assessed could be truly described as being species-rich *Nardus* grassland. In fact, the abundance of *Juncus effusus* across much of the site and the widespread occurrence of true heath communities suggests that the habitat is largely absent from the site.

The assessment of the habitat at the Galtee Mountains (000646) as unfavourable – bad could also be considered harsh as Dwyer *et al.* argued that in reality the condition of the grassland was not seen to be excessively poor with 7 or 8 positive indicator species being recorded in the Stops that failed (instead of the target number of 9 or more).

However, the condition of the species-rich *Nardus* grassland on the remaining 5 sites was particularly poor, especially in Kilduff, Devilsbit Mountain (00934) and Bolingbrook Hill (002125), where a significant number of 'Fail' results were recorded for a combination of the four attributes assessed at most of the Stops carried out. Indeed it was questioned whether the once healthy population of the orchid *Pseudorchis albida* known to have occurred on Kilduff may have been completely lost from the site.

These results refer only to the condition of the habitat within protected sites. It can thus be assumed that the condition of the habitat on sites outside of designated areas is likely to be even poorer. Hence, the Structure and Functions of species-rich *Nardus* grassland in Ireland is considered to be **Unfavourable Bad.**

## 5.2. Typical Species

O'Sullivan (1982) lists the species considered by him to be representative of the only reliably defined association for *Nardetalia* in Ireland, the Achilleo-Festucetum tenuifoliae. These species, including the class and order diagnostic species as listed by White and Doyle (1982) include the following: *Nardus stricta*, *Danthonia decumbens*, *Luzula multiflora*, *Carex pilulifera*, *Veronica officinalis*, *Festuca vivipara*, *Lathyrus montanus*, *Achillea millefolium*, *Agrostis capillaris*, *Festuca ovina*, and *Viola canina*. Additional species listed in the EU Habitats Manual occurring in the upland grasslands in Ireland are *Galium saxatile, Hypericum maculatum, Pedicularis sylvatica,* and *Polygala vulgaris.* The orchid *Pseudorchis albida* is also listed in the Manual as being an indicator species for species-rich *Nardus* grassland. Following discussion with grassland experts within the NPWS staff and analysis of the above, published sources, Dwyer *et al*. (2007) compiled a list of 21 species deemed to be indicative of this grassland type in the Irish context. These are listed here with those species listed in the Interpretation Manual for species-rich *Nardus* grassland denoted by an asterix:

*Achillea millefolium, Agrostis capillaris, Anthoxanthum odoratum, Carex pilulifera, Danthonia decumbens, Festuca ovina*, Galium saxatile*, Hypericum maculatum*, Juncus squarrosus, Lathyrus montanus*, Luzula multiflora, Nardus stricta*, Pedicularis sylvatica*, Polygala serpyllifolia, Polygala vulgaris*, Potentilla erecta, Pseudorchis albida*, Rhytidiadelphus squarrosus, Succisa pratensis, Viola canina*, and Viola riviniana.*

### 5.2.1. Conservation Status of Habitat Typical Species

An accurate assessment of the condition of the typical species for species-rich *Nardus* grassland is impossible to carry out in the absence of a specific monitoring programme. As the ecological amplitude of most of the species listed above is broad, their conservation status could be argued to be favourable. However, as the presence of a target number of positive indicator species was one of the attributes used to assess the Structure and Functions of the habitat, the conservation status of the typical species of the habitat is in someway related to the habitats Structure and Functions, which was assessed as unfavourable bad. Furthermore, *Pseudorchis albida* is listed in *The Irish Red Data Book of Vascular Plants* (Curtis and McGough, 1988) as being vulnerable with the authors suggesting that the decline of this species appears to have stemmed from the increased pressure on hill pastures from overgrazing, reclamation and the associated application of artificial fertilisers. The conservation status of the habitats typical species is thus considered to be **Unfavourable Bad**.

## 6. Impacts and Threats

The continued existence of species-rich *Nardus* grasslands is under threat from

- agricultural intensification (overgrazing or the application of fertiliser and re-seeding etc. leading to a more improved type of grassland),
- agricultural abandonment (undergrazing, leading to invasion by scrub, bracken and heathland)
- and afforestation.

The results of the GMP indicate that undergrazing and the encroachment by *Pteridium aquilinum* and scrub species are currently the most significant threats to the habitat having been recorded as occurring at 6 of the 7 (86%) sites surveyed (Dwyer *et al.*, 2007). These two threats are obviously directly related to each other with encroachment occurring as a direct result of undergrazing. Insufficient management is thus the core threat facing species-rich *Nardus* grasslands with the abandonment of pastoral systems recorded at one of the sites surveyed. Other significant threats listed by Dwyer *et al*. included the application of fertiliser, agricultural improvement, overgrazing by sheep and general forestry management.

Only two entries were recorded under species-rich *Nardus* grasslands in the Site Inspection Reports (SIR) from 2001-2003. These are reports carried out in relation to designated sites on a three-year cycle by regional NPWS staff. The lack of entries is probably due more to an under-staffing of the regional staff rather than a lack of impacts on the habitat. The two entries made in the SIR were animal breeding – stock feeding (171) on Bolingbrook Hill and pollution (700) on Anglesey Road. Damage caused by animal breeding – stock feeding was also recorded by the GMP on the Silvermine Mountains.

### 6.1 Encroachment by *Pteridium aquilinum* and woody scrub species

Encroachment by *Pteridium aquilinum* and scrub species (along with undergrazing) are the most frequent negative impacts recorded by Dwyer *et al*. (2007). Indeed such encroachment was recorded at parts of 6 of the 7 sites surveyed (86%) with the Galtee Mountains (000646) the only site where the problem was not recorded. Furthermore, three of the six sites where the problem was recorded registered an intensity level of A (high influence), two registered B (medium influence) and one registered C (low influence). The primary reason for the encroachment was adjudged to be the abandonment of traditional farming (or the scaling down to a more part-time farming set-up) and the concurrent failure to put replacement management procedures in place. It was also noted that encroachment as a result of such abandonment is not a new issue as numerous references were made to the problem in many of the original survey notes from the NHA surveys undertaken in the 1990's. Reference to the potential for the problem to expand was also flagged at that time. Dwyer *et al*. (2007) allude to the fact that as the rate at which farming is declining on a national level has increased in recent years, further losses in the extent and quality of species-rich *Nardus* grasslands can be expected to occur as a result of encroachment in the near future, unless a focussed programme to target the issue (at least on protected sites) is put in place. Indeed of the three sites with an A intensity, both Bolingbrook Hill (002124) and Anglesey Road (002125), bracken has already encroached to such an extent that significant areas of both sites would now be classed under the habitat category as 'Dense Bracken' according to Fossitt (2000).

**Encroachment trend**

From an examination of the site notes taken during the NHA surveys in the 1990s and the GMP notes taken in 2006, there is anecdotal evidence to suggest that the issue of encroachment by *Pteridium aquilinum* and scrub species such as *Prunus spinosa, Crataegus monogyna*, and *Ulex* spp. appears to be increasing.

## 6.2 Undergrazing

Undergrazing was also recorded in parts of 6 of the 7 sites surveyed (86%) by Dwyer *et al.* (2007) with the Silvermine Mountains (000939) being the only site surveyed where the problem was not recorded. However, this is likely to be in error as encroachment by bracken was recorded, which is likely to mean that undergrazing is occurring. The reason for undergrazing is similar to that described above for encroachment – abandonment of traditional farming, or the scaling down of traditional farming to a more part-time farming set-up. If these sites are continually undergrazed, large parts of the grassland are again likely to be lost to the encroachment of bracken, scrub or heathland.

**Undergrazing trend**

Although little comparable data is available, it would seem from a comparison of the GMP site notes taken in 2006 to those notes taken during the NHA surveys in the 1990s that the problem of undergrazing is increasing.

## 6.3 The application of fertiliser

Dwyer *et al*. (2007) noted the application of fertilisers as occurring at 5 of the 7 sites (71%) surveyed. However, the relative intensity of the impact of this activity on species-rich *Nardus* grassland appears to be less than that resulting from invasion by scrub or *Pteridium aquilinum*. Only one sites, Bollingbrook Hill (002124) recorded an intensity level of B (medium influence) for fertilisation with the other four sites recording a C intensity (low influence). These values reflect a general perception noted by field workers on the ground, that while a degree of agricultural improvement was still occurring at grassland sites, the consequences of the reduction or even abandonment of old farming practices were much more noticeable as an impact on the quality of species-rich *Nardus* grassland.

**The application of fertiliser trend**

Again little comparable data is available. However, anecdotal evidence from a comparison of the GMP site notes taken in 2006 to those notes taken during the NHA surveys in the 1990s would suggest that the problem of the over-use of fertiliser application is declining, at least on the sites surveyed during the GMP. However, it should be realised that as this survey was limited to protected sites (SAC's), this trend cannot be assumed to be similar on non-protected species-rich Nardus grassland sites.

### 6.4 Agricultural Improvement –cultivation

Agricultural improvement, in the form of reseeding with a *Lolium perenne* dominated grass mix coupled with the application of fertiliser was noted in only one of the seven SAC's surveyed by Dwyer *et al*. (2007). This form of 'improvement' is much more detrimental than the application of fertiliser on its own as it is much more difficult to reverse. Unfortunately, the only reseeding within areas formerly described as species-rich *Nardus* grassland took place in what was arguably the best example in the country of the habitat (O'Criodáin, pers. comm.). This area was also known to contain a significant population of *Pseudorchis albida* (NPWS, Fitzgerald 1991 Rare Plant Survey). However, it is now likely that this population has been greatly diminished and possibly even completely lost.

**Agricultural Improvement (cultivation) trend**

Again little comparable data is available. However, anecdotal evidence suggests that the amount of land being agriculturally improved in this manner is decreasing, at least on protected sites.

### 6.5 Overgrazing by sheep

Although overgrazing was recorded at only one of the seven SAC sites surveyed by Dwyer *et al*. (2007), it has undoubtedly played a role in the degradation of areas of species-rich *Nardus* grasslands over the last two to three decades in much of the uplands of the north-west, west and south west (Dromey pers. obs,). Over-grazing in upland grasslands leads to an abundance of the less palatable species such as *Nardus* and a reduction in species diversity, a requirement necessary for the grassland to qualify as per the EU Habitat description. Indeed, the *Interpretation Manual of European Union Habitats* (Anon, 2003) acknowledges that such damage has occurred and specifically states that "the habitats which have become irreversibly degraded through overgrazing should be excluded" – from SAC status.

The overstocking of sheep (leading to overgrazing) on much of Ireland's uplands was encouraged throughout the 1980's and most of the 1990s through European policy adopted by the Irish government such as the E.U.-funded Headage payments scheme. This scheme was an integral part of Irish farming during this period supporting farm incomes in disadvantages areas and resulted in sheep numbers almost trebling in the country between 1980 and 1991 (Cabot, 1999).

**Overgrazing by sheep trend**

From the mid 1990's onwards agricultural policy in Ireland has paid more attention to agric-environmental issues, beginning with the launch in 1994 of the Rural Environment Protection Scheme (REPS), which is an EU-funded Department of Agriculture, Food and Forestry scheme aimed at encouraging environmentally sensitive farming that is currently entering its fourth phase (REPS IV). More recently stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (FAPRI-Ireland Partnership 2003). Thus, overgrazing is becoming less of an issue for species-rich *Nardus* grasslands particularly on designated sites.

## 6.6 General Forestry Management

Although designated sites are protected from afforestation, forestry in Ireland is often synonymous with marginal agricultural land, into which species-rich *Nardus* grasslands may be placed. However, because the extent and distribution of species-rich *Nardus* grasslands is largely unknown in Ireland, it is impossible to estimate how much of the habitat has been planted with forestry. All that can be stated is that within the FRR of species-rich *Nardus* grassland (17,900km$^2$), there are 1,444km$^2$ (8% of FRR) of forestry according to FIPS (1998 – see appendix 4). An unknown proportion of this 1,444km$^2$ will have been planted on areas of species-rich *Nardus* grassland.

The threat posed by forestry to the grassland was noted by Dwyer *et al.* (2007) during the GMP in 2006 on the Galtee Mountains. An area of the habitat here had been refused a forestry grant application in 1996 and coniferous forestry plantations were noted as occurring adjacent to the northern, eastern, and parts of the southern boundaries to this cSAC.

**General Forestry Management trend**

Although designated sites are in someway protected from forestry, areas of species-rich *Nardus* grassland outside of designated sites have little or no such protection. Thus, there is likely to be an ongoing loss of the habitat to forestry. This loss is presently unquantifiable and further strengthens the call for a comprehensive uplands survey in order that a baseline figure for the extent of species-rich *Nardus* grassland can be estimated.

## 7 Future Prospects

### 7.1 Negative Future Prospects

On six of the seven sites (86%) surveyed by the GMP (Dwyer *et al.*, 2007), the future prospects of species-rich *Nardus* grassland were deemed unfavourable – bad with the remaining site (Galtee Mountains) considered unfavourable – inadequate. This is largely a result of a departure from traditional farming methods. The farming community has essentially chosen two polarised routes: intensification or abandonment. This has resulted in the problems outlined in section 6 above. As can be seen from the results of the GMP, simply designating a site as being a Special Area of Conservation is not enough, even if deleterious activities such as agricultural improvements were prevented. The largest threat to the grasslands is found in merely doing nothing. Hence, a management system needs to be put in place to replace or emulate the traditional farming practices that maintained the grassland for centuries.

## 7.2 Positive Future Prospects

Although at present the future of species-rich *Nardus* grasslands appears bleak, there are a number of factors/schemes giving some hope for their continued existence. These include:

- As already noted, following the introduction of a Single Farm Payment (SFP) (FAPRI-Ireland Partnership 2003), stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies. As long as the market value of hill sheep remains low, there is little incentive for farmers to maintain large flocks in the uplands.

  Payment under the SFP requires the farmer to keep lands in "Good Agricultural and Environmental Condition".
- The Rural Environment Protection Scheme (REPS), which is an EU-funded Department of Agriculture, Food and Forestry scheme aimed at encouraging environmentally sensitive farming that is currently entering its fourth phase (REPS IV).
- Another scheme launched in February 2006, the National Farm Plan Scheme, operates on designated sites and commonage land and allows the Department of Agriculture to pay farmers and landowners who are not in REPS, for losses incurred through restrictions caused by the designation of their lands as well as paying for certain actions, which are beneficial to wildlife as agreed in a Farm Plan.
- Species-rich *Nardus* grasslands within SAC's are also protected to a degree through a list of Notifiable Actions. This lists activities, which should not be carried out on the site without consent including for example the application of fertilisers, pesticides or herbicide and re-seeding.

## 7.3 Overall habitat future prospects

Despite several positive prospects, overall the habitat future prospects are **Unfavourable Bad.**

## 8 Overall Assessment of the Habitat Conservation Status

- The Favourable Reference Range (FRR) has been defined, as the current range therefore the status of the habitat range is **Favourable**.
- The current habitat extent is difficult to determine, as a complete inventory of the national resource of the habitat in Ireland is required. Thus, no estimate of the current national area is given, other than it is much less than 2,000km$^2$. (A figure for the area within SACs and Coillte sites is available). However, there has been an 11% loss in the extent of the habitat since designation in the seven SAC's surveyed in 2006. Thus since the Favourable Reference Area (FRA) is required to be at least the surface area present when the Habitats Directive came into force, the status of habitat extent is **Unfavourable Bad**.
- An **Unfavourable Bad** assessment is also given to the habitat structures and functions, due mainly to agricultural abandonment, but also to agricultural improvement and some over-grazing.
- The habitat's future prospects are deemed to be **Unfavourable Bad**. Sub-optimal grazing levels and the encroachment of scrub was recorded in parts of 86% of the SAC sites surveyed in 2006 by the GMP and thus severely threatens the long-term existence of the habitat. Major positive management actions including the removal of scrub and the implementation of adequate grazing regimes are required.

The overall conservation status for species-rich *Nardus* grassland is **Unfavourable Bad**.

# 9 References

Anon. (2003) *Interpretation Manual of European Union Habitats*. EUR 25. European Commission, DG Environment.

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O'Sullivan, A.M. (1982) The Lowland Grasslands of Ireland. *Journal of Life Sciences*. Royal Dublin Society. 3, 131-142.

White, J. and Doyle, G. (1982) The Vegetation of Ireland, a Catelogue Raisonne. *Journal of Life Sciences*. Royal Dublin Society. 3, 289-368.

**Appendix 1**: The following is a full list of Irish SAC sites for which species-rich *Nardus* grassland (6230 habitat) is noted as a qualifying interest. The areas given are the areas of species-rich *Nardus* grassland estimated to occur on each site by the Grassland Monitoring Project in 2006 (Dwyer et al, 2007).

| Site Code | Site Name | Surveyed by the GMP 2006 | Area in 2006 (ha) |
|---|---|---|---|
| IE0000584 | Cuilcagh - Anierin Uplands | No | N/A |
| IE0000646 | Galtee Mountains | Yes | 300 |
| IE0000934 | Kilduff, Devilsbit Mountain | Yes | 7 |
| IE0000939 | Silvermine Mountains | Yes | 1 |
| IE0001197 | Keeper Hill | Yes | 1 |
| IE0002122 | Wicklow Mountains | No | N/A |
| IE0002124 | Bolingbrook Hill | Yes | 30 |
| IE0002125 | Anglesey Road | Yes | 5 |
| IE0002257 | Moanour Mountain | Yes | 2 |
| IE0002258 | Silvermines Mountains West | No | N/A |

**Appendix 2**: The following is the list of additional sites highlighted by the Habitats Assignment Project (2006) as supporting areas of species-rich *Nardus* grassland (6230 habitat).

| Site Code | Site Name | Designation |
|---|---|---|
| IE0000093 | Caha Mountains | cSAC |
| IE0000190 | Slieve Tooey/Tormore Island/Loughros Beg Bay | cSAC |
| IE0000330 | Tully Mountain | cSAC |
| IE0000375 | Mount Brandon | cSAC |
| IE0000453 | Carlingford Mountain | cSAC |
| IE0000623 | Ben Bulben, Gleniff and Glenade Complex | cSAC |
| IE0000770 | Blackstairs Mountains | cSAC |
| IE0000881 | The Great Heath of Portlaoise | cNHA |
| IE0001938 | Coguish Bog | cNHA |
| IE0001986 | Garinish Point | cNHA |
| IE0002129 | Murvey Machair | cNHA |
| IE0002301 | River Finn | pcSAC |
| IE0002390 | Nephin Mountain Bog | cNHA |
| IE0002393 | Nephin Beg Bogs | cNHA |
| IE0002461 | Crockahenny | cNHA |
| IE0002693 | Knockmealdown Mountains | cNHA |

**Appendix 3**: The following is the list of areas highlighted by the Coillte Biodiversity Database (in May 2007) as supporting areas of species-rich *Nardus* grassland (6230 habitat).

| County | Coillte Property | Approximate area of habitat 6230 (ha) |
|---|---|---|
| Cork | Cummery-Connell | 1.1 |
| Cork | Milleenduff | 1.8 |
| Cork | Cappaphaudeen | 0.6 |
| Cork | Scrahan | 2.0 |
| Donegal | Scalp | 28.0 |
| Donegal | Beaghmore | 14.0 |
| Donegal | Clogher North | 17.6 |
| Donegal | Meenateia | 20.9 |
| Donegal | Roechrow | 21.0 |
| Donegal | Fintragh | 21.0 |
| Donegal | Largysillagh | 9.1 |
| Donegal | Straness | 2.1 |
| Galway | Cammanagh | 6.5 |
| Kerry | Cloghvoola | 9.2 |
| Kerry | Dromore Old | 1.1 |
| Kerry | Caherbarnagh | 14.7 |
| Louth | Carlingford | 9.2 |
| Louth | Crumpaun | 2.5 |
| Leitrim | Aghaderrard East | 0.3 |
| Leitrim | Gorteendarragh | 9.2 |
| Leitrim | Largy | 0.9 |
| Leitrim | Boleyboy | 4.6 |
| Leitrim | Dergvone | 0.5 |
| Leitrim | Moher Gregg | 0.8 |
| Leitrim | Tullintowell | 2.0 |
| Mayo | Ballymoyock | 0.2 |
| Mayo | Doonbreedia | 0.5 |
| Mayo | Shanvoley | 10.0 |
| Mayo | Largan | 7.0 |
| Mayo | Clooneshill | 2.1 |
| Mayo | Kilgarve | 2.5 |
| Sligo | Gleniff | 28.0 |
| Tipperary | Cappa | 3.1 |
| Tipperary | Scaragh | 7.2 |
| Wicklow | Laragh West | 24.0 |

**Appendix 4**: Dataset Review

**Botanical Society of the British Isles (BSBI) Data**

The data for nine indicator species of species-rich *Nardus* grassland was downloaded from the BSBI website (www.searchnbn.net) on a 10km grid basis. The fact that this data was analysed on a 10km basis has obvious flaws as although all nine indicator species may have been recorded in one 10km grid square, it does not necessarily imply that the nine species (or even any two of the nine species) occurred in close association with each other in that 10km square. Furthermore, it is likely that many species on the BSBI website have been under-recorded in Ireland. An attempt was made to compensate for this by including all records (i.e. including all pre-1970 and even pre-1900) from the BSBI. However, this may also have lead to errors when estimating the current range, as although a species may have been recorded in an area in the past, this does not imply that the species is still present in the area.

**Geology Data**

Geological data, made available by the Geological Survey of Ireland was essential in determining where species-rich *Nardus* grassland is likely to occur in Ireland (i.e. siliceous rock).

**Contour Data**

Contour data, made available by the Ordnance Survey of Ireland was essential in determining where species-rich *Nardus* grassland is likely to occur in Ireland (i.e. between 200-400m in altitude). However, although the data was available in vector format, it was as polylines and not polygons. Thus, areas could not be calculated.

**FIPS 1998**

The FIPS data was used only used in order to give an indication of the extent of forestry that may occur within areas that were formerly species-rich *Nardus* grassland. The following table lists the categories and areas of forestry listed by FIPS and occurring within the Favourable Reference Range of species-rich *Nardus* grasslands.

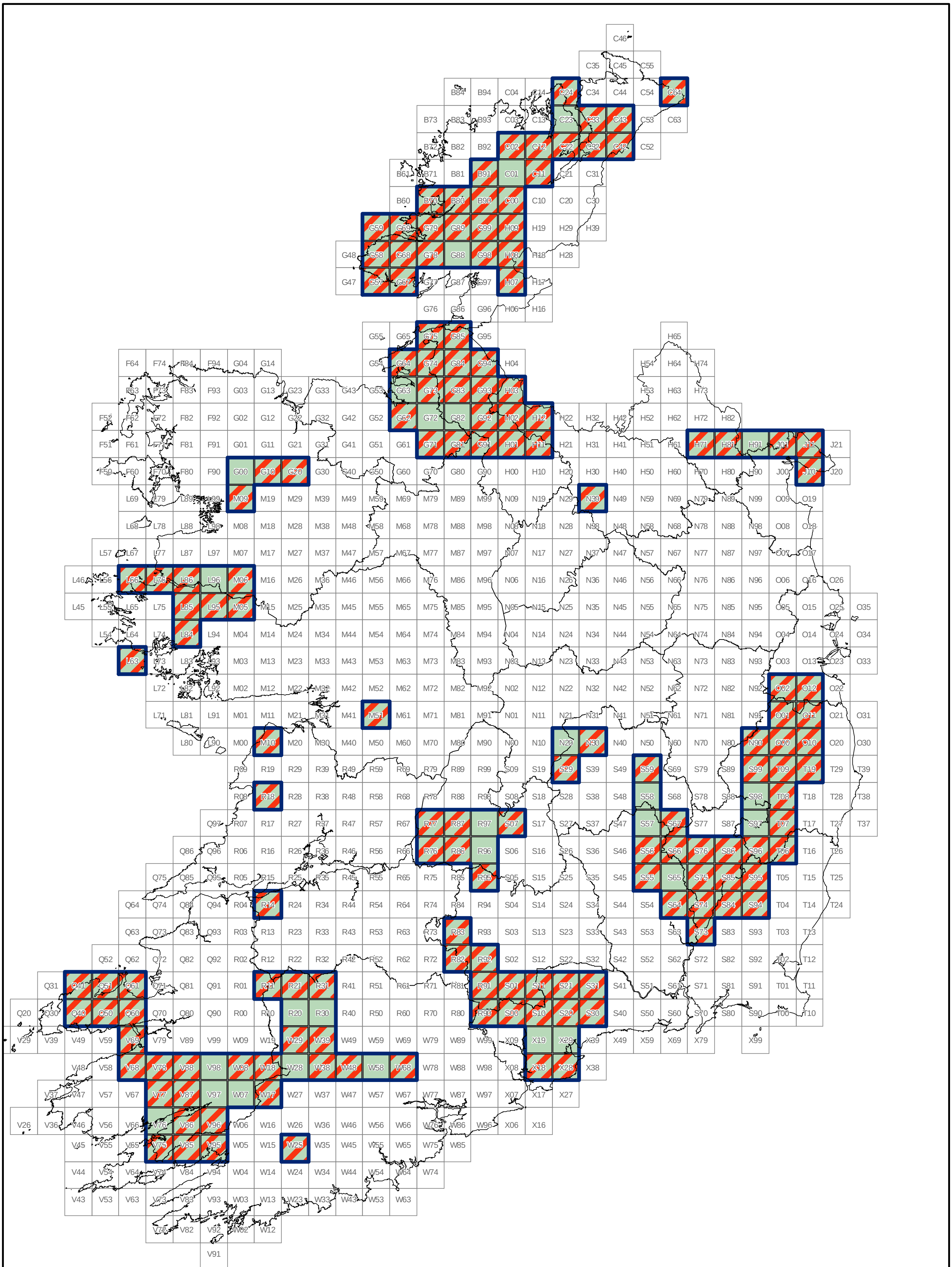
| Class Category | Area (ha) |
|---|---|
| Broadleaf forest | 142.0 |
| Conifer forest | 1237.5 |
| Mixed forest | 61.4 |
| Other forest | 3.0 |
| **Total of the above forest categories** | **1443.9** |
| Planting Grant App | 297.8 |
| BLANK | 37.2 |
| Cleared | 309.0 |

## 6230 Species-rich *Nardus* grasslands on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)

| National Level | |
|---|---|
| **Habitat Code** | 6230 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | Dwyer, R., Crowley, W. and Wilson, F. (2007) *Grassland Monitoring Project 2006*. Unpublished Report, National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.<br>O'Sullivan, A.M. (1982). The Lowland Grasslands of Ireland. *Journal of Life Sciences*. Royal Dublin Society. 3, 131-142.<br>White, J. and Doyle, G. (1982). The Vegetation of Ireland, a Catelogue Raisonne. *Journal of Life Sciences*. Royal Dublin Society. 3, 289-368. |
| **Range** | Species-rich *Nardus* grasslands are predominantly found on acidic soils on sloping ground in upland areas of Ireland. They generally occur in a narrow band between 200-400m in elevation, above the upper limit of enclosed farmland and below areas of heathland. However, the distribution of good quality species-rich *Nardus* grassland in Ireland is currently unclear as there has been no comprehensive vegetation survey of the uplands in the country. |
| Surface area | 17,800km² |
| Date | 06/2007 (Data sources from 1995 to 2006) |
| Quality of data | 1 = poor |
| Trend | 0 = stable |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | N/A |
| **Area covered by habitat** | |
| Surface area | Unknown |
| Date | 06/2007 |
| Method used | N/A |
| Quality of data | 1 = poor |
| Trend | Decrease (-) |
| Trend magnitude | 11% loss of habitat within seven SACs |
| Trend-Period | 1995 - 2006 |
| Reasons for reported trend | 3 = direct human influence (agricultural abandonment and improvement) |
| Justification of % thresholds for trends | Trend based on a ground survey of seven of the ten SACs designated for the habitat. |
| Main pressures | 954 Invasion by a species<br>149 Undergrazing<br>120 Fertilisation<br>103 Agricultural improvement<br>142 Overgrazing by sheep<br>160 General forestry management |
| Threats | 954 Invasion by a species<br>149 Undergrazing<br>120 Fertilisation<br>103 Agricultural improvement<br>142 Overgrazing by sheep<br>160 General forestry management |
| ***Complementary information*** | |

| | |
|---|---|
| **Favourable reference range** | 17,800km² (= current range) |
| **Favourable reference area** | Unknown (much less than 2000km² estimated by O' Sullivan (1982) to occur at that time. The precise are of the habitat in Ireland is unknown and cannot be accurately determined in the absence of a dedicated national field survey. Areas of 7 SAC sites are given in addition to that within 35 Coillte sites. |
| **Typical species** | *Achillea millefolium, Agrostis capillaris, Anthoxanthum odoratum, Carex pilulifera, Danthonia decumbens, Festuca ovina, Galium saxatile, Hypericum maculatum, Juncus squarrosus, Lathyrus montanus, Luzula multiflora, Nardus stricta, Pedicularis sylvatica, Polygala serpyllifolia, Polygala vulgaris, Potentilla erecta, Pseudorchis albida, Rhytidiadelphus squarrosus, Succisa pratensis, Viola canina* and *Viola riviniana.* |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | |
| ***Conclusions (assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable – Range stable and not below favourable reference range |
| **Area** | Bad (U2) – 11% habitat decline in the period 1995-2006 on the seven SACs surveyed by the GMP in 2006. |
| **Specific structures and functions (incl. typical species)** | Bad (U2) – Structures and functions were investigated on the seven SACs surveyed by the GMP in 2006 by assessing a) herb content, b) the presence of typical positive indicator species, c) the presence of negative indicator species, and d) the percentage cover of woody species and/or Bracken and the conservation assessment was unfavourable bad. |
| **Future prospects** | Bad (U2) - Major positive management actions including the removal of scrub and the implementation of adequate grazing regimes are required |
| **Overall assessment of CS** | Bad (U2) |



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1:1,800,000

0 12.5 25 50 Kilometers

**Species-rich *Nardus* grassland on siliceous substrates in mountain areas 6230**

Current Distribution (151 cells)

Current Range (178 cells)

Favourable Reference Range (178 cells)

W48 10km grid cells

Date: August 2007

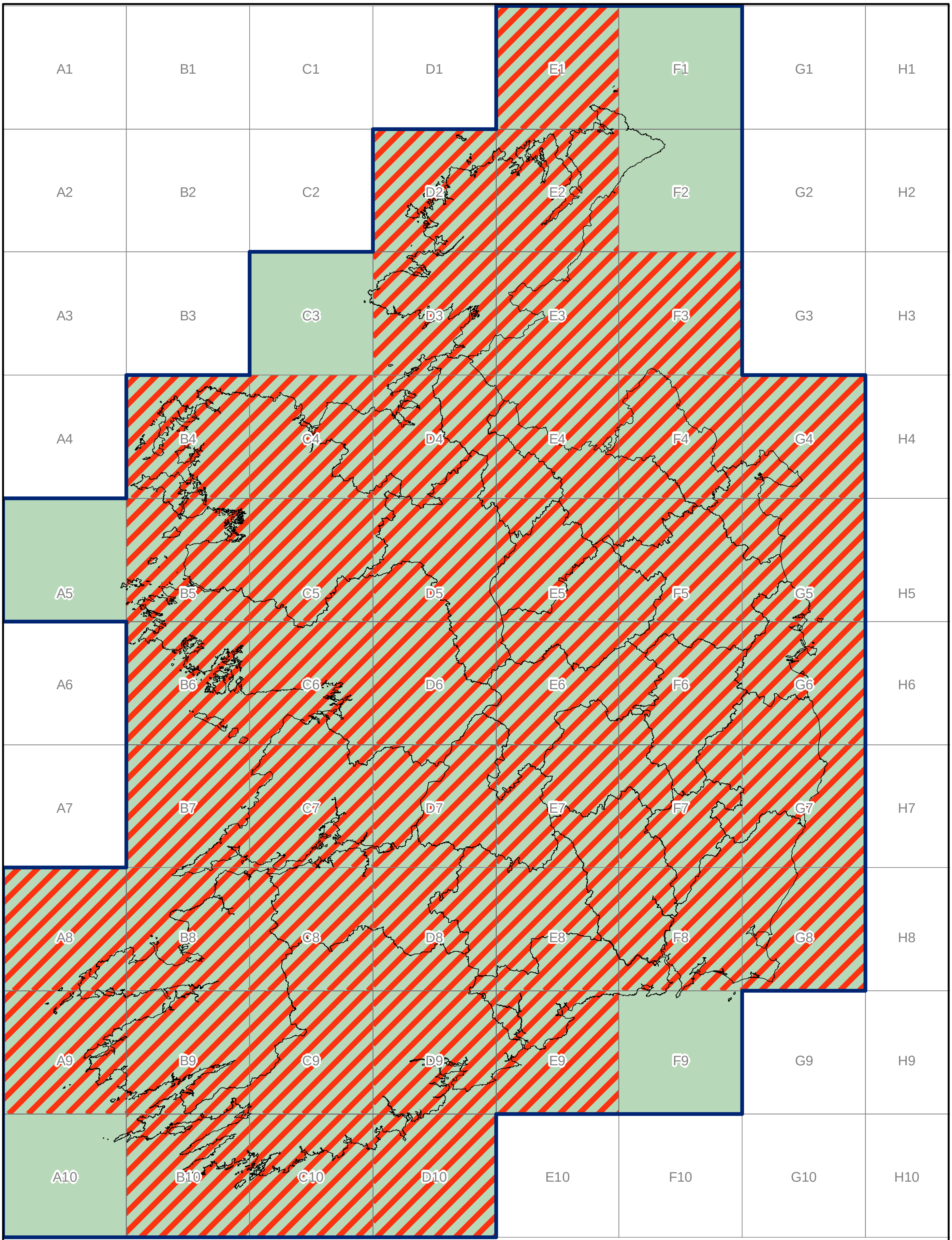
## 6410 Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

| National level | |
|---|---|
| **Habitat Code** | 6410 Molinia Meadows |
| **Member State** | IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Range within the country concerned |

| Biogeographic level (complete for each biogeographic region concerned) | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | Heery, S. (1991). The plant communities of the grazed and mown grasslands of River Shannon Callows. *Proceedings of the Royal Irish Academy* **91B** (1): 1-19.<br>O'Sullivan, A. M. (1982). *The lowland grasslands of Ireland. Journal of Life Sciences, Royal Dublin Society* **3**, 131-142.<br>O' Sullivan, A.M. (1968). Irish *Molinietalia* communities in relation to those of the Atlantic region of Europe. In: *Planzensoziologische systematik*. R. Tüxen (ed.), pp 273-280. Den Haag. Junk.<br>White, J. and Doyle, G. J. (1982). T*he vegetation of Ireland: a catalogue raisonné. Journal of Life Sciences, Royal Dublin Society* **3**, 289-368.<br>http://www.jncc.gov.uk/PDF/CSM_lowland_grassland.pdf<br><br>Other sources included site based information held by the National Parks and Wildlife Service. |
| **Range** | Widespread throughout Ireland although there is a western bias particularly on acid substrates |
| Surface area | 127,500 km² |
| Date | 1995-2007 |
| Quality of data | 2 = moderate |
| Trend | 0 = stable |
| Trend-Period | 1995-2007 |
| Reasons for reported trend | NA |
| **Area covered by habitat** | |
| Surface area | 200 ($km^2$) |
| Date | 1995 |
| Method used | 1 = based on expert opinion |
| Quality of data | 1 = poor |
| Trend | net loss |
| Trend-Period | 1994-2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| Justification of % thresholds for trends | There have been losses due to abandonment, agricultural improvement and drainage. These losses have not been quantified. Corine Land Cover does not accurately map this habitat type. |
| Main pressures | 141 Abandonment of pastoral systems<br>810 Drainage<br>140 Grazing (cessation)<br>103 Agricultural improvement |
| Threats | 141 Abandonment of pastoral systems<br>810 Drainage<br>140 Grazing (cessation)<br>103 Agricultural improvement |
| ***Complementary information*** | |
| **Favourable reference range** | 127,500 km² |
| **Favourable reference area** | Greater than current day |

| | |
|---|---|
| **Typical species** | *Agrostis* spp., *Carex echinata,* Carex nigra, *Carex hostiana, Carex panicea, Carex pulicaris, Holcus lanatus, Angelica sylvestris, Caltha palustris, Cardamine pratensis, Cirsium dissectum, Cirsium palustre, Filipendula ulmaria, Juncus acutiflorus, Juncus articulatus, Juncus conglomeratus, Juncus effusus, Lotus pedunculatus, Lychnis flos-cuculi, Lythrum salicaria, Molinia caerulea, Myosotis laxa, Orchidaeae spp., Potentilla anglica, Potentilla erecta, Ranunculus repens*, *Ranunculus flammula, Senecio aquaticus, Succisa pratensis, Pseudoscleropodium purum, Thuidium tamariscinum, Hylocomium splendens, Carex pallescens, Carum verticillatum, Sisyrinchium bermudiana, Wahlenbergia hederacea,* |
| Typical species assessment | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | A national grassland surveyhas been initiated. This survey will provide contemporary data on distribution, extent and condition of Molinia meadows in Ireland. |
| ***Conclusions* *(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Bad (U2) |
| **Specific structures and functions (incl. typical species)** | Bad (U2) |
| **Future prospects** | Bad (U2) |
| **Overall assessment of CS**[1] | Bad (U2) |

[1] A specific symbol (e.g. arrow) can be used in the unfavourable categories to indicate recovering habitats

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1:2,000,000

0 12.5 25 50 Kilometers

**Molinia meadows**

**6410**

Current Distribution (45 grid cells)
Current Range (51 grid cells
Favourable Reference Range (51 grid cells)
E5 50km grid cells

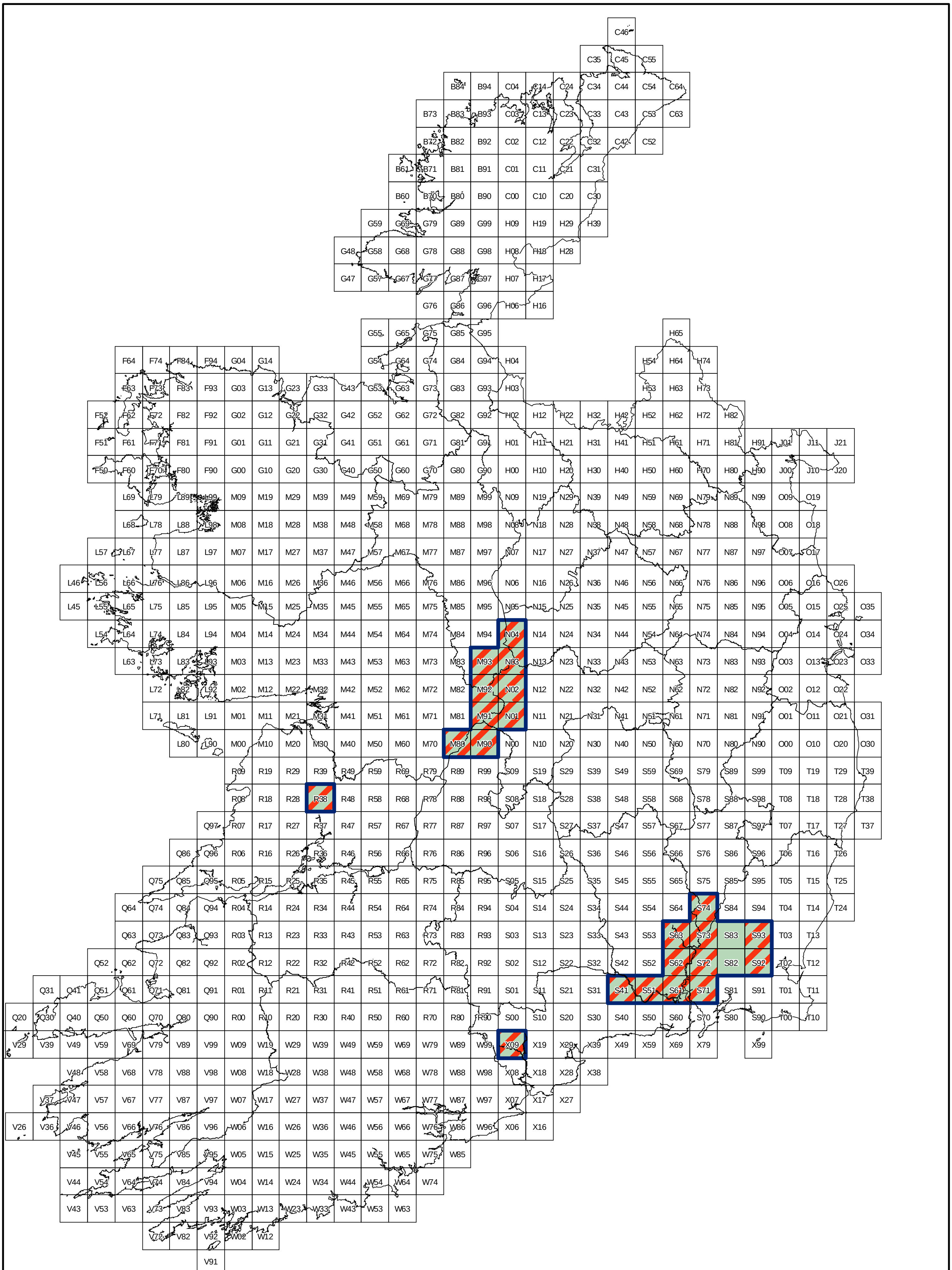
Date: October 2007

## **6430** Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

| National level | |
|---|---|
| **Habitat Code** | 6430 |
| **Member State** | IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Range within the country concerned |

| Biogeographic level<br>(complete for each biogeographic region concerned) | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | O'Sullivan, A. M. (1982). *The lowland grasslands of Ireland. Journal of Life Sciences, Royal Dublin Society* **3**, 131-142.<br>White, J. and Doyle, G. J. (1982). T*he vegetation of Ireland: a catalogue raisonné. Journal of Life Sciences, Royal Dublin Society* **3**, 289-368.<br><br>Other sources included site based information held by the National Parks and Wildlife Service. |
| **Range** | |
| Surface area | 2400 km² |
| Date | 1999-2007 |
| Quality of data | 1 = poor |
| Trend | 0 = stable |
| Trend-Period | 1999-2007 |
| Reasons for reported trend | NA |
| **Area covered by habitat** | |
| Surface area | 0.1 km² |
| Date | 1999-2007 |
| Method used | 1 = based on expert opinion |
| Quality of data | 1 = poor |
| Trend | 0 = stable |
| Trend-Period | 1999-2007 |
| Reasons for reported trend | NA |
| Justification of % thresholds for trends | No evidence in a decline in areas where the habitat is known. |
| Main pressures | 811 management of aquatic and bank vegetation for drainage purposes<br>870 dykes, embankments<br>954 Invasion by a species |
| Threats | 811 management of aquatic and bank vegetation for drainage purposes<br>870 dykes, embankments<br>954 Invasion by a species |
| ***Complementary information*** | |
| **Favourable reference range** | 2400 km² |
| **Favourable reference area** | 0.1 km² |
| **Typical species** | *Calystegia sepium, Crepis paludosa, Epilobium hirsutum, Epilobium parviflorum, Eupatorium cannabinum, Filipendula ulmaria, Glechoma hederacea, Galium aparine, Lythrum salicaria, Petasites hybridus, Solanum dulcamara, Stachys palustris, Symphytum* spp., *Urtica dioica, Valeriana officinalis* |
| Typical species assessment | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | This habitat is seriously threatened by the spread of *Impatiens glandulifera* in Ireland.<br>The figures provided for range and area are based on current known records for this habitat, without the benefit of a national survey. The habitat may be more widespread, therefore the figures and reference values may change in future reporting cycles due to improved knowledge.<br>A national grassland survey has been initiated. This survey will provide contemporary data on distribution, extent and condition of Tall Herb communities in Ireland. |

| ***Conclusions*** ***(assessment of conservation status at end of reporting period)*** | |
|---|---|
| **Range** | Favourable (FV) |
| **Area** | Favourable (FV) |
| **Specific structures and functions (incl. typical species)** | Inadequate (U1) |
| **Future prospects** | Inadequate (U1) |
| **Overall assessment of CS** | Inadequate (U1) |



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1:1,800,000

0 12.5 25 50 Kilometers

**Tall herb meadows**

**6430**

- Current Distribution (22 grid squares)
- Current Range (24 grid squares)
- Favourable Reference Range (24 grid squares)
- W48 10km grid squares

Date: July 2007

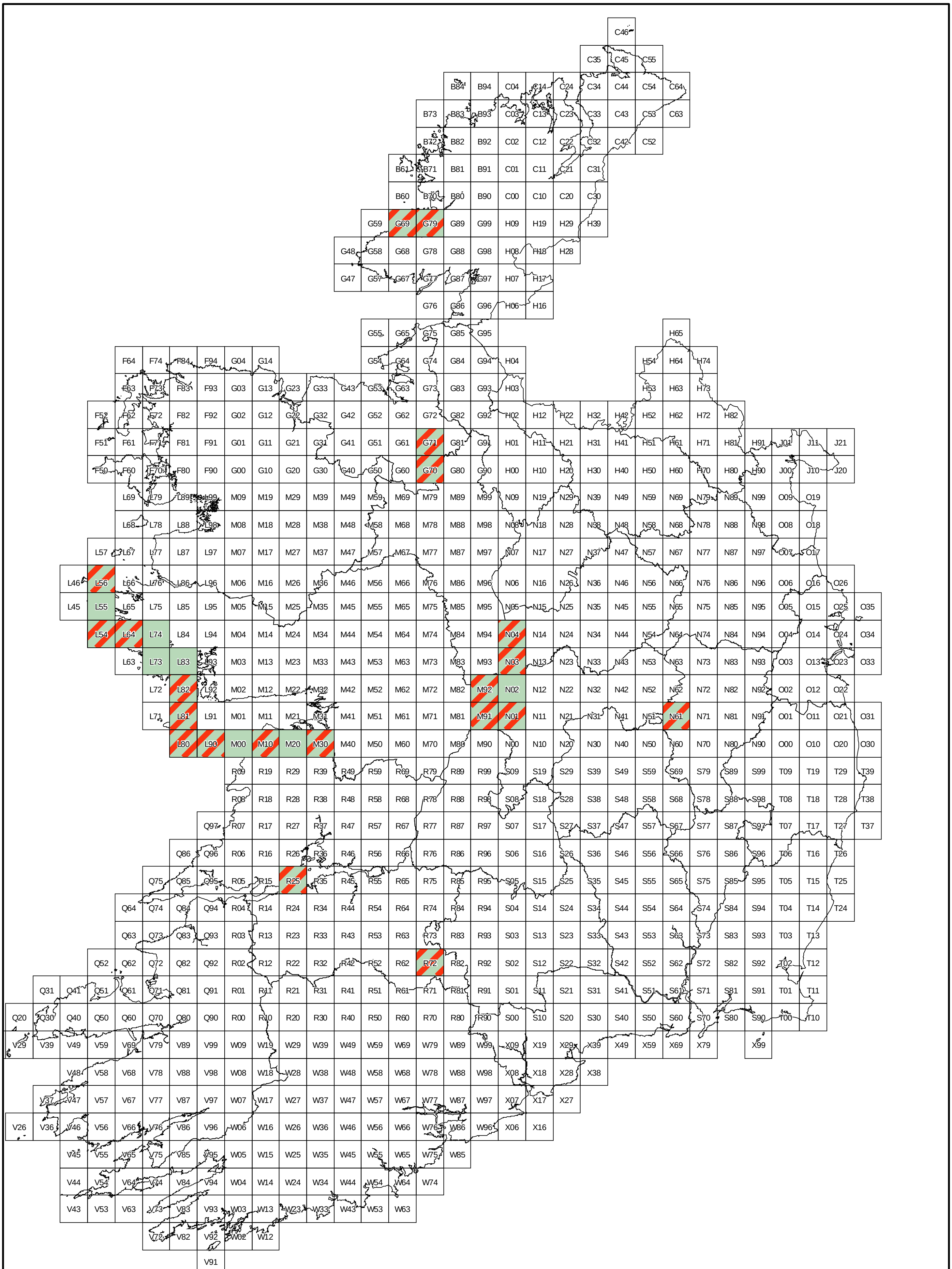
## **6510** Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*)

| **National level** | |
|---|---|
| **Habitat Code** | 6510 |
| **Member State** | IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Range within the country concerned |

| **Biogeographic level** (complete for each biogeographic region concerned) | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | Heery, S. (1991). The plant communities of the grazed and mown grasslands of River Shannon Callows. *Proceedings of the Royal Irish Academy* **91B** (1): 1-19.<br>Curtis, T.G.F., McGough, H.N. and Wymer, E.D. (1988). The discovery and ecology of rare and threatened arable weeds, previously considered extinct in Ireland, on the Aran Islands, Co. Galway. *The Irish Naturalists' Journal*, **22**, 505-513.<br>McGough, H.N. (1984). A report on the grasslands and closely related vegetation types of the burren region of western Ireland. Report to the Forest and Wildlife Service.<br>O'Sullivan, A. M. (1982). *The lowland grasslands of Ireland. Journal of Life Sciences, Royal Dublin Society* **3**, 131-142.<br>O' Sullivan, A.M. (1968). Irish *Molinietalia* communities in relation to those of the Atlantic region of Europe. In: *Planzensoziologische systematik*. R. Tüxen (ed.), pp 273-280. Den Haag. Junk.<br>White, J. and Doyle, G. J. (1982). T*he vegetation of Ireland: a catalogue raisonné. Journal of Life Sciences, Royal Dublin Society* **3**, 289-368.<br>http://www.jncc.gov.uk/PDF/CSM_lowland_grassland.pdf<br><br>Other sources included site based information held by the National Parks and Wildlife Service. |
| **Range** | |
| Surface area | 2800 km² |
| Date | 1994-2007 |
| Quality of data | 1 = poor |
| Trend | net loss<br>Magnitude unknown |
| Trend-Period | 1994-2007 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| **Area covered by habitat** | |
| Surface area | 0.2 km² |
| Date | 1994-2007 |
| Method used | 1 = based on expert opinion |
| Quality of data | 1 = poor |
| Trend | net loss<br>Magnitude unknown |
| Trend-Period | 1994-2007 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| Justification of % thresholds for trends | There has been reported observations of losses of this habitat, however the distribution and coverage of this habitat is poorly known, therefore the magnitude is unknown. |
| Main pressures | 102 Mowing/cutting<br>150 Restructuring of agricultural land holding<br>502 Routes<br>800 Landfill<br>810 Drainage<br>852 Modifying structures of inland watercourses<br>400 Urbanised areas<br>140 Grazing |
| Threats | 102 Mowing/cutting<br>810 Drainage<br>400 Urbanised areas<br>140 Grazing |

| ***Complementary information*** | |
|---|---|
| **Favourable reference range** | Greater than present day |
| **Favourable reference area** | Greater than present day |
| **Typical species** | *Agrostis* spp., *Alopecurus pratensis, Anthoxanthgum odoratum, Arrhenatherum elatius, Avenula pubescens, Bromus* spp., *Cynosurus cristatus, Festuca pratensis, Festuca rubra, Holcus lanatus, Phleum pratense, Poa pratensis, Poa trivialis, Trisetum flavescens, Achillea millefolium, Carex hirta, Centaurea nigra, Daucus carota, Filipendula ulmaria, Galium verum, Knautia arvensis, Leontodon hispidus, Leucanthemum vulgare, Lotus corniculatus, Plantago lanceolata, Potentilla erecta, Ranunculus acris, Rhinanthus minor, Sanguisorba officinalis, Trifolium pratense, Linum bienne, Filipendula ulmaria, Carex nigra, Carex panicea, Ranunculus repens, Succisa pratensis, Thalictrum flavum, Hordeum secalinum, Sanguisorba officinalis.*<br><br>All characteristic of wet or dry variants of Hay meadows. *Hordeum secalinum* and *Sanguisorba officinalis* are rarities. |
| Typical species assessment | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | The figures provided for range and area are based on known records for this habitat. The habitat may be more widespread, therefore the figures and reference values may change in future reporting cycles due to improved knowledge.<br>A national grassland survey has been initiated. This survey will provide contemporary data on distribution, extent and condition of Hay meadows in Ireland. |
| ***Conclusions<br>(assessment of conservation status at end of reporting period)*** | |
| **Range** | Bad (U2) |
| **Area** | Bad (U2) |
| **Specific structures and functions (incl. typical species)** | Bad (U2) |
| **Future prospects** | Bad (U2) |
| **Overall assessment of CS**[1] | Bad (U2) |

[1] A specific symbol (e.g. arrow) can be used in the unfavourable categories to indicate recovering habitats



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1:1,800,000

0 12.5 25 50 Kilometers

**Hay meadows**

**6510**

Current Distribution (21 grid squares)

Current Range (28 grid squares)

W48 10km grid squares

Date: July 2007

## **7110** Active Raised Bog

# CONSERVATION STATUS ASSESSMENT REPORT

## TABLE OF CONTENTS

## 1. Habitat characteristics in Ireland

Irish raised bogs are classified as Oceanic raised bog mire (*sensu* Moore & Bellany, 1974). This mire type has a very restricted distribution on the Atlantic fringe of the north-west of Europe. The vegetation of a typical raised bog that is still hydrologically intact is assigned to the Oxycocco-Sphagnetea and to the Erico-Sphagnetum magellanici phytosociological association (Whyte and Doyle, 1982).

Irish raised bogs are classified into two sub-types: **Western raised bogs** or **Intermediate** and **True Midland raised bogs** (Schouten, 1984), with the boundary between the two being taken as the 1,000mm isohyet. This division is based on a combination of phytosociological and morphological characteristics. Western raised bog, also termed as Oceanic raised bog (Goodwillie, 1980) or Transitional bog (Hammond, 1981), occurs in areas with rainfall ranges from 1,000 to 1,250mm. Whereas True Midland raised bog also known as Concentric bog (Goodwillie, 1980) are characterised by an average rainfall between 750 and 1000mm/year. These divisions are, of course, somewhat artificial and in reality there is a continuum across the country from Lowland blanket bog in the hyper-oceanic west to True Midland raised bog in the drier centre and east (Bellamy and Bellamy, 1966, Schouten ,1984).

Raised bogs mainly comprise Active raised Bog habitat (7110) and Degraded Raised bog habitat still capable of natural regeneration (7120). However, a third category *Secondary degraded raised bog* was identified during this assessment. This includes highly drained high bog devoid of vegetation (including the majority of Bord na Mona sites), cutaway, cutover bog and occasionally reclaimed agriculture land with peaty soils. Although this sub-type of Degraded raised bog does not correspond with the strict definition of the Habitats Directive Interpretation Manual, re-establishment of vegetation with peat forming capability, it may be possible and may even more feasible to restore to Active bog than in some areas of Degraded bog.

## 2. Habitat mapping

The mapping of Active Raised Bog distribution and range[1] is based on National Parks and Wildlife Service (NPWS) surveys carried out since the mid 1990's (see Appendix II):

- *Raised Bog Restoration Project*. Kelly *et al*. (1995)
- *Raised Bog Restoration Project*. Derwin and MacGowan (2000)
- *Raised Bog Monitoring Project*. Fernandez *et al*. (2005)
- *Assessment of Impacts of Turf Cutting on Designated Raised Bogs Project*. Fernandez *et al*. (2006)

The above surveys involved mapping vegetation at the ecotope level (see glossary). Active Raised Bog habitat consists of two ecotopes (central and sub-central) and active peat forming flushes. Bog Woodland habitat (91D0), on raised bog, is also deemed part of Active Raised Bog habitat as it also actively peat forming. All the records provided by these surveys are limited to designated sites (i.e. NHAs or SACs). The digitised high bog vegetation maps were used to produce a final habitat map in Arcview 3.2 format. This map also shows those sections of high bog which are considered to be Degraded Raised Bog habitat. The distribution of the habitat is illustrated on a 10km square grid by selecting those squares where the habitat is present. This will be the minimum area and range of Active Raised Bog. As may yet be found in other locations such as some of the *intact* high bog areas, which high bog vegetation has not been yet comprehensibly surveyed. Botanical surveys are required to determine whether active peat forming communities are present. Thus, the actual range of Active Raised Bog is likely to be slightly larger than that depicted on the habitat range map.

The mapping of the habitat range is defined by the smallest polygon size containing all grid squares, where the habitat was recorded, drawn using a minimum number of 90 degrees angles. Horizontal or vertical gaps in the habitat distribution of 3 or more grid squares (10-km side) or oblique gaps of 2 or

[1] Fernandez *et al*. (2005) reported a total of 139 raised bogs within 127 sites (74 NHAs and 53SACs). The use of a combination of sources as part of the assessment of conservation status of Degraded Raised Bog habitat (also part of the Habitats Conservation Status Assessment Program) allowed us to identify 47 other designated sites (NHAs and SACs) containing raised bogs. The overall extent of high bog within these 47 sites is 3,207ha and 6 of them only contain *Secondary degraded raised bog* (86ha). The occurrence of Active Raised Bog within these sites is unknown but is likely to be extremely limited. Most of these raised bogs sites contain only small areas of high bog (<60ha) which reduces the possibility of occurrence of this priority habitat. Many of these raised bogs are currently cut for peat.

more squares are deemed enough as to justify a break in the range. When the ecological conditions for the development of the habitat are deemed unsuitable, gaps of just 1 (10-km) squares may be also admitted.

## 3. Habitat Range

Raised bogs are abundant in the lowlands of central and mid-west Ireland. In Ireland raised bogs are confined to areas with an annual rainfall below 1250 mm (Hammond, 1984). In areas of high rainfall raised bogs are replaced by blanket bog. Raised bog occur principally in land below 130m and are most extensive and abundant where the limestone plain is covered by a variable thickness of undulating glacial drift which originally provided suitable basins for the development of lakes and/or fens, which in turn acted as precursors to the bogs. The eastern and southern boundary of their distribution is not very clear as the bogs which would have occurred in these areas were relatively small and have been cut away entirely. In the west, the raised bog grade into the blanket bogs but extensive cutting in the past has largely destroyed this transition zone (Cross, 1990). Raised bogs occurred throughout the lowlands of Northern Ireland but currently only scattered small remnants are present, with the greatest concentrations occurring in the west and in the northeast.

The current range of Active Raised Bog habitat is much smaller than the range of raised bogs in Ireland. The habitat distribution map (Map I) shows that the range is separated into two major units. The larger one stretches throughout the midlands and the smaller with an elongated shape in a north-south direction covers areas of counties Clare and Kerry. The Degraded Raised Bog habitat range map also illustrates a gap between these two main areas, which is likely to correspond to areas not suitable for the development of raised bogs. In the intervening region Hammond (1979) Peatland Map indicates that the climatic, geological and altitudinal conditions were more appropriate for the development of Blanket bog, both Lowland and Highland. Two isolated records of the Degraded Raised Bog are found in counties Carlow and Cork. These are remnants of a previous more extensive habitat distribution along the southern and eastern margins of the country where raised bog developed was confined to small basins. These small raised bogs were drained and cutaway down to the mineral layer in the past. Thus, the mapping of the distribution of these outliers has not been possible.

It is important to remember that actual range of Active Raised Bog may be larger than that shown in Map I as this is based only on known areas of this habitat. It is possible that it may occur on other un-mapped high bog sites that are all currently classified as degraded (class B - figure 4.1).

### 3.1. Conservation Status of Habitat Range

The difference between the current Active Raised Bog habitat range (13,400km²) and the Favourable Reference Range (FRR) (24,600km²) for this habitat reveals that the current range is 45.53% below the FRR. The latter is considered to be the current range of Degraded Raised Bog still capable of regeneration (7120). A habitat range which is more than 10% below the FRR is considered to be **Unfavourable Bad** according to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive).

- **Habitat Range Area:** Can be considered as either the area of the grid cells occupied by the habitat which is 7,600km² (76 grid cells x 100km²) or the area of the polygon which contains all of the grid cells with the habitat that is 13,400km² (see section 2).
- **Favourable Reference Range** 20,100 km² (201 grid cells x 100 km²) or 24,600km² (area polygon derived from grid cells). This range is defined by the range of Degraded raised bog habitat (7120).

## 4. Habitat Extent

The original extent of raised bog in the Republic of Ireland was 308,742ha (Hammond, 1979). A large proportion of this figure would originally have been deemed Active Raised Bog as defined in the Interpretation Manual of the Habitats Directive. According to figure 4.1, 50,011ha of *intact* raised bog remain in the country, much of this is fragmented and includes Degraded Raised Bog habitat. 21,519ha are within designated sites (NHAs and SACs).

Traditional cutting of bogs by turbary over the last 400 years has had a serious impact on raised bogs and 68% of their extent has been cut away by this process (Hammond 1979, Ryan & Cross, 1984, Cross 1989). The mechanisation of peat cutting combined with a grant aid scheme under the Turf Development Act (1981) enabled many small scale extraction programmes to get underway has resulted in further loss of raised bog resource. Peat is still currently cut privately for fuel purposes. The most serious impact of mechanisation has been on midland raised bogs, accounting for a loss of 22% of the resource in less than 50 years (Cross, 1990). Only 8% of the original peatland area was considered suitable for conservation (Ryan & Cross 1984). Further losses have occurred in the last two decades but despite this, the Republic of Ireland still has the most extensive area of conservation worthy sites remaining in Western Europe.

### Estimated High Bog Extent

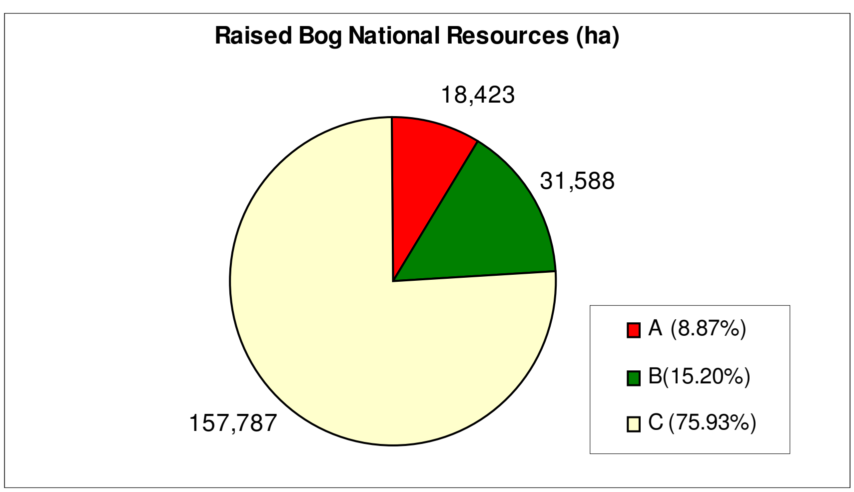
To calculate the current extent of High Bog, all available sources of data relating to raised bog ecosystem were digitally mapped using Arcview 3.2 (see Appendix II). The known Active Raised Bog was mapped and the extent measured. High bog extent is given below:

- Surveyed high bog by Kelly *et al.* (1995) (revised by Fernandez *et al.* (2005)), Derwin & MacGowan (2000) and Fernandez *et al*. (2006): **18,423ha** (see class A – figure 4.1).
- Un-mapped high bog: **31,588ha,** (3,096ha within designated sites) (see class B – figure 4.1). These data have been taken from Corine Land Cover Maps (2000) and the presence of *intact* high bog confirmed by looking at the aerial images from the year 2000. This figure is approximate and may be an overestimate as Corine mapped cutover areas adjacent to high bog as part of *intact* whereas as according to our criteria these areas correspond with *Secondary degraded raised bog*.

  The above two figures give us a total of **50,011ha** of *intact* high bog.
- Un-surveyed *Secondary degraded raised bog*: **157,787ha** (see class D – figure 4.1). This figure was calculated using Corine Land cover maps (2000) taking into consideration the degraded raised bog category. This figure is likely to be underestimated as Corine classifies coniferous plantations on peat soils as a conifer habitat and not as Degraded Raised Bog. Other exceptions may also be found (i.e. small sections of very Degraded Raised Bog classed as other habitat type). In addition, large areas of land surrounding current raised bog have also been reclaimed for agriculture. But most of these will have significant areas of peat soils.

To summarise, the overall extent of *intact* high bog and *Secondary degraded raised bog* is at a minimum **207,798ha**. This figure is significantly smaller than that given by Hammond (1979) for the Republic of Ireland (310,000ha approx.). The difference between these two figures is probably due to the former figure being based on the interpretation of aerial photographs and satellite imaginary, which underestimate the area of peat soils now reclaimed for agriculture and forestry while Hammond (1979) figures where mainly based on soils surveys. It is probably that only small areas have had all the peat removed. A more accurate figure will only become available when more up to date soils survey figures are compiled.

**Figure 4.1 Raised bog current extent in Ireland**



A- Surveyed high bog (Active and Degraded Raised Bog habitats present)

B- Un-mapped high bog (Presence of Active Raised Bog habitat unknown)

C- Un-surveyed *Secondary degraded raised bog*

The overall known current extent of **Active Raised Bog habitat**[2] is **1945.2ha** (see figure 4.2). This figure is obtained by adding the extent of the habitat mapped by Fernandez *et al*. in 2005 (997.31ha - 51.27%) to the habitat extent provided by other sources listed in section 2 (947ha – 48.68%) for the rest of the sites where the Active Raised Bog habitat is known to occur. The habitat extent given by these sources is likely to have subsequently decreased since the surveys were carried out due to ongoing drainage and turf cutting. Although the current suite of designated sites is considered to contain those sections of Active Raised Bog most worthy of conservation small additional areas of the habitat may also be present in un-surveyed raised bogs.

**Figure 4.2 Active and Degraded Raised Bog habitat current extent within surveyed sites**

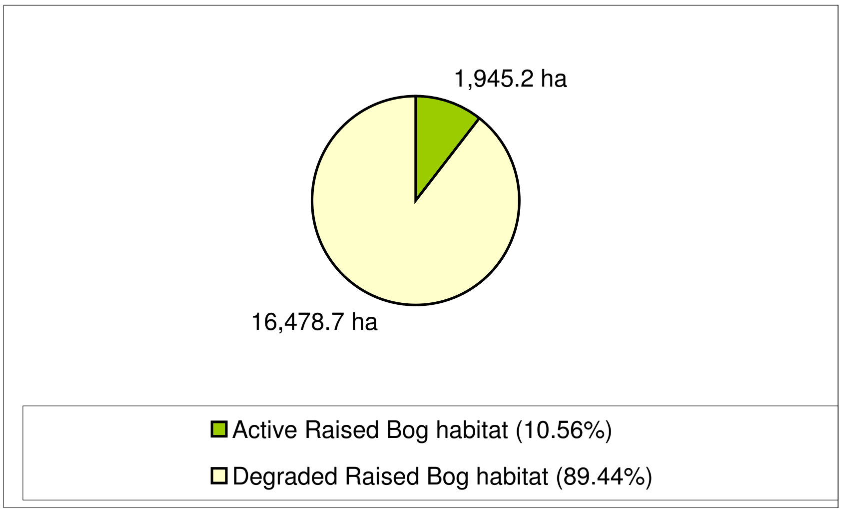



Figure 4.2 illustrates the overall extent of Active and Degraded Raised Bog habitat in surveyed sites where the presence of Active Raised Bog is known (class A - figure 4.1). As the above figure shows only 10.56% of the high bog within these raised bogs supports Active Raised Bog.

## 4.1. Conservation Status of Habitat Extent

Fernandez *et al*. (2005) assessed the conservation status of Active Raised Bog at 48 raised bogs which had a high bog area of 7,961ha. These bogs represent the range of the ecological variation in the habitat and account for 43.21% of the total high bog within designated sites where a comprehensive ecological survey has been carried out (18,423ha - see class A - Figure 4.1). They also represent 15.92% of the national resource of *intact* high bog (50,011ha). These 48 raised bogs comprise 51.27% (997.31ha) of the current national resource of Active Raised Bog habitat (1,945ha).

In the ten years reporting period the habitat extent decreased by 36.80% (580.61ha), which is more than 1% per year and thus enough as to give an Unfavourable Bad assessment for the habitat extent according to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive). The habitat extent was assessed as Unfavourable Bad at 26 raised bogs, which implies a decrease in habitat extent greater than 15%. These 26 raised bogs contain 557.34ha of Active Raised Bog, which accounts for 28.65% of the national resource in 2005 (1,945ha).

The conservation status of the remaining (48.73%) habitat resource has not been assessed. Fernandez *et al*. (2006) reported similar intensity and impact of peat cutting and related activities (i.e. burning and

[2] Active Raised Bog encompasses active peat forming ecotopes (central and sub-central), active flushes and Bog Woodland habitat.

drainage) for these other bogs containing the habitat. It is therefore reasonable to assume that similar declines in Active Raised Bog would have occurred in these sites. Hence, the conservation status of habitat extent is deemed to be **Unfavourable Bad**.

Furthermore, the current habitat area is 91% below the Favourable Reference Area (FRA) (215.2 km$^2$). A habitat extent which is more than 10% below the FRA is considered to be **Unfavourable Bad** according to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive). This implies that the remaining 195.7 km$^2$ of Degraded Raised Bog within designated sites, still capable of regeneration according to their definition, should be restore to Active Raised Bog habitat. However this restoration area will be targeted in areas deemed suitable for the restoration throughout the range of raised bogs. Particularly in adjacent areas to raised bogs within designated sites with ARB habitat present in order to optimise the conservation of their biodiversity values.

- **Area covered by the habitat:** 19.45 km$^2$
- **Favourable Reference Area:** 215.2 km$^2$. This is based on the area of Active and Degraded Raised Bog in designated areas. The definition of Degraded Bog implies that it will be restored to Active within 30 years. This forms the basis for this objective.

## 5. Structures and Functions

### 5.1. Habitat Structures and Functions

According to Fernandez *et al*. (2005) the decrease in habitat extent has been coupled by a decline in habitat quality (i.e. structure and functions). Habitat quality for Active Raised Bog is mainly gauged by variations in the extent of central ecotope that is the finest quality Active Raised Bog ecotope. Twenty raised bogs have been given an Unfavourable Inadequate assessment as the extent of central ecotope decreased between 5-25% in the reporting period. Sixteen raised bogs were given an Unfavourable Bad assessment as the central ecotope extent decrease was greater than 25%.

A decrease in the extent of central ecotope is indicated by a reduction in the bog moss (*Sphagnum*) cover; degradation in the habitat microtopography; increase in the presence of negative indicators (e.g. algae in pools and hollows); an increase of bare peat; loss of quality indicators and a reduction in water table levels. Although, the extent of central ecotope may remain unchanged in some cases, adverse changes in some of the above attributes would indicate deterioration in habitat structure.

#### 5.1.1. Conservation Status of Habitat Structures and Functions

The conservation status of the habitat Structures and Functions were assessed for 51.27% of the current Active Raised Bog national resource as part of Fernandez *et al*. (2005) project and an overall Unfavourable Bad assessment was given. As already mentioned above although the conservation status of the remaining (48.73%) habitat resource has not been assessed. The results given by Fernandez *et al*. (2006), indicate that similar trend is likely to have occurred in these remaining areas. Thus, the overall habitat structure and functions for the national resource are assessed as **Unfavourable Bad**.

### 5.2. Typical Species

Raised bogs typically contain only a small suite of vascular plant and none occurs exclusively on raised bogs. Active Raised Bog habitat is particularly characterised by the presence of mosses of the *Sphagnum* genus, which are essential for the formation of peat. The abundance and composition of *Sphagnum* species define a bog as *Active* peat forming or *Non-Active* (i.e. Degraded Raised Bog (7120)).

According to the 2003 version of the Interpretation Manual the characteristic plant communities and species of Active Raised Bog Habitat (7110) are as follows:

Erico - Sphagnetalia magellanici - Andromeda polifolia*, Carex pauciflora, Cladonia* spp., *Drosera rotundifolia, Eriophorum vaginatum, Odontoschisma sphagni, Sphagnum magellanicum, S. imbricatum, S. fuscum, Vaccinium oxycoccos;* in the Boreal region also *Betula nana*, *Chamaedaphne calyculata, Calluna vulgaris, Ledum palustre* and *Sphagnum angustifolium.* Scheuchzerietalia palustris *p*., Utricularietalia intermedio-minoris *p*., Caricetalia fuscae *p*.- *Carex fusca, C. limosa, Drosera anglica, D. intermedia, Eriophorum gracile, Rhynchospora alba, R. fusca, Scheuchzeria palustris, Utricularia intermedia, U. minor, U. ochroleuca*; in the Boreal region also *Sphagnum balticum* and *S. majus*.

The vegetation of a hydrologically *intact* Irish raised bog is characterised by the dominance of Sphagna and dwarf ericoid shrubs. The most abundant *Sphagnum* species are *Sphagnum capillifolium, S. imbricatum* and *S. papillosum* forming hummocks or low ridges. *S. fuscum* and *Leucobryum glaucum* also form hummocks, although they are much less abundant than the other Sphagna. *Calluna vulgaris, Erica tetralix* and the sedge *Trichophorum cespitosum* are the most abundant angiosperms and are most vigorous in the association Erico-Sphagnetum magellanici (White & Doyle, 1982) in which *Andromeda polifolia* and *Drosera rotundifolia* also occur with high constancy but low cover value. Lichens: *Cladonia ciliata* and *C. portentosa* may be co-dominant with Sphagna if the bog was un-burnt.

On the flats *Sphagnum magellanicum, S. subnitens* and *Narthecium ossifragum* are abundant, sometimes with *Aulacomnium palustre,* although these last two species appear to prefer areas where there is slight flushing. The permanent waterlogged hollows are dominated by *Sphagnum cuspidatum* and *Rhynchospora alba* with *Drosera anglica, Eriophorum angustifolium* and *Menyanthes trifoliata* commonly present (White & Doyle, 1982). Areas of nutrient enrichment (e.g. flushes) may contain *Betula pubescens*.

**Ecological variations**

**Western sub-type** is typified by the presence of the moss *Campylopus atrovirens* and the liverwort *Pleurozia purpurea* (both also characteristic species of lowland blanket bog) and the abundance of *Carex panicea* (Cross, 1990). *Pedicularis sylvatica* that is a differential species for Atlantic blanket bog (White and Doyle, 1982) is also found at western raised bogs. Schouten, M. (*pers. comm.*) based on his work on Irish raised bogs, stated that *Racomitrium lanuginosum* is also an important western indicator species. This species is also said to have a northern distribution (Smith, 1993).

**True Midland sub-type** is characterised by the abundance of *Andromeda polifolia* and *Vaccinium oxycoccus*. Moore (1972) states that *Sphagnum magellanicum* is much rarer on the western low-level blanket bogs and is frequent on true midland raised bogs.

The following are the species indicators used as part of the *Raised Bog Monitoring Project* (Fernandez *et al*., 2005):

- Hummock indicators: *Sphagnum fuscum* and *S. imbricatum.*
- Pool indicators: *S. cuspidatum*, *S. auriculatum.*
- *Cladonia portentosa* is abundant on un-burnt vegetation.

Moreover, a series of disturbance indicators were used to assess habitat quality (structure and functions) as part of this project.

- Abundant *Narthecium ossifragum* indicates drying out and/or burning.
- *Trichophorum caespitosum* and *E. vaginatum* become tussocky during drying out processes.
- *Sphagnum magellanicum* indicates drying out processes when it becomes abundant in pools previously dominated by *Sphagnum* species typical of very wet conditions (e.g. *S. cuspidatum*).
- *Cladonia floerkeana* indicates burning.
- *Carex panicea* occurs in True - Midlands raised bogs where there has been frequent burning.

**Table 3.1 List of typical species of Active Raised Bog habitat in Ireland**

| Species | Characteristic species in the Habitats Directive Interpretation Manual (2003) | Characteristic species on Raised Bog (White & Doyle, 1982) | Good quality indicators used by Fernandez *et al.* (2005) | Typical Active Raised Bog habitat species list |
|---|---|---|---|---|
| *Andromeda polifolia* | Yes | Yes | - | Yes |
| *Aulacomnium palustre* | No | Yes | - | Yes |
| *Calluna vulgaris* | Yes | Yes | - | Yes |
| *Cladonia spp (C. ciliata and C. portentosa)* | Yes | Yes | Un-burnt | Yes |
| *Drosera anglica* | Yes | No | - | Yes |
| *D. intermedia* | Yes | No | - | Yes |
| *D. rotundifolia* | Yes | Yes | - | Yes |
| *Erica tetralix* | No | Yes | - | Yes |
| *Eriophorum. angustifolium* | No | Yes | - | Yes |
| *E. vaginatum* | Yes | Yes | - | Yes |
| *Leucobryum glaucum* | No | Yes | - | Yes |
| *Menyanthes trifoliata* | No | Yes | - | Yes |
| *Narthecium ossifragum* | No | Yes | - | Yes |
| *Rhynchospora alba* | Yes | Yes | - | Yes |
| *R. fusca* | Yes | No | - | Yes |
| *Sphagnum auriculatum* | No | No | Pools | Yes |
| *Sphagnum capillifolium* | No | Yes | - | Yes |
| *S. cuspidatum* | No | Yes | Pools | Yes |
| *S. fuscum* | Yes | Yes | Hummocks | Yes |
| *S. imbricatum* | Yes | Yes | Hummocks | Yes |
| *S. magellanicum* | Yes | Yes | - | Yes |
| *S. papillosum* | No | Yes | - | Yes |
| *S. pulchrum* | No | No | - | Yes |
| *S. subnitens* | No | Yes | - | Yes |
| *Trichophorum cespitosum* | No | Yes | - | Yes |
| *Utricularia minor* | Yes | No | - | Yes |
| *Vaccinium oxycoccos* | Yes | No | - | Yes |

Table 3.1 list typical species for Active Raised Bog habitat in the Republic of Ireland. The final list include species that are characteristic of the habitat extended with those species used as good habitat quality indicators. An over representation of a single species does always indicate good habitat quality (e.g. *Calluna vulgaris*).

This list is slightly different from that in the Interpretation Manual of the Habitats Directive. The following plant communities and species are included in the Interpretation Manual as characteristic of the habitat but do not occur on Irish sites: *Scheuchzerietalia palustris, Carex pauciflora, C. fusca,* and *Scheuchzeria palustris.*

All these species listed are mainly found on the high bog of a typical raised bog. Other species commonly found on the lagg zone, soaks, flushes and rand zone (generally dry and supporting Degraded Raised Bog) are not listed.

### 5.2.1. Conservation Status of Habitat Typical Species

The recording of all typical species on Fernandez *et al*. (2005) survey was not systematic and only some of the species listed in table 3.1 were used as indicators in variation of habitat quality (*Sphagnum fuscum, S. imbricatum*, *S. cuspidatum, S. auriculatum* and *Cladonia portentosa*). Nonetheless, the assessment of the habitat quality (i.e. Structure and Functions) which was partially based on changes in ecotope extent (i.e. central for Active Raised Bog) can be used to assess the conservation status Typical Species. The definition of an ecotope is based on the presence and dominance of certain typical species, with particular emphasis on *Sphagnum* species. Thus, a decline in habitat quality also indicates a decline in the presence of Typical Species. Fernandez *et al.* (2005) calculated an Unfavourable Bad conservation status for Active Raised Bog based on changes in quality.

As quality and typical species are so interdependent, it can be suggested that an **Unfavourable Bad** conservation status can also be inferred for Typical Species.

## 6. Impacts and Threats

Fernandez *et al*. (2005) assessed the intensity and influence of impacting activities at 48 raised bogs. An individual assessment of impacts was carried out for each habitat present on this selection of raised bogs. Peat cutting, drainage and burning were the most impacting activities affecting the conservation status of these bogs. These activities were found to seriously disrupt the high bog hydrology, leading to desiccation of the bog and loss of the characteristic micro-topographical features and eventually flora and fauna (Schouten 2002). This project found that except in a few cases drainage and burning are always related to the occurrence of turf cutting.

### 6.1. Turf cutting

Turf cutting, which in the past mainly consisted of hand cutting, became mechanised in the 1980's and was stimulated by the introduction of the Turf Development Act in 1981. As recognised by Feehan & O'Donovan (1996) the mechanisation of peat extraction by private producers allowed the exploitation of small bogs by small commercial companies and co-operatives. They also noted that this was accompanied by intensive drainage of the high bog, which was practically non-existent on the smaller bogs up to 1981. Therefore, in the last three decades, medium and small size bogs have been increasingly severely impacted by mechanised turf cutting. In the view of the IPCC (2005), the widespread use of machinery has in recent years greatly accelerated the process of decline in peatland resource, particularly Lowland Raised Bogs. They consider that more peat is being harvested over a wider area of bog and on a semi-commercial basis since the decline of hand cutting. This has in many cases altered the scale of cutting from the traditional domestic small scale level to much more intensive semi-industrial scale extraction.

127 sites are designated for the conservation of 139 raised bogs in the Republic of Ireland, 74 as NHAs and 53 as SACs. In 2005, 117 of these bogs were still being cut for turf.

Following the publication of the list of SAC raised bog sites in 1997, there was prolonged and strenuous objection from turf cutters. The objectors were especially concerned about loss of property rights, loss of future fuel supplies and loss of a way of life in the summer months. The then Minister, Síle de Valera T.D., addressed the objections of bog owners by allowing them cut for domestic use for 10 years, up to and including 2008, at which stage all cutting would have to cease. When the NHAs were designated in 2004, a similar 10-year derogation was put in place, allowing cutting until 2014.

In a report commissioned by NPWS, Fernandez *et al*. (2006) examined the impact of turf cutting on these bogs The main objectives of their work were to assess the impacts of turf cutting and to develop appropriate responses to such impacts. They noted that 2,660 turf cutting plots were cut in 2003 on these bogs.

The report offered a variety of options for cessation of turf cutting on the designated bogs, ranging from immediate and complete cessation (recommended) to phased cessation based on potential impact of cutting and related activities on sensitive areas (in particular active raised bog and bog woodland) and the status of the bog under designation. However NPWS believe that cessation of cutting in parts of bogs is not feasible or manageable and that the end of cutting in 2008 in SACs as required by Minister de Valera is the best option and this stage. Further restorative works will be required on many bogs.

Fernandez *et al*. (2006) also estimated that 20,000 turbary rights exist on all designated sites but that only a small proportion of those are currently active.

Although peat cutting recorded by Fernandez *et al*. (2006) is mainly for domestic purposes, peat cutting for semi-commercial purposes also occurred at a number of designated sites. Mechanical peat extraction, generally by Hopper machinery, for fuel purposes was the most common technique on the sites surveyed. This method of peat cutting also involved the insertion of drains of various width and depth generally perpendicular to the face-bank. Occasionally, high bog drains were also inserted close to the face-bank. Fernandez *et al*. (2005) noted that the common trend has been a reduction in the length of margin actively cut and a decline in number of cutters in the 1994/95-2004/05 reporting period. However, this trend has been accompanied by intensification in the amount of peat extracted as result of the mechanisation of cutting. This has involved an increase of the negative effects associated with this activity. This project estimated that the overall loss of high bog to peat cutting in the ten year reporting period was 1%.

## Turf Cutting Trend

Thus, unless a more restrictive approach (i.e. mandatory cessation of cutting coupled by compensation packages) is taken, turf cutting is likely to continue at current levels or even increase with increasing fuel prices.

### 6.2. Drainage

Drainage is intended to dry out the high bog surface and is generally used to facilitate the cutting of turf. It is found either on the high bog and/or the cutover area (Fernandez *et al*., 2005).

The *Raised Bog Monitoring Project* (2005) recorded drainage on the high bog on 46 of the 48 raised bogs surveyed. The activity was considered to have high negative influence on high bog habitats at 21 raised bogs and in several cases was considered to be the main reason for the decline in Active Raised Bog extent. Cutover drainage was deemed to have a high negative influence on the high bog at 29 out of 48 raised bogs. Most of these bogs also had extensive peat cutting, which generally correlates with cutover drainage maintenance. According to observations made by this survey, high bog drainage is rarely maintained and in-filling processes are frequent in many sites. However, natural blocking of drains is a very slow process and active blocking of drains is required to counteract the negative effects of this activity.

Arterial drainage directed at improving agriculture land and providing for improve bog drainage was also considered a serious threat to the hydrological status of the high bog and therefore the Active Raised Bog habitat.

The blocking of drains is considered essential for the recovery of the habitat, as highlighted by Fernandez *et al*. (2005).

### Drainage Trend

Although according to the findings of Fernandez *et al*. (2005) the insertion of new high bog drains on designated raised bogs is unusual. However, previous drains continues to have a serious impact on the raised bog habitats within designated sites. Data are not available for un-designated sites.

### 6.3. Burning

According to the finding of Fernandez *et al*. (2005), burning is a frequent activity occurring on raised bogs. It has occurred at 24 of the 48 raised bogs surveyed in the ten years reporting period. This activity is mainly associated with peat extraction and thus is more frequent in those sites with high intensity of cutting where the bog surface is burnt to facilitate marginal cutting.

Although the damage to high bog vegetation depends on the intensity and frequency of burning, it generally decreases the *Sphagnum* cover and thus the capacity to generate new peat. Indeed, burning was one of the main factors for the decline in Active Raised Bog at 5 raised bogs surveyed by Fernandez *et al*. (2005).

### Burning Trend

No previous records are available, however the 2005 project shows that this activity frequently occurs on raised bogs and its occurrence is mainly related to peat cutting. Thus any increase in peat cutting is likely to lead to an increase in fire events.

## 6.4. Afforestation

Forestry, which mainly consists of coniferous plantations, is found either on the high bog or on the cutover area adjacent to the high bog. Surface drainage is always associated with forestry plantations and has similar negative effects to that carried out to facilitate peat cutting. However, other impacts such as shading of vegetation and compression of the peat caused by heavy machinery are related to afforestation. Fernandez *et al*. (2005) recorded forestry on the high bog at 10 raised bogs and it was deemed to have high negative influence at 6 bogs. 31 of 48 raised bogs surveyed had cutover coniferous plantations adjacent to the high bog and these were considered to have high negative influence at 4 of these bogs.

Table 6.1 below illustrates the overall extent of coniferous plantations on raised bog in the Republic of Ireland. 4.36% (2,179ha) of the high bog has been afforested. A total of 8,040ha of *Secondary degraded raised bog* have been planted with conifers. This corresponds to areas of very degraded raised bog (i.e. highly drained, devoid of vegetation, cutover and cutaway) and subsequently planted. However, the actual extent of coniferous plantation on cutover raised bog is likely to be higher. These data has been obtained by intersecting Forest Inventory and Planning System (FIPS) 1998 maps with raised bog maps produced as part of this project. Coniferous plantations encompass three class categories within FIPS maps (i.e. Conifers forestry, Cleared and Planting Grant applications). The year 2000 aerial images confirm the presence of coniferous plantations within these categories. Egan (1998) mentioned that in 1987, Coillte initiated a major afforestation programme on cutaway bogland and up to 1998 over 4,000ha were planted.

**Table 6.1 Coniferous plantations on raised bog**

| | Extent (ha) | Coniferous plantations (ha) | % of planted high bog |
|---|---|---|---|
| Surveyed high bog (Active and Degraded Raised Bog habitat) | 18,423 | 682 | 3.70 |
| Un-mapped high bog (Presence of Active Raised Bog habitat unknown) | 31,588 | 1,497 | 4.74 |
| **Subtotal** | 50,011 | 2,179 | 4.36 |
| *Secondary degraded raised bog* | 157,787 | 8,040 | 5.1 |
| **Total** | 207,909 | 10,219 | 4.92 |

### Afforestation Trend

Grant aid for private forestry, which is administered by the Forest Service of the Department of Agriculture and Food, is now effectively withheld from designated peatlands. All grant-aided development in Ireland must also conform to the Forest Service Forest biodiversity guidelines, which set out measures to protect existing habitats and wildlife and to maximise the biodiversity of forest.

Coillte Teoranta, one of the major owners of peatland in the country, has ceased planting conifers on intact peatlands on its ownership, principally on economic grounds. It has also made strong commitments to the implementation of the Helsinki Process on Sustainable Forest Management and as part of their Nature Conservation Program. Coillte has initiated a *Raised Bog Restoration Project* that will result in the felling of coniferous plantations and drain blocking on some of their raised bogs.

The threat to raised bog from afforestation is therefore appears to be declining particularly on designated raised bogs. The current trend for un-designated sites is unknown.

### 6.5. Invasive Species

Although Fernandez *et al*. (2005) survey found invasive species at 35 of 48 raised bogs, they were not considered a major threat to raised bog habitats in general but can be important on specific sites. The most common invasive species are *Pinus contorta*, *Rhododendron ponticum* and *Sarracenia purpurea. Pinus sy*lvestris was deemed invasive when it was found encroaching on the high bog. In this case, its origin is mostly adjacent coniferous plantations and the spreading of pines is likely to indicate drying out of the high bog.

#### Invasive Species Trend

Although the overall trend is likely to be an increase in invasive species in part as a result of the ongoing drying out process and the spreading of pines from adjacent plantations. Their impact is considered small compare to peat cutting, drainage and burning.

### 6.6. Site Inspection Form results

Regional NPWS Management is responsible for patrolling designated sites and enforcing relevant legislation (e.g. Habitats Directive 92/43 EEC or the Wildlife Act). NPWS Conservation Rangers are required to summarise information collected on the integrity of sites within their areas during the course of their duties. They are given the responsibility for reporting the information required under the Site Inspection Reporting (SIR) programme. Reporting is carried out on a three yearly cycle that began in 1998.

The Research Branch Monitoring Section (NPWS) developed the SIR programme to be used as a monitoring tool. Local NPWS staff log the following info: activities occurring on the site and their effects on the site's integrity, follow-up actions including all outcomes such as prosecutions, notifiable actions and positive management undertaken and site patrolling frequency and purpose.

The results given by the SIR reporting programme confirm that mechanical removing of peat, drainage, burning and invasion by species are the most frequently reported activities negatively affecting the habitat. However, a series of other negatively impacting activities were also reported with various degrees of intensity. These activities are:

| Activity | Code |
|---|---|
| ▪ Mowing/cutting | 102 |
| ▪ Overgrazing by cattle | 143 |
| ▪ Removal of scrub | 152 |
| ▪ Stock feeding | 171 |
| ▪ Taking/Removal of flora, general | 250 |
| ▪ Quarries | 301 |
| ▪ Disposal of household waste | 421 |
| ▪ Energy transport | 510 |
| ▪ Pipe lines | 512 |
| ▪ Other pollution or human impacts/activities | 790 |
| ▪ Landfill, land reclamation and general drying out | 800 |

Although some of these activities were reported as affecting Active Raised Bog habitat their actual impact and threat to the habitat is much smaller than that arising from the previously reported activities.

### 6.7. Other Impacting Activities

Impacting activities such as grazing, dumping, fertilisation, restructuring agricultural land, communication routes, cultivation, mowing/cutting, modification of inland water structures, sand and gravel extraction were reported within and around high bog at some of the raised bogs surveyed as part of the *Raised Bog Monitoring Project* (2005). These activity impacts were not assessed as part of the project and they were considered to have a minor influence on the high bog habitats compared to peat cutting, drainage, burning and forestry.

# 7. Future Prospects

## 7.1. Negative Future Prospects

36.55% (18,423ha) of Ireland's remaining *intact* high bog (see section 4), contains 100% of the known resource of Active Raised Bog habitat and this occurs within designated sites (SAC or NHA). A few other examples of the habitat may be present in un-surveyed undesignated sites. Deterioration of the raised bog hydrology at current rates caused by peat cutting, drainage, forestry and burning seriously threatens the viability of the habitat.

Fernandez *et al*. (2005) project, which assessed the conservation status of 51.27% of the known habitat national resource, results indicate that the Future Prospects for the habitat at 26 raised bogs is Poor while it is Bad at 15 of the 48 bogs assessed.

Climate change predictions of increases in temperatures accompanied by a decrease in summer rainfall would increase the summer moisture deficit of peatlands and potentially prevent peat formation. Therefore, resulting in further habitat losses and possible reduction in habitat viability.

## 7.2. Positive Future Prospects

Fernandez *et al*. (2005) assessed the habitat Future Prospects as Favourable at 7 of the 48 raised bogs surveyed. This generally corresponds to raised bogs where either the major impacting activities (i.e. turf cutting, drainage, forestry and burning) are absent or have a very low intensity and thus low negative influence on the habitat. In addition, restoration works detailed below were carried out in some of these bogs.

Only a few examples of restoration works have been undertaken on Irish raised bogs. NPWS commenced a *Raised Bog Restoration Project* in 1994, which ran up to the end of 1999 and included 10 sites. This project was assisted by the EU Cohesion Fund (Ryan and Streefkerk, 1998). Objectives of the project were the restoration of the bogs hydrology, acquisition of raised bog land, survey of high bog and lagg systems and establishment of a monitoring program. These restoration works consisted of the blocking of drains, mainly on the high bog, and the construction of dams. NPWS again carried out restoration works (i.e. blocking of drains) on three new sites in 2003 and one in 2006. The results of these restoration works are considered positive overall, as there is some expansion and new Active Raised Bog habitat formation occurring (Fernandez *et al.* 2005).

Coillte Teoranta initiated a *Raised Bog Restoration Project* in 2004. This was funded by an EU Life - Nature Programme. This project will be completed in 2008 and forms part of Coillte's Nature Conservation Programme. The project will work towards restoring 571.2 hectares of raised bog habitat on its property in the midland counties. This project area will be managed with nature conservation as the primary management objective into the future. The project also involves the felling of 450ha of plantation forest, felling of naturally regenerated exotic trees on open bog, perimeter protection of vulnerable raised bog sites against fire, blocking of drains after felling and ongoing monitoring of vegetation and water levels on 14 sites (Coillte, 2005 - www.raisedbogrestoration.ie).

NPWS have operated two turf cutting cessation schemes since 1999 to buy out turbary rights in NHAs and SACs. Fernandez *et al*. (2006) considered that the schemes were relatively successful in dealing with obvious commercial activity (i.e. moss peat developments), but were less successful in dealing with small scale, semi-commercial to commercial fuel peat operations and had almost negligible impact on domestic cutting. They did not appear to have significantly reduced the numbers of cutters and thus the negative effects of cutting on raised bog priority habitats

## 7.3. Overall Habitat Future Prospects

Although certain positive management actions have been taken in recent year (raised bog restoration projects, Turf Cutting cessation schemes, land purchase and surveillance programs (e.g. SIR program)), these actions seem to have affected only a small portion of the habitat resource. A long-term programme of targeted restoration is needed.

Negative actions such as turf cutting, drainage and burning continue impacting the habitat, decreasing its extent and degrading its structure and functions. The extent of the habitat in non-designated sites is unknown and similar impacting activities are likely to be present on these sites.

To summarise the habitat long-term viability is not assured and there are bad prospects for its future. The Future Prospects are deemed to be **Unfavourable Bad**.

## 8. Overall Assessment of the Habitat Conservation Status

The habitat conservation status of the four main attributes has been assessed as Unfavourable Bad at national level.

- The habitat natural range is considered to be more than 10% below the Favourable Reference Range (FRR) and thus Unfavourable Bad. The FRR is defined by the range of Degraded Raised Bog Habitat that is still capable of natural regeneration and thus may form peat.
- The extent of Active Raised Bog habitat has decreased by 36% in a ten year reporting period (1994-2005) with 43.21% of the national resource of raised bog known to contain this priority habitat. This represents a yearly loss greater than 1% in the reporting period and thus the habitat extent is deemed Unfavourable Bad.
- An Unfavourable Bad assessment is also given to the habitat structures and functions as the decrease in the finest habitat vegetation ecotope indicates. This decrease is illustrated by reduction in *Sphagnum* species cover, degradation the habitat microtopography and increase in the presence of negative indicators. This has been coupled by a decline in typical species, particularly good quality indicators (*Sphagnum fuscum, S. imbricatum*, *S. cuspidatum, S. auriculatum* and *Cladonia portentosa*).
- The habitat's Future Prospects are overall deemed to be Unfavourable Bad. Ongoing deterioration of the hydrological conditions of raised bogs at current rates caused by peat cutting, drainage, forestry and burning severely threatens the viability of the habitat. Major positive management actions: land and turbary purchase and restoration works are required.

Thus, considering the Unfavourable Bad assessment for the four main habitat's attributes the overall conservation status for Active Raised Bog habitat is **Unfavourable Bad**.

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# APPENDICES

# APPENDIX I

## HABITAT CONSERVATION STATUS ASSESSMENT PROJECT

The National Parks and Wildlife Service (NPWS) carried out a *Raised Bog Monitoring Project* (Fernandez *et al*., 2005) in the period 2004-05 with the aim of assessing the conservation status of a selection of raised bog habitats: Active Raised Bog (7110), Degraded Raised Bog still capable of regeneration (7120), Bog Woodland (91DO) and Depressions on peat substrates of the Rhynchosporion (7150).

A suite of 48 raised bogs, with an overall high bog extent of 7,961ha, was surveyed and an individual habitat conservation status assessment was produced for each raised bog. The extent of these selected raised bogs represents 43.21% of the overall extent of high bog within designated sites where a comprehensive ecological survey has been carried out (18,423ha). They account for 15.92% of the national resource of relatively *intact* high bog (50,011ha) and support 51.27% of the current national resource of Active Raised Bog habitat (1,945.18ha).

These 48 raised bogs were considered to be representative of the selected habitats' natural variation and range. Thus, the raised bog ecological - geographical variation was taken into account (i.e. Western raised and True Midland variant).

The assessment was done by comparing habitat attributes between a baseline survey (Kelly *et al*. 1995) with current values obtained by Fernandez *et al*. (2005).

These attributes are 1) Habitat extent, 2) Habitat quality and 3) Future prospects. Habitat range was also used as an attribute to assess habitat conservation status at national level but not at site level.

Habitat extent was calculated using changes in values within the reporting period (1994/5-2004/5).

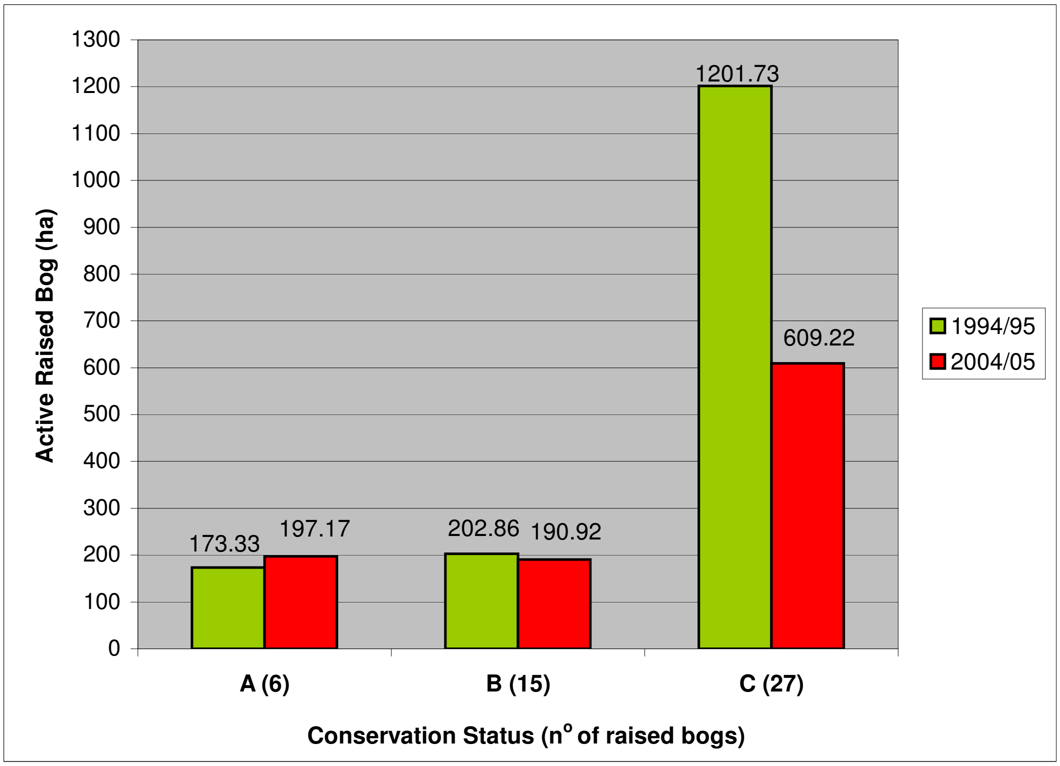
Habitat quality was assessed at two different levels:

a) Habitat functions and b) Habitat structures. Variations in ecotopes extent were considered indicative of changes in the habitat functions, as each ecotope indicates a different level of quality. Therefore the main target would be to increase the extent of good quality ecotopes. A series of attributes (e.g. quality indicators, *Sphagnum* cover, surface features, etc) were selected to ascertain changes in habitat structures. Changes in habitat structures may occur within an ecotope while the ecotope extent would remain unchanged during the reporting period.

Future Prospects for habitats present on a site were assessed by identifying impacting activities and them quantifying their intensity and influence. Examples of the most impacting activities on the habitats are turf cutting, drainage and burning.

The project results indicate that the conservation status of Active Raised Bog was A – Favourable at 6 raised bogs, B - Unfavourable Inadequate at 15 raised bogs and C - Unfavourable Bad at 27 raised bogs out of 48 raised bogs surveyed. Habitat extent has decreased by 36.80% since 1994/95. The overall habitat quality (Structure and Functions) has been assessed as Unfavourable Bad. The Future Prospects are considered Poor at 26 raised bogs and Bad at 15 raised bogs and thus the habitat is either moderately threatened or severely threatened. Therefore the overall conservation status for Active Raised bog habitat for the 48 raised bogs assessed is considered to be **Unfavourable Bad**.

**Figure I.1 Results of Raised Bog Monitoring Project (2005)**




As figure I.1 illustrates 27 raised bogs fall into the C (Unfavourable Bad) conservation status assessment category. They represent 65.96% (5,251.18ha) of the total extent of the raised bogs surveyed as part of the *Raised Bog Monitoring Project* (2005) and there has been a decline in Active Raised Bog habitat extent from 1,201.73ha in 1994/95 to 609.22ha in 2004/05. Active Raised Bog habitat has been assessed as B (Unfavourable Inadequate) at 15 bogs (23.95% of raised bog extent surveyed). The habitat extent has declined from 202.86 to 190.92ha within these bogs. Six raised bogs fall into the A (Favourable) assessment and account for 10.08% of the raised bog extent surveyed. The extent of Active Raised Bog habitat has increased from 173.33ha to 197.17ha in 2004/05.

**Note**

Active and Degraded Raised Bog pose an unusual conservation assessment situation as the latter should progress to an active peat forming state and as a result its extent would decrease. Despite their ecological interconnection Fernandez *et al*. (2005) considered the two habitats as independent as regards habitat conservation status assessment.

# APPENDIX II

# SOURCES OF DATA

The following is a summary of the main sources of information employed to produce the habitat's distribution map, to evaluate its current range and extent and to carry out its conservation status assessment:

### A. Raised Bog Restoration Project - Kelly *et al*. (1995)

This project aimed to identify raised bogs that were suitable for declaration as National Reserves. It included a comprehensive ecological and hydrological investigation of a number of selected raised bogs. As a result a comprehensive report was written for each site and a series of maps (i.e. vegetation, drainage, hydrochemistry, slopes and land-use) were prepared. 45 sites were visited during the surveys. Clara (SAC 572) and Raheenmore (SAC 582) bogs were also included in the final assessment based in data collected during the Irish/Dutch Raised Bog study (Schouten. 2002).

The project botanical surveys mapped the vegetation at the community complex level. Each complex was characterised by a series of vegetation communities. These complexes were amalgamated into a series of ecotopes. These maps provided the basis for identifying the boundaries for Active and Degraded Raised Bog habitats.

This project resulted in the designation of 31 SACs.

### B. Raised Bog Restoration Project - A Continuation of the Investigation into the conservation and restoration of selected raised bog sites in Ireland - Derwin and MacGowan. (2000)

This project used the methodology established by Kelly *et al*. (1995) to assess 28 sites not surveyed in 1995 as potential Active or Degraded Raised Bog SACs. The sites assessed were selected from a total of 102 sites which were assessed, using aerial photography for their conservation potential.

As a result 6 sites were proposed as SACs as they comprised Active Raised Bog habitat. Other 17 were also proposed as SACs as they contained Degraded Raised Bog habitats. A further 10 sites were proposed by NPWS. The latter sites were surveyed as part of the 1995 survey but were not included in that original list of proposed SACs. The habitat maps produced by this survey were also used to compile the final habitat distribution map and calculate habitat extent.

### C. Raised Bog Monitoring Project - Fernandez *et al*. (2005)

This project aimed to monitor the conservation status of raised bog habitats included in the Annex I of the Council Directive 92/43/ECC. A total of 48 of designated sites that represent the habitat's range were selected for this purpose based mainly on the original sites investigated by Kelly *et al*. (1995). These sites were resurveyed using similar methods and the vegetation descriptions and maps of Kelly *et al*. (1995) were used as a baseline to identify changes which will occurred in he intervening period. The main outcomes of the project were individual site's habitat and overall habitat conservation status assessments as well as detailed impacts and habitat (i.e. ecotopes) maps.

The habitat maps were used to produce the final habitat distribution map and estimate habitat extent within this project.

### D. Assessment of Impacts of Turf Cutting on Designated Raised Bogs 2003-06 Project - Fernandez *et al*. (2006)

This project initiated in 2003 and completed in 2006, assessed the impacts of turf cutting in all designated raised bogs and proposed appropriate responses to such impacts (i.e. prioritising program to phase out this activity). Comprehensive botanical surveys were carried out in those sites not surveyed previously. Turf cutting was described for all those sites where priority habitats (i.e. Active Raised Bog or Bog Woodland) were recorded. A comprehensive turf cutting impact assessment was carried out at

93 bogs where priority habitats are present and cutting was recorded in 2003. Detailed maps of turf cutting plots and sensitive margins were produced.

### E. Corine Land Cover Map (2000)

Corine Land Cover (CLC) is a map of the European environmental landscape based on interpretation of satellite images. It provides comparable digital maps of land cover for each country for much of Europe. The CLC 2000 project in Ireland forms part of the update of land cover maps for the whole of Europe, which is being co-ordinated by the EEA (European Environmental Agency) with the co-operation of national competent authorities in contributing states. The Environmental Protection Agency (EPA) is the national competent authority for CLC 2000 data in Ireland. The CLC 2000 database was created by first assessing and correcting the existing CLC 1990 land cover database and images for geometric and thematic content, followed by mapping land cover changes using 2000 satellite imagery and ancillary data. The CORINE project provides a coarse quantification of land cover in Ireland (EPA, 2004).

CLC is based on a simple 3-level hierarchy classification system consisting of 44 land cover classes. The land cover inventory was conducted at a scale of 1:100,000 and the minimum area digitised in the updated version, CORINE 2000 is 25 ha. Additional work was undertaken for some habitat on the hierarchical levels 4 & 5 of raised bog and up to level 6 of blanket bog (http://www.epa.ie/OurEnvironment/Land/CorineLandCover).

Raised bog land cover was divided into two subtypes:

a) **Exploited raised bog (Code 41211)** mainly corresponds to cutaway, cutover, reclaimed agriculture land with peat soils (e.g. surrounding either cutaway, cutover or intact raised bog). These areas are mostly deemed Secondary degraded raised bog. Bord na Mona extensive cutover bogs areas have been classified as *Secondary degraded category*. Thse areas of *Secondary degraded* of geographical importance (i.e. isolated sections of raised bog in counties outside the main concentration of raised bog) have been remapped as part of this project with the aids of the year 2000 aerial photographs. These areas occasionally included small areas of reclaimed agriculture land were all the peat may have been removed. These areas would therefore not be considered raised bog.

b) **Intact raised bog (Code 41212)** corresponds to either Degraded Raised Bog habitat (7120) or Active Raised Bog habitat (7110). Occasionally large drained areas of high bog where the raised bog vegetation remains are included in this type. These areas correspond to Degraded Raised Bog habitat (7120). However those areas where the top vegetation layer has been removed and mapped as 41212 by Corine are allocated to *Secondary degraded raised bog* within Exploited raised bog (41211) as part of this project. They generally grade into cutover and reclaimed land with peaty soils.

**CLC map shortcomings**

CLC maps are the most current comprehensive source of information to produce raised bogs distribution and range maps. However, it has certain land cover assignment and class boundary mapping shortcomings that we have try to minimise by processing their data (i.e. reclassifying or adjusting high bog boundaries). The use of 2000 year aerial images where raised bog boundaries are discernible was essential for processing CLC polygons.

- In several occasions CLC 2000 map classed small sections of intact raised bog as other sort of habitat (e.g. land occupied by agriculture with areas of natural vegetation). These areas were re-classed as Degraded Raised Bog habitat as part of this project.
- Raised bog afforested with conifers were frequently mapped as conifers and not as raised bogs. These areas were mapped within this project and classed as Degraded Raised Bog habitat. However this was not systematic within this project and there are still some afforested areas not included in the final habitat map.
- Those raised bog areas mapped by Corine as Exploited raised bog (41211) where the high bog vegetation is *intact* has been promoted to Intact raised bog (41212). The presence of Active Raised bog habitat is unknown here.

Those CLC raised bog areas already mapped more comprehensibly by any of the other sources were eliminated from the final habitat map. Those areas not mapped by any of the other sources were classed as a) *intact* high bog areas or b) *Secondary degraded* areas. *Intact* high bog areas were divided into those within or outside designated sites. Furthermore, they were classed as Degraded Raised Bog where the possibilities of finding Active Raised Bog habitat are minute or those where the presence of Active Raised Bog habitat is unknown.

### F. Year 2000 aerial photographs

The year 2000 orthorectified aerial imagery (Ordnance Survey of Ireland) was used to aid mapping habitat boundaries or in the case of raised bog habitats to confirm the presence of the habitat once it was identified by other sources (e.g. Corine Land Cover maps 2000).

### G. The distribution on a 10k grid of selected habitats in the Republic of Ireland - Conaghan, J. (2000)

This consisted on a desktop survey of the distribution, on a 10km basis, of 9 nationally important habitats within the Republic of Ireland. The author used a series of sources to determine the presence or absence of the selected habitats.

Conaghan (2000) reported the occurrence of raised bogs in grid squares that were not recorded by any of the other sources (e.g. Corine Land Cover map, NPWS records, etc). In those cases, the use of the year 2000 aerial images have been essential to identify the location of the reported record and digitised the high bog boundary. A total of 8 *intact* raised bog records and 13 records of *Secondary degraded raised bog* were reported exclusively by this source.

### H. Habitat Assignment Project (NPWS 2006)

This desktop project was undertaken by NPWS and the main aim was identifying and listing habitats listed in the Annex I of the Habitats Directive (92/43/EEC) reported within a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, aerial photographs, NGOs shadow list, etc. A total of 17 records of raised bog were exclusively obtained from this resource.

### I. Digitised Peatland Map of Ireland - Hammond (1979)

Hammond's *Peatland Map of Ireland* (1979) is the most comprehensive over-view of the distribution of peatlands in Ireland at the end of the 1970s. Hammond mapped the mire subtypes described by Moore (1962).

Hammond's map is based on data from several sources, principally the detailed soil map data from the National Soil Survey carried out by An Foras Talúntais since 1968, these maps covered 10 counties fully and 2 counties partially. Aerial photographs from 1973/74 together with site visits covered the rest of the country. No aerial cover existed however for county Donegal and parts of counties Sligo, Cork, Waterford and Louth. Hammond acknowledges that the these counties were not covered by the same detailed reconnaissance field sheets as the other counties and were mapped principally on the basis of the far cruder 1920 peat map for Ireland. However, these deficiencies seem to apply more to blanket bog than to raised bog and Hammond's map is regarded as the only peatland map which has been methodically produced and which specifically targets peatlands.

Raised bog, was divided into seven subtypes:

1- Raised Bog –Machine Peat

2- Raised Bog – Milled Peat

3- Raised Bog – Moss Peat

4- Raised Bog – Man Modified

5- Raised Bog – True Midland Type

6- Raised Bog – Transitional Type

7- Raised Bog – Potential Industrial Areas

Although Hammond maps categorised mires (i.e. blanket bog, raised bog and fen) according to the level of disturbance (i.e. man modified, milled peat, moss peat) the current status of those sites considered unmodified is likely to have changed since 1979. Hammond's maps are therefore not reliable for identifying the current site status due to the impact of the Turf Development Act (1981-1995) supported projects and private afforestation grant aids. However, Hammond's map is considered to be the most accurate national map available for indicating the location of raised bog peat soils.

The Soils Division of Teagasc has now digitised the original Hammond's *Peatland Map of Ireland* (1979). This was used to refine the habitat distribution map produced from other sources by overlaying the Hammond's digital map on it. This provided further validations for those sites already mapped and most importantly identify raised bog areas in grid squares where they had not been identified by other sources. Only three records of *intact* raised bog not recorded by any of the other sources were given by Hammond's (1979) map. However Hammond's map extremely useful for mapping some areas of *Secondary degraded raised bog* not shown by Corine 2000.

It was found that some raised bog areas reported by Hammond in 1979 are not visible on the aerial images. This is likely to be due either to the complete transformation of the landscape through land reclamation or in some cases to errors in Hammond's maps. These areas were not included in the final map but it is probable that at least some of these areas still contain raised bog peat soils.

### J. NPWS Enquiries Database

This is a comprehensive NPWS internal database, which includes data on habitats and sites designated. This source reported a total of 26 raised bogs within designated sites that were not reported by any of the other sources.

# APPENDIX III

# GLOSSARY

ACTIVE PEAT FORMING - According to the Interpretation Manual of the Habitats Directive, the term active must be taken to mean still supporting a significant area of vegetation that is normally peat forming. Bogs where active peat formation is temporarily at a standstill, such as after a fire or during a natural climatic cycle e.g., a period of drought, are also included.

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

COMMUNITY COMPLEX – This is the most simple level of vegetation classification described within this survey. A community-complex is made up of a characteristic mosaic of stands of different community types. They are identified by the dominance of one to three plant species; acrotelm (presence and depth); *Sphagnum* cover and the presence of pools. The community complexes are pooled into ecotope types.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CUTAWAY BOG - This term describes areas where peat has been removed systematically by industrial means. Any peat remaining can no longer be considered as economically removable (Irish Peatland Conservation Council).

CUTOVER BOG – An NPWS habitat classification that describes areas of bog which have been previously cut (by hand or by mechanical means), although not down to the underlying mineral soils or bedrock. Remaining peat can still be an economic reserve. Cut-over areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DEHLG - Department of Environment, Heritage and Local Government

DESICCATION - Drying out.

DOMESTIC PURPOSES - Used in relation to the cutting of peat. Peat that is cut for domestic purposes is not for commercial sale and is cut at the rate of one year’s supply for a household per year.

DRAINAGE DITCHES - An NPWS habitat classification which refers to water channel systems with moving or stagnant water bodies, artificial in origin. Most ditches are cleared cyclically, although this category also includes ditches that are overgrown with wetland plants.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ECOTOPE - The abiotic environment or habitat of a particular biotic system (Kulcher, 1967; Whittaker et al., 1973). According to work carried out by Kelly (1993) on Clara and Raheenmore raised bogs vegetation can be assigned to five different ecotopes. Sub-central and central ecotopes with Active peat formation (Active Raised Bog habitat) and marginal, sub-marginal and facebank ecotopes with little or no peat formation (Degraded Raised Bog habitat).

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

FENS AND FLUSHES - An NPWS habitat classification. Fens are peatlands fed by calcium rich water, either from groundwater or from inflowing surface water. Flushes are wet areas maintained by the seepage of water down slopes of various gradient, and are usually local features. Both are characterised by an abundance of small sedge forming species-rich mosaics with other species. Orchid species are particularly noticeable in fens and butterworts are more typical of flushes. According to Cross (1990) flushes are areas where nutrient enrichment occurs, usually as a result of more concentrated horizontal water movement. They are particularly common near the bog margin and at the base of low mineral ridges and are characterised by the presence of *Molinia caerulea, Myrica gal*e and often *Sphagnum recurvum*.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT. - Refers to traditional cutting of peat using a slean or spade.

HIGH BOG – This is the area of bog which have not been previously cut and generally its vegetation is characterised by the presence of ericoid and *Cyperaceae* species and an abundant of *Sphagnum* species.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

INTACT HIGH BOG: refers to uncut high bog still supporting typical high bog vegetation (Active or Degraded Raised Bog). No completely intact raised bog remains in Ireland and all have been damaged to a certain degree by activities such as turf cutting, drainage, burning and afforestation.

LAGG - A term used to describe the transition from bog to mineral soil around a raised bog.

LIMESTONE - Sedimentary rock composed predominantly of calcium carbonate, often containing fossils.

MARGIN WITH LOW SENSITIVITY TO CUTTING (or None sensitive margin) - Section of high bog margin that is within more than 250m of priority habitat (i.e. Active Raised Bog or Bog Woodland).

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MICROTOPOGRAPHY – This is the small scale variation in surface level and the following terms used by Kelly (1993) and Schouten (2002) are used to describe it:

- Pools - Depressions in the bog surface where the water table remains above surface level all year round or below surface level for only very short periods of time. They are characterised by the presence of aquatic plant species such as *Sphagnum cuspidatum* and *Cladopodiella fluitans*.
- Hollows - These are shallow depressions in the bog surface where surface water collects, or where the water table reaches ground level or lies just above ground level, depending on seasonal conditions. Marginal hollows tend to be elongated as they are focus points for surface water run off. They are often dominated by *Narthecium ossifragum*. On the high bog they take many forms but are often eye shaped.
- Lawns - These are shallow hollows or flat areas where one species dominates to form a lawn. This is frequently a *Sphagnum* species, such as *Sphagnum magellanicum*, which can completely fill in a hollow to form a small lawn.

- Flats - These are more or less flat areas which are intermediate between hollow and hummock communities. They tend to be drier than the above situations.
- Hummocks - These are mounds on the bog surface which can range from a few centimetres to more than a metre in height. They are usually composed mainly of *Sphagnum* species, such as *Sphagnum magellanicum, S. capillifolium, S. imbricatum* and *S. fuscum* but other bryophyte species such as *Hypnum jutlandicum* and *Leucobryum glaucum* are also important, especially as the hummock grows taller and becomes drier. *Calluna vulgaris* is another important element, as it flourishes where the water table is not at surface level.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PEAT CUTTING BY HAND. - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

RAISED BOG - An NPWS habitat classification characterised by an elevated dome of peat, the surface of which is isolated from the surrounding ground water table and receiving water solely from precipitation. The peat surface is wet, often with pools and hummock hollow systems and is usually dominated by *Sphagnum* mosses and bushy heather, with Deer-grass, Bog Cottons and other associated species. Raised bogs can be distinguished from blanket bogs by their paucity of grasses which typify blanket bog.

SECONDARY DEGRADED RAISED BOG - This includes highly drained high bog devoid of vegetation (including the majority of Bord na Mona sites), cutaway bog, cutover and occasionally reclaimed agriculture land with peaty soils. Although this sub-type of Degraded raised bog does not correspond with the strict definition of the Habitats Directive Interpretation Manual, re-establishment of vegetation with peat forming capability, it may be possible and may even more feasible to restore to Active bog than in some areas of Degraded bog.

SENSITIVE MARGIN (or Margin with high sensitivity to cutting) - Section of high bog margin that is within 250m of priority habitat (i.e. Active Raised Bog or Bog Woodland).

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

TURBARY – Turbary is the term used to describe the ancient right to cut turf on a particular area of bog. These rights came about with the resettlement of confiscated land or by prescription. Prescription is a legal term meaning that if a person is able to demonstrate that they cut turf without secrecy, without permission and without force continuously for a period of 30 years they have a turbary right. This implies that not all turbary rights will be formally registered.

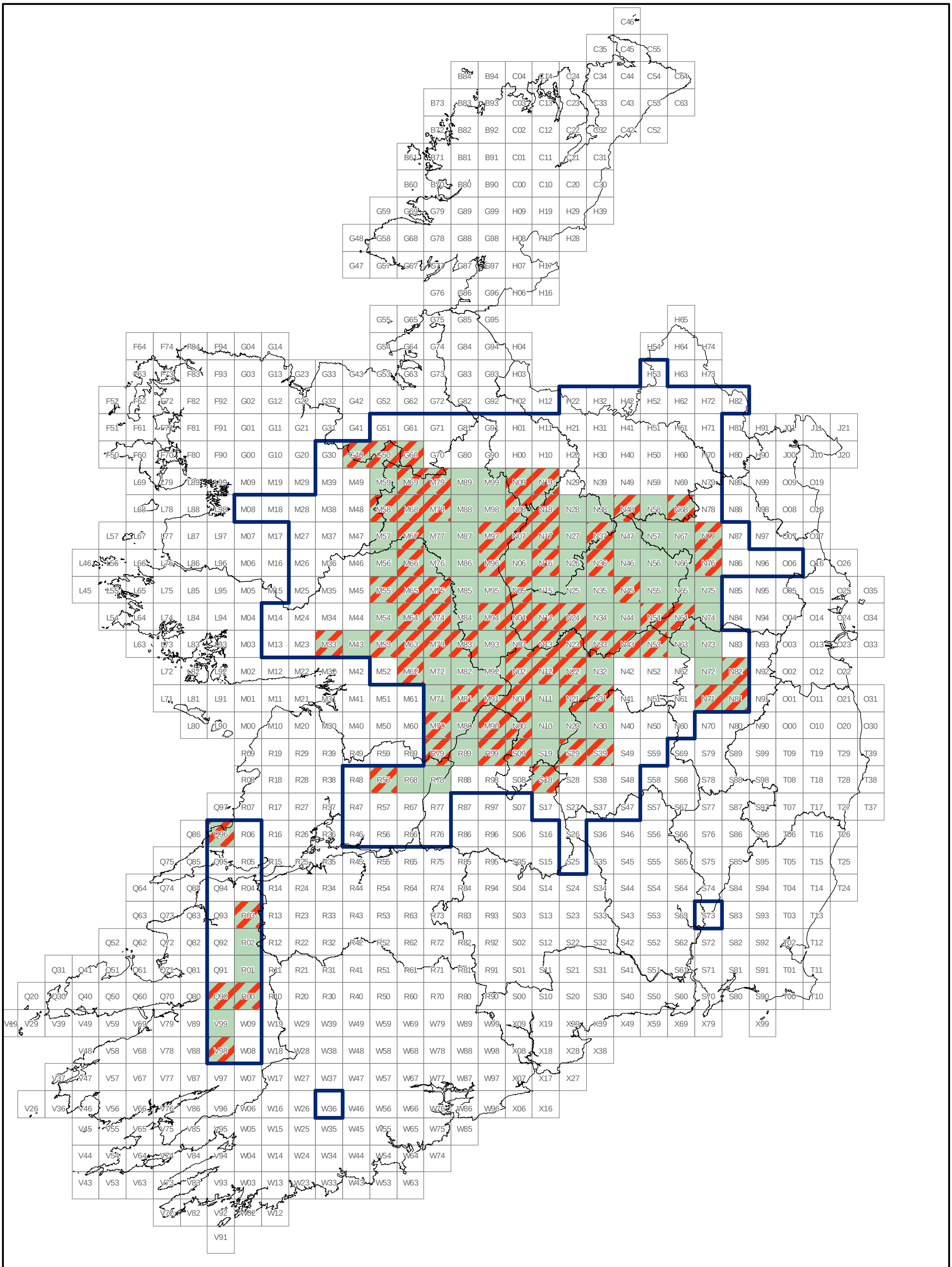
## **7110** Active Raised Bog

| National Level | |
|---|---|
| **Habitat Code** | 7110 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | ▪ Charles, S. 1996. *The Peat Resource of Ireland*. Global Peat Resource. Eino Lappalainen. International Peat Society.<br>▪ Derwin, J. & MacGowan, F. 2000. *Raised Bog Restoration Project: A Continuation of the Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland.* Unpublished report, Dúchas the Heritage Service, Dublin.<br>▪ Fernandez, F., Fanning, M., Mccorry, M. & Crowley, W. 2005. *Raised Bog Monitoring Project 2004-05*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.<br>▪ Fernandez, F., MacGowan F., Crowley, W., Farrell, M., Croal, Y., Fanning, M. & McKee, A. 2006. *Assessment of impacts of turf cutting on designated Raised Bogs 2003-06*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage Local Government, Dublin.<br>▪ Hammond, R.F. 1979. The Peatlands of Ireland. Soil and Survey Bulletin. No. 35. An Foras Taluntais (Teagasc), Dublin.<br>▪ Hammond, R.F. 1984. *The Classification of Irish peats as surveyed by the National Soil Survey of Ireland*. 7th International Peat Congress, Dublin.<br>▪ Kelly, L., Doak, M. & Dromey, M. 1995. *Raised Bog Restoration Project: An Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland.* Unpublished report, National Parks & Wildlife Service, Department of Arts, Heritage, Gaeltacht and the Islands, Dublin. |
| **Range** | Concentrated in the lowlands of central and mid-west Ireland with disjunct areas occurring in the south-west. |
| Surface area | 7,600km² (76 grid cells x 100km²) or 13,400km² (area polygon derived from grid cells) |
| Date | 08/2006 : 1994/2005 |
| Quality of data | 3 = good (based on extensive surveys) |
| Trend | Stable |
| Trend-Period | 1994 - 2005 |
| Reasons for reported trend | No changes |
| **Area covered by habitat** | 19.45 km$^2$ |
| Distribution map | See map I attached |
| Surface area | 19.45 km$^2$ |
| Date | 08/2006 : 1994/2005 |
| Method used | 3 = ground based survey |
| Quality of data | 3 = good (based on extensive surveys) |
| Trend | - 36% = net loss 36% (within 43.21% of the national resource of raised bogs known to support the habitat in 2005) |
| Trend-Period | 1994 - 2005 |

| | |
|---|---|
| Reasons for reported trend | 3 = direct human influence |
| Justification of % thresholds for trends | |
| Main pressures | 150 Restructuring agricultural land holding<br>160 General Forestry management<br>161 Forestry planting<br>180 Burning<br>310 Peat Extraction<br>311 Hand-cutting of peat<br>312 Mechanical removal of peat<br>810 Drainage<br>954 Invasion by a species |
| Threats | 150 Restructuring agricultural land holding<br>160 General Forestry management<br>180 Burning<br>312 Mechanical removal of peat<br>810 Drainage<br>954 Invasion by a species |
| ***Complementary information*** | |
| **Favourable reference range** | 20,100 km² (201 grid cells x 100 km²) or 24,600km² (area polygon derived from grid cells) (The Favourable Reference Range is defined by the range of Degraded raised bog habitat) See map I attached |
| **Favourable reference area** | 215.2km² (based on the area of Active and Degraded Raised Bog habitats in designated areas) |
| **Typical species** | Vascular plants*: Andromeda polifolia, Calluna vulgaris, Drosera anglica, D. intermedia, D. rotundifolia, Erica tetralix, Eriophorum angustifolium, E. vaginatum, Menyanthes trifoliata, Narthecium ossifragum, Rhynchospora alba, R. fusca, Trichophorum cespitosum, Utricularia minor, Vaccinium oxycoccos.*<br>Mosses, Liverworts and Lichens: *Aulacomnium palustre, Cladonia spp (C. ciliata and C. portentosa), Leucobryum glaucum, Sphagnum auriculatum, S. capillifolium S. cuspidatum, S. fuscum, S. imbricatum, S. magellanicum, S. papillosum, S. pulchrum, S. subnitens.*<br><br>Methods: all the species above are characteristic of Active Raised bog habitat in Ireland. Only a small selection of them was used as habitat quality indicators.<br><br>Indicator species: *Sphagnum fuscum, S. imbricatum*, *S. cuspidatum, S. auriculatum* and *Cladonia portentosa* |

| | |
|---|---|
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement.<br>Characteristic species were assessed as unfavourable/bad (Fernandez et.al. 2005). |
| **Other relevant information** | The favourable reference values of the Active (ARB) and Degraded Raised Bog (DRB) are linked as DRB is described in the Interpretation Manual as restorable to peat-forming capability in 30 years. However we do not consider that the final value for DRB habitat should be zero, i.e. that all the current DRB must be restored to ARB as in some cases this will not be technically feasible. Ireland is obliged to ensure that Favourable Conservation Status is achieved for ARB habitat and to that end designated 195.7 $km^2$ of DRB within protected areas. It is considered that this, approximately 10 times the current ARB area, should be the theoretical target value for the restoration. The areas targeted for restoration will be those deemed most favourable and will be spread throughout the range of raised bogs. However priority will be given to areas within currently designated sites which possess ARB so as to support the conservation of these sites and maximise biodiversity values of the restored areas.<br><br>Restoration initiatives have been undertaken by:<br>• The National Parks and Wildlife Service (NPWS): *Raised Bog Restoration Project* (1994, 2003 and 2006). The overall result is positive with the expansion or new formation of Active Raised bog habitat. These works took place in 14 sites.<br>• Coillte Teoranta initiated in 2004 a Raised Bog Restoration Project founded by an EU Life -Nature Programme that will be completed in 2008. The project aim is to restore 571.2ha of raised bog with actions such as tree felling, protection against fire and blocking of drains in 14 SACs. |
| ***Conclusions*<br>*(assessment of conservation status at end of reporting period)*** | |
| **Range** | Bad (U2) - More than 10% below "favourable reference range". |
| **Area** | Bad (U2) - 36% habitat decline in the period 1994-2005 within 43.21% of the national resource of raised bogs known to support the habitat. More than 1% loss per year. |
| **Specific structures and functions (incl. typical species)** | Bad (U2) - decreases in central ecotope greater than 25% in 43.39% (684.7ha) of the 1994/95 habitat resource assessed in 2005. This decrease indicates declines in good habitat quality indicators (*Sphagnum fuscum, S. imbricatum*, *S. cuspidatum, S. auriculatum* and *Cladonia portentosa*). |
| **Future prospects** | Bad (U2) - ongoing deterioration of the hydrological conditions of raised bogs at current rates caused by peat cutting, drainage, forestry and burning severely threats the viability of the habitat. |
| **Overall assessment of CS** | Bad (U2) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

# Active raised bogs

7110

- Current Distribution (76 cells)
- Current Range (134 cells)
- Favourable Reference Range (246 cells)
- W48 10km grid cells

Date: July 2007

# 7120 Degraded Raised Bog still capable of regeneration

## CONSERVATION STATUS ASSESSMENT REPORT

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## 1. Habitat characteristics in Ireland

Irish raised bogs are classified as Oceanic raised bog mire (*sensu* Moore & Bellany, 1974). This mire type has a very restricted distribution on the Atlantic fringe of the north-west of Europe. The vegetation of a typical raised bog that is still hydrologically intact is assigned to the Oxycocco-Sphagnetea and to the Erico-Sphagnetum magellanici phytosociological association (Whyte and Doyle, 1982).

Irish raised bogs are classified into two sub-types: **Western raised bogs** or **Intermediate** and **True Midland raised bogs** (Schouten, 1984), with the boundary between the two being taken as the 1,000mm isohyet. This division is based on a combination of phytosociological and morphological characteristics. Western raised bog, also termed as Oceanic raised bog (Goodwillie, 1980) or Transitional bog (Hammond, 1979), occurs in areas with rainfall ranges from 1,000 to 1,250mm. Whereas True Midland raised bog also known as Concentric bog (Goodwillie, 1980) are characterised by an average rainfall between 750 and 1000mm/year. These divisions are, of course, somewhat artificial and in reality there is a continuum across the country from Lowland blanket bog in the hyper-oceanic west to True Midland raised bog in the drier centre and east (Bellamy and Bellamy, 1966, Schouten, 1984).

Raised bogs mainly comprise Active raised Bog habitat (7110) and Degraded Raised bog habitat still capable of natural regeneration (7120). However, a third category *Secondary degraded raised bog* has been considered as part of this assessment. This includes highly drained high bog devoid of vegetation, including the majority of Bord na Mona sites, cutaway, cutover bog and occasionally reclaimed agriculture land with peaty soils. Although this sub-type of degraded raised bog does not correspond to the strict definition of the Habitats Directive Interpretation Manual, re-establishment of vegetation with peat forming capability may occur in some of these areas.

## 2. Habitat mapping

The mapping of Degraded Raised Bog distribution and range[1] is partially based on National Parks and Wildlife Service (NPWS) surveys carried out since the mid 1990's (see Appendix II):

- *Raised Bog Restoration Project*. Kelly *et al*. (1995)
- *Raised Bog Restoration Project*. Derwin and MacGowan (2000)
- *Raised Bog Monitoring Project*. Fernandez *et al*. (2005)
- *Assessment of Impacts of Turf Cutting on Designated Raised Bogs Project*. Fernandez *et al*. (2006)

The above surveys involved mapping vegetation at the ecotope level (see glossary). Degraded Raised Bog habitat consists of three ecotopes (sub-marginal, marginal and facebank), as well as inactive flushes and dry woodland on the high bog (the latter does not correspond with the priority habitat Bog Woodland – 91D0).

The production of the national habitat resource map was completed with data provided by:

- *Corine Land Cover Map* (2000)
- *The distribution on a 10k grid of selected habitats in the Republic of Ireland.* Conaghan (2000)
- *Habitat Assignment Project* (NPWS, 2006)
- *Peatland map of Ireland.* Hammond (1979)
- Records reported in the *NPWS Enquiries database.*

The use of the year 2000 aerial photographs and 6" maps (1910s) has been essential to confirm the current presence of the habitat in those areas where some of the sources indicate so. Such as the case of records only illustrated by Hammond (1979) in the 1970s, areas only recorded by Corine (2000) and those

[1] Fernandez *et al*. (2005) reported a total of 139 raised bogs within 127 sites (74 NHAs and 53SACs). The use of a combination of sources as part of the assessment of conservation status of Degraded Raised Bog habitat allowed us to identify other 47 other designated sites (NHAs and SACs) containing raised bogs. The overall extent of high bog within these 47 sites is 3,207ha and 6 of them only contain *Secondary degraded raised bog* (86ha). Many of these raised bogs are currently cut for peat.

examples of the habitat for which only a sites name or bog name was given by the *Habitat Assignment Project* (NPWS, 2006) or *NPWS Enquiries database*. The use of the digitised townlands maps and discovery maps was also needed to locate these records where a specific geographical reference was absent.

The habitat records given by the previous sources were compiled within a final habitat digital map in Arcview 3.2 format. The distribution of the habitat is illustrated on a 10km square grid by selecting those squares where the habitat is present.

The mapping of the habitat range is defined by the smallest polygon size containing all grid squares, where the habitat was recorded, drawn using a minimum number of 90 degrees angles. Horizontal or vertical gaps in the habitat distribution of 3 or more grid squares (10-km side) or oblique gaps of 2 or more squares are deemed enough as to justify a break in the range. When the ecological conditions for the development of the habitat are deemed unsuitable, gaps of just 1 (10-km) squares may be also admitted.

The distribution of *Secondary degraded raised bog* has also been mapped. A total of seventy 10km grid squares are considered to contain exclusively this particular type of Degraded Raised Bog habitat. Corine (2000) Land Cover map was the main source of data to depict *Secondary degraded raised bo*g. Its occurrence was visually confirmed by overlaying the year 2000 aerial photographs.

## 3. Habitat Range

Raised bogs are abundant in the lowlands of central and mid-west Ireland. In Ireland raised bogs are confined to areas with an annual rainfall below 1250 mm (Hammond, 1984). In areas of high rainfall raised bogs are replaced by blanket bog. Raised bog occur principally in land below 130m and are most extensive and abundant where the limestone plain is covered by a variable thickness of undulating glacial drift which originally provided suitable basins for the development of lakes and/or fens, which in turn acted as precursors to the bogs. The eastern and southern boundary of their distribution is not very clear as the bogs which would have occurred in these areas were relatively small and have been cut away entirely. In the west, the raised bog grade into the blanket bogs but extensive cutting in the past has largely destroyed this transition zone (Cross, 1990). Raised bogs occurred throughout the lowlands of Northern Ireland but currently only scattered small remnants are present, with the greatest concentrations occurring in the west and in the northeast.

The current range of Degraded Raised Bog is similar to the range of the whole raised bog ecosystem, which occasionally may contain Active Raised Bog habitat. However, it does not include those areas *of Secondary degraded raised bog*.

The habitat distribution map produced as part of this project illustrates two main areas: the larger one stretching throughout the midlands and the smaller which has elongated shape in a north-south direction covers areas of counties Clare and Kerry. The gap between these two areas is likely to correspond to areas not suitable for the habitat. . In the intervening region Hammond (1979) Peatland Map indicates that the climatic, geological and altitudinal conditions were more appropriate for the development of Blanket bog, both Lowland and Highland. Two isolated records of the Degraded Raised Bog are found in counties Carlow and Cork. These are remnants of a previous more extensive habitat distribution along the southern and eastern margins of the country where raised bog developed was confined to small basins. These small raised bogs were drained and cutaway down to the mineral layer in the past. Thus, the mapping of the distribution of these outliers has not been possible.

### 3.1. Conservation Status of Habitat Range

The favourable reference values of the Active and Degraded Raised Bog habitats conservation status assessments are linked, however we do not consider that these values should be zero for Degraded Raised Bog habitat. Ireland is obliged to ensure that Favourable Conservation Status is achieved for both Active and Degraded Raised Bog, which may not necessarily require the restoration of the total national area of Degraded Raised Bog. Ireland was obliged to designate areas of Degraded Raised Bog that were capable of regeneration to Active Raised Bog. 19,574ha of raised bog, which correspond to the extent of Degraded

Raised Bog within protected areas, should be the target value for the restoration of Active Raised Bog areas. However this restoration area will be targeted in areas deemed suitable for the restoration throughout the range of raised bogs. Particularly in adjacent areas to raised bogs within designated sites with Active Raised Bog habitat present in order to optimise the conservation of their biodiversity values.

Setting a Favourable Reference Range value for Degraded Raised Bog is meaningless as the aim is to restore a certain amount of Degraded Raised Bog to Active Raised Bog throughout its range. This should result in a reduction of the extent of Degraded Raised Bog but not necessarily a change in the current range of DRB. Therefore a greater than 1% decline per year in the habitat range as a result of the destruction of the habitat before Active Raised Bog has had a chance to be restored will be assessed as Unfavourable Bad.

The habitat's current range is considered to cover all significant ecological variations of the habitat and sufficiently large to allow the long term survival of the habitat. The favourable reference range for Degraded Raised Bog is considered to be similar to the current range. Therefore, the habitat range is assessed as **Favourable**.

- **Habitat Range Area:** Can be considered as either the area of the grid cells occupied by the habitat which is 20,100km² (201 grid cells x 100km²) or the area of the polygon which contains all of the grid cells with the habitat that is 24,600km² (see section 2).
- **Favourable Reference Range:** 20,100km² (201 grid cells x 100 km²) or 24,600km² (area polygon derived from grid cells).

## 4. Habitat Extent

The original extent of raised bog in the Republic of Ireland was 308,742ha (Hammond, 1979). A large proportion of this figure would originally have been deemed Active Raised Bog as defined in the Interpretation Manual of the Habitats Directive. According to figure 4.1, 50,011ha of *intact* raised bog remain in the country, much of this is fragmented and includes Degraded Raised Bog habitat. 21,519ha are within designated sites (NHA, SAC). The overall extent of the national resource of Degraded Raised Bog is 48,066ha.

Traditional cutting of bogs by turbary over the last 400 years has had a serious impact on raised bogs and 68% of their extent has been cut away by this process (Hammond 1979, Ryan & Cross, 1984, Cross 1989). The mechanisation of peat cutting combined with a grant aid scheme under the Turf Development Act (1981) enabled many small scale extraction programmes to get underway has resulted in further loss of raised bog resource. Peat is still currently cut privately for fuel purposes. The most serious impact of mechanisation has been on midland raised bogs, accounting for a loss of 22% of the resource in less than 50 years (Cross, 1990). Only 8% of the original peatland area was considered suitable for conservation (Ryan & Cross 1984). Further losses have occurred in the last two decades but despite this, the Republic of Ireland still has the most extensive area of conservation worthy sites remaining in Western Europe.

As reported above, the overall estimated extent of Degraded Raised Bog is 48,066ha. This figure is obtained by adding the extent of the habitat calculated for those sites surveyed by NPWS (class A – figure 4.1) to the extent of un-mapped high bog (class B – figure 4.1). The latter are mainly provided by Corine Land Cover Map 2000, Hammond (1979) and records of the NPWS Habitat Assignment Project (2006). The current extent of Active Raised Bog habitat (1,945.1ha) has been deducted from the previous figures. Class B (figure 4.1) may be slightly overestimated as this is calculated by compiling habitat maps from the mentioned sources, which mapping is occasionally rather coarse (i.e. cutover or reclaimed bog is mapped as high bog).

### Estimated High Bog Extent

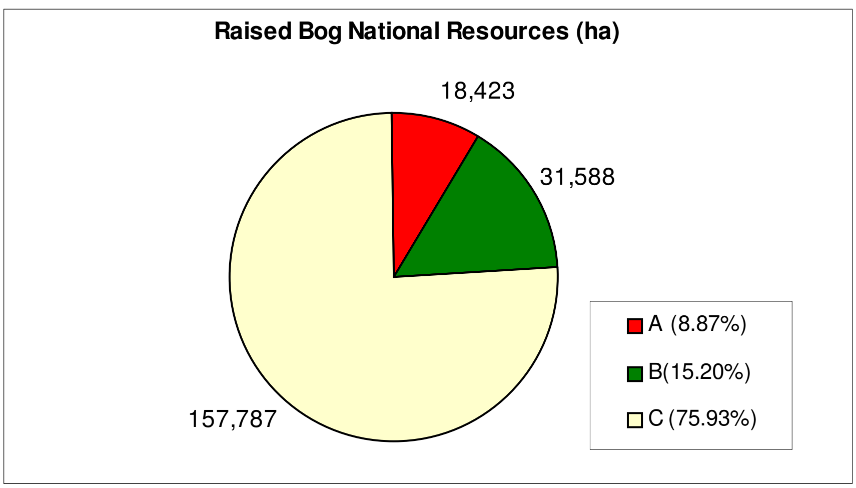
To calculate the current extent of High Bog, which mainly correspond to Degraded Raised Bog, all available sources of data relating to raised bog ecosystem were digitally mapped using Arcview 3.2 (see Appendix II). High bog extent is given below:

- Surveyed high bog by Kelly *et al.* (1995) (revised by Fernandez *et al.* (2005)), Derwin & MacGowan (2000) and Fernandez *et al*. (2006): **18,423ha** (see class A – figure 4.1).
- Un-mapped high bog: **31,588ha** (28,492ha outside designated sites) (see class B – figure 4.1). These data have been taken from Corine Land Cover Maps (2000) and the presence of *intact* high bog confirmed by looking at the aerial images from the year 2000. This figure is approximate and may be an overestimate as Corine mapped cutover areas adjacent to high bog as part of *intact* whereas as according to our criteria these areas correspond with *Secondary degraded raised bog*.

  The above two figures give us a total of **50,011ha** of *intact* high bog.
- Un-surveyed *Secondary degraded raised bog*: **157,787ha** (see class D – figure 4.1). This figure was calculated using Corine Land cover maps (2000) taking into consideration the degraded raised bog category. This figure is likely to be underestimated as Corine classifies coniferous plantations on peat soils as a conifer habitat and not as Degraded Raised Bog. Other exceptions may also be found (i.e. small sections of very Degraded Raised Bog classed as other habitat type). In addition, large areas of land surrounding current raised bog have also been reclaimed for agriculture. But most of these will have significant areas of peat soils.

To summarise, the overall extent of *intact* high bog and *Secondary degraded raised bog* is at a minimum **207,798ha**. This figure is significantly smaller than that given by Hammond (1979) for the Republic of Ireland (310,000ha approx.). The difference between these two figures is probably due to the former figure being based on the interpretation of aerial photographs and satellite imaginary, which underestimate the area of peat soils now reclaimed for agriculture and forestry while Hammond (1979) figures where mainly based on soils surveys. It is probably that only small areas have had all the peat removed. A more accurate figure will only become available when more up to date soils survey figures are compiled.

**Figure 4.1 Raised bog current extent in Ireland**




A- Surveyed high bog (Active and Degraded Raised Bog habitats present)

B- Un-mapped high bog (Presence of Active Raised Bog habitat unknown)

C- Un-surveyed *Secondary degraded raised bog*

**Figure 4.2 Active and Degraded Raised Bog habitat current extent within surveyed sites**

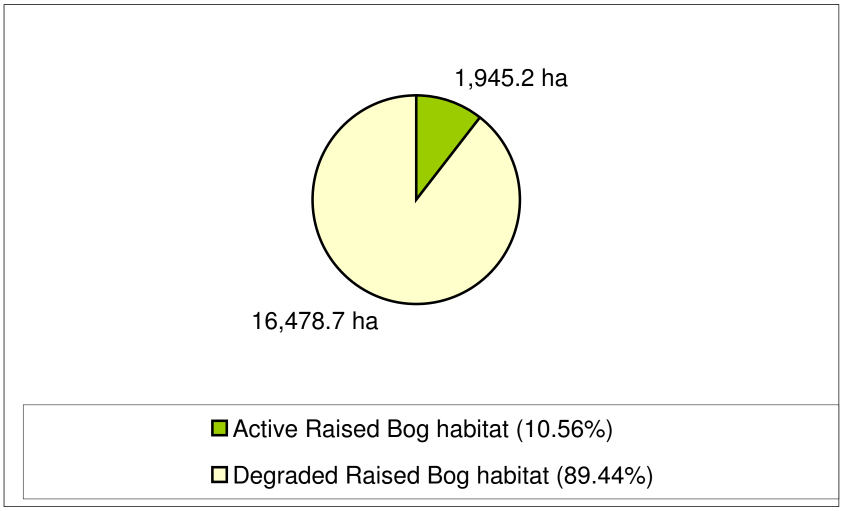



Figure 4.2 illustrates the overall extent of Active and Degraded Raised Bog habitat in surveyed sites where the presence of Active Raised Bog is known (class A - figure 4.1). As the figure shows 89.44% of the high bog within these raised bogs supports Degraded Raised Bog.

## 4.1. Conservation Status of Habitat Extent

Fernandez *et al*. (2005) results indicate that there has been an increase of 533ha (8.30%) in the extent of Degraded Raised Bog habitat in the period 1994-2005 for 48 raised bogs surveyed. These bogs account for 15.92% of the current national resource of *intact* raised bog. The conservation status of habitat extent has been assessed as A-Favourable at 42 of 48 raised bogs surveyed, which implies that the extent of the habitat has decreased by 0-5% or increased as a result of degradation of former Active Raised Bog habitat. The habitat extent was assessed as B-Unfavourable Inadequate at 1 raised bog, where Active Raised Bog has increased; C-Unfavourable Bad at 5 raised bogs, where there has been a loss in high bog area greater than 5% due to peat cutting or in one particular site as a result of boundary amendments (i.e. exclusion).

This project also estimated the loss in high bog as a result of peat cutting in the period 1995 – 2000. According to their calculation 44.86ha of high bog were irreversibly lost, which accounts for 0.56% of the original survey high bog. Although, a possible decrease in the peat-cutting rate is mentioned, the overall loss in high bog extent in the reporting period 1994 –2005 is estimated to be approximately 1%. A decrease in the habitat extent of more than 1% per year in the reporting period should be assessed as Unfavourable Bad. However the decrease has been approximately of 1% within 10 years. Thus a favourable assessment should be given.

The overall increase in habitat extent has occurred at the expense of Active Raised Bog habitat and thus does not indicate overall good conditions for the habitat neither the high bog. However, according to the conservation status assessment criteria established within the project both Active and Degraded Raised Bog habitats should be assessed independently. Thus an increase in habitat extent is assessed as favourable.

The conservation status of the remaining habitat resource has not been assessed. Fernandez *et al*. (2006) reported similar intensity and impact of peat cutting and related activities (i.e. burning and drainage) for these other bogs containing the habitat. It is therefore reasonable to assume that similar increases in Degraded Raised Bog would have occurred in these sites.

As mentioned in section 4.1 the favourable reference values for Active and Degraded Raised bog habitat are linked. Thus, as the favourable reference value for Active Raised Bog habitat extent is based on the area of Degraded Raised Bog still capable of regeneration within designated sites (195.7 $km^2$). A decrease in the extent of Degraded Raise Bog as a result of the restoration to Active Raised Bog should be assessed as positive. Therefore, the favourable reference area for Degraded Raised Bog habitat, which value is 285km², is based on the habitat extent outside designated areas. Degraded Raised Bog habitat is a special case as if restored it becomes Active Raised Bog habitat and thus the favourable reference area will be less than the present day area. Therefore both extent values can not be compared on the same basis than for other habitats.

To summarise, the current habitat extent value is above the favourable reference value and thus the habitat extent conservation status is deemed to be **Favourable**. A future decrease in habitat extent as a result of restoration should be deemed positive and thus favourable.

- **Area covered by the habitat:** 480.7 $km^2$
- **Favourable Reference Area:** 285km² (based on the area of Degraded Raised Bog habitat outside designated areas)

## 5. Structures and Functions

### 5.1. Habitat Structures and Functions

According to Fernandez *et al*. (2005) the increase in habitat extent has been coupled by a decline in habitat quality (i.e. Structure and Functions) indicated by an increase in the extent of marginal ecotope. This is a very degraded ecotope within the habitat, characterised by low bog moss (*Sphagnum*) cover. The Structure and Functions of Degraded Raised Bog habitat were assessed as B-Unfavourable Inadequate at 13 raised bogs, which implies an increase in marginal ecotope between 5 and 25%. Other 6 raised bogs were given C – Unfavourable Bad assessment, which indicates increases in marginal ecotope extent greater than 25%. On the other hand, the habitat quality was assessed as A- Favourable at 29 raised bogs mainly due to small variations in the extent of marginal ecotope (<5%).

The quality (i.e. Structure and Functions) of the habitat were only assessed in those areas that were classified as Degraded Raised Bog in 1994/95 as the inclusion of new areas (i.e. deteriorated Active Raised Bog) in the assessment would give an inadequate assessment. The recently degraded Active Raised Bog areas would correspond with high quality Degraded Raised Bog habitat. The results indicate that 32.27% (2,396ha) of the 1994/95 resource of Degraded Raised Bog were assessed as Unfavourable.

An increase in the extent of marginal ecotope is indicated by a reduction in the bog moss (*Sphagnum*) cover; degradation in the habitat microtopography; increase in the presence of negative indicators (e.g. algae in pools and hollows); an increase of bare peat; loss of quality indicators and a reduction in water table levels. Although, the extent of central ecotope may remain unchanged in some cases, adverse changes in some of the above attributes would indicate deterioration in habitat structure.

#### 5.1.1. Conservation Status of Habitat Structures and Functions

Fernandez *et al*. (2005) assessed the conservation status of the habitat Structures and Functions at 15.92% of the national resource of *intact* raised bog. The bogs surveyed represent 36.80% of the extent of raised bogs designated. This assessment is considered to reflect the status of the habitat within designated sites. Some sort of protection is expected from the designation of the sites and thus worse scenario is likely to occur in those raised bogs not designated. Therefore, the habitat conservation status as regards Structures and Functions is deemed to be **B-Unfavourable Inadequate** at national level.

### 5.2. Typical Species

Raised bogs typically contain only a small suite of vascular plant and none occurs exclusively on raised bogs. Active Raised Bog habitat is particularly characterised by the presence of mosses of the *Sphagnum* genus, which are essential for the formation of peat. The abundance and composition of *Sphagnum* species define a bog as *Active* peat forming or *Non-Active* (i.e. Degraded Raised Bog (7120)). Degraded Raised Bog habitat occurs on those raised bogs where there has been disruption of the natural hydrology of the peat body, leading to desiccation and/or species change or loss. The typical species of Degraded Raised

Bog are similar to those of Active Raised Bog, but the relatively abundance of individual species is different. Indeed the dominance of a single species (e.g. heather) is likely to indicate problems on the surface of the mire. In addition hydrological changes lead to changes in microtopography, thus hummocks and pools become less dominant and absent in very Degraded Raised Bog (i.e. marginal ecotope). It should be remembered that sub-marginal ecotope, which is good quality Degraded Raised Bog, forms the transition between Degraded and Active Raised Bog habitats.

According to the 2003 version of the Interpretation Manual the characteristic plant communities and species of Active Raised Bog Habitat (7110) are as follows:

Erico - Sphagnetalia magellanici - Andromeda polifolia*, Carex pauciflora, Cladonia* spp., *Drosera rotundifolia, Eriophorum vaginatum, Odontoschisma sphagni, Sphagnum magellanicum, S. imbricatum, S. fuscum, Vaccinium oxycoccos;* in the Boreal region also *Betula nana*, *Chamaedaphne calyculata, Calluna vulgaris, Ledum palustre* and *Sphagnum angustifolium.* Scheuchzerietalia palustris *p*., Utricularietalia intermedio-minoris *p*., Caricetalia fuscae *p*.- *Carex fusca, C. limosa, Drosera anglica, D. intermedia, Eriophorum gracile, Rhynchospora alba, R. fusca, Scheuchzeria palustris, Utricularia intermedia, U. minor, U. ochroleuca*; in the Boreal region also *Sphagnum balticum* and *S. majus*.

The vegetation of a hydrologically *intact* Irish raised bog is characterised by the dominance of Sphagna and dwarf ericoid shrubs. The most abundant *Sphagnum* species are *Sphagnum capillifolium, S. imbricatum* and *S. papillosum* forming hummocks or low ridges. *S. fuscum* and *Leucobryum glaucum* also form hummocks, although they are much less abundant than the other Sphagna. *Calluna vulgaris, Erica tetralix* and the sedge *Trichophorum cespitosum* are the most abundant angiosperms and are most vigorous in the association Erico-Sphagnetum magellanici (White & Doyle, 1982) in which *Andromeda polifolia* and *Drosera rotundifolia* also occur with high constancy but low cover value. Lichens: *Cladonia ciliata* and *C. portentosa* may be co-dominant with Sphagna if the bog was un-burnt.

On the flats *Sphagnum magellanicum, S. subnitens* and *Narthecium ossifragum* are abundant, sometimes with *Aulacomnium palustre,* although these last two species appear to prefer areas where there is slight flushing. The permanent waterlogged hollows are dominated by *Sphagnum cuspidatum* and *Rhynchospora alba* with *Drosera anglica, Eriophorum angustifolium* and *Menyanthes trifoliata* commonly present (White & Doyle, 1982). Areas of nutrient enrichment (e.g. flushes) may contain *Betula pubescens*.

In the particular case of Degraded Raised Bog, the microtopography of highest quality ecotope's (i.e. sub-marginal ecotope) is characterised by flats/lawns and hummocks. Hollows dominated by algae, *Rhynchospora alba* and *Narthecium ossifragum* are also found. *Sphagnum cuspidatum* becomes rare and *Eriophorum vaginatum*, *Trichophorum cespitosum, Calluna vulgaris* and *Narthecium ossifragum* occurrence increases, becoming dominant in the most degraded sections of the habitat (i.e. marginal ecotope).

**Ecological variations**

Same ecological variation for Active Raised Bog applies to Degraded Raised Bog.

**Western sub-type** is typified by the presence of the moss *Campylopus atrovirens* and the liverwort *Pleurozia purpurea* (both also characteristic species of lowland blanket bog) and the abundance of *Carex panicea* (Cross, 1990). *Pedicularis sylvatica* that is a differential species for Atlantic blanket bog (White and Doyle, 1982) is also found at western raised bogs. Schouten, M. (*pers. comm.*) based on his work on Irish raised bogs, stated that *Racomitrium lanuginosum* is also an important western indicator species. This species is also said to have a northern distribution (Smith, 1993).

**True Midland sub-type** is characterised by the abundance of *Andromeda polifolia* and *Vaccinium oxycoccus*. Moore (1972) states that *Sphagnum magellanicum* is much rarer on the western low-level blanket bogs and is frequent on true midland raised bogs.

The following are the species indicators used as part of the *Raised Bog Monitoring Project* (Fernandez *et al*., 2005):

- Hummock indicators: *Sphagnum fuscum* and *S. imbricatum*.
- Pool indicators: *S. cuspidatum* and *S. auriculatum.*

- *Cladonia portentosa* is abundant on un-burnt vegetation.

Moreover, a series of disturbance indicators were used to assess habitat quality (structure and functions) as part of this project.

- Abundant *Narthecium ossifragum* indicates drying out and/or burning.
- *Trichophorum caespitosum* and *E. vaginatum* become tussocky during drying out processes.
- *Sphagnum magellanicum* indicates drying out processes when it becomes abundant in pools previously dominated by *Sphagnum* species typical of very wet conditions (e.g. *S. cuspidatum*).
- *Cladonia floerkeana* indicates burning.
- *Carex panicea* occurs in True - Midlands raised bogs where there has been frequent burning.

**Table 3.1 List of typical species of Active and Degraded Raised Bog habitats in Ireland**

| Species | Characteristic species in the Habitats Directive Interpretation Manual (2003) | Characteristic species on Raised Bog (White & Doyle, 1982) | Good quality indicators used by Fernandez *et al*. (2005) | Typical Active Raised Bog habitat species list |
|---|---|---|---|---|
| *Andromeda polifolia* | Yes | Yes | - | Yes |
| *Aulacomnium palustre* | No | Yes | - | Yes |
| *Calluna vulgaris* | Yes | Yes | - | Yes |
| *Cladonia spp (C. ciliata and C. portentosa)* | Yes | Yes | Un-burnt | Yes |
| *Drosera anglica* | Yes | No | - | Yes |
| *D. intermedia* | Yes | No | - | Yes |
| *D. rotundifolia* | Yes | Yes | - | Yes |
| *E. angustifolium* | No | Yes | - | Yes |
| *Erica tetralix* | No | Yes | - | Yes |
| *Eriophorum vaginatum* | Yes | Yes | - | Yes |
| *Leucobryum glaucum* | No | Yes | - | Yes |
| *Menyanthes trifoliata* | No | Yes | - | Yes |
| *Narthecium ossifragum* | No | Yes | - | Yes |
| *Rhynchospora fusca* | Yes | No | - | Yes |
| *R. alba* | Yes | Yes | - | Yes |
| *S. auriculatum* | No | No | Pools | Yes |
| *S. cuspidatum* | No | Yes | Pools | Yes |
| *S. fuscum* | Yes | Yes | Hummocks | Yes |
| *S. imbricatum* | Yes | Yes | Hummocks | Yes |
| *S. magellanicum* | Yes | Yes | - | Yes |
| *S. papillosum* | No | Yes | - | Yes |
| *S. pulchrum* | No | No | - | Yes |
| *S. subnitens* | No | Yes | - | Yes |
| *Sphagnum capillifolium* | No | Yes | - | Yes |
| *Trichophorum cespitosum* | No | Yes | - | Yes |
| *Utricularia minor* | Yes | No | - | Yes |
| *Vaccinium oxycoccos* | Yes | No | - | Yes |

Table 3.1 list typical species for Active and Degraded Raised Bog habitats in the Republic of Ireland. The final list include species that are characteristic of the habitat extended with those species used as good

habitat quality indicators. An over representation of a single species does always indicate good habitat quality (e.g. *Calluna vulgaris*).

This list is slightly different from that in the Interpretation Manual of the Habitats Directive. The following plant communities and species are included in the Interpretation Manual as characteristic of the habitat but do not occur on Irish sites: *Scheuchzerietalia palustris, Carex pauciflora, C. fusca,* and *Scheuchzeria palustris.*

All these species listed are mainly found on the high bog of a typical raised bog. Other species commonly found on the lagg zone, soaks, flushes and rand zone (generally dry and supporting Degraded Raised Bog) are not listed.

### 5.2.1. Conservation Status of Habitat Typical Species

The recording of all typical species on Fernandez *et al*. (2005) survey was not systematic and only some of the species listed in table 3.1 were used as indicators in variation of habitat quality (*Sphagnum fuscum, S. imbricatum*, *S. cuspidatum, S. auriculatum* and *Cladonia portentosa*). Nonetheless, the assessment of the habitat quality (i.e. Structure and Functions) which was partially based on changes in ecotope extent (i.e. marginal for Degraded Raised Bog) can be used to assess the conservation status of Typical Species. The definition of an ecotope is based on the presence and dominance of certain Typical Species, with particular emphasis on *Sphagnum* species. Thus, a decline in habitat quality also indicates a decline in the presence of Typical Species. Fernandez *et al.* (2005) calculated an Unfavourable Inadequate conservation status for Degraded Raised Bog based on changes in quality. In the particular case of this habitat, the overall increase in the extent of marginal ecotope is indicated by the increase in the presence of *Narthecium ossifragum-Rhynchospora alba* hollows, *Trichophorum cespitosum* tussocks and *Carex panicea* and *Narthecium ossifragum* flats. As well as higher density of ericoids (e.g. *Calluna vulgaris, Erica tetralix)* that become more robust.

As quality and typical species are so interdependent, it can be suggested that an **Unfavourable Inadequate** conservation status can also be inferred for Typical Species.

## 6. Impacts and Threats

Fernandez *et al*. (2005) assessed the intensity and influence of impacting activities at 48 raised bogs. An individual assessment of impacts was carried out for each habitat present on this selection of raised bogs. Peat cutting, drainage and burning were the most impacting activities affecting the conservation status of these bogs. These activities were found to seriously disrupt the high bog hydrology, leading to desiccation of the bog and loss of the characteristic micro-topographical features and eventually flora and fauna (Schouten 2002). This project found that except in a few cases drainage and burning are always related to the occurrence of turf cutting.

### 6.1. Turf cutting

Turf cutting, which in the past mainly consisted of hand cutting, became mechanised in the 1980's and was stimulated by the introduction of the Turf Development Act in 1981. As recognised by Feehan & O'Donovan (1996) the mechanisation of peat extraction by private producers allowed the exploitation of small bogs by small commercial companies and co-operatives. They also noted that this was accompanied by intensive drainage of the high bog, which was practically non-existent on the smaller bogs up to 1981. Therefore, in the last three decades, medium and small size bogs have been increasingly severely impacted by mechanised turf cutting. In the view of the IPCC (2005), the widespread use of machinery has in recent years greatly accelerated the process of decline in peatland resource, particularly Lowland Raised Bogs. They consider that more peat is being harvested over a wider area of bog and on a semi-commercial basis since the decline of hand cutting. This has in many cases altered the scale of cutting from the traditional domestic small scale level to much more intensive semi-industrial scale extraction.

127 sites are designated for the conservation of 139 raised bogs in the Republic of Ireland, 74 as NHAs and 53 as SACs. In 2005, 117 of these bogs were still being cut for turf.

Following the publication of the list of SAC raised bog sites in 1997, there was prolonged and strenuous objection from turf cutters. The objectors were especially concerned about loss of property rights, loss of future fuel supplies and loss of a way of life in the summer months. The then Minister, Síle de Valera T.D., addressed the objections of bog owners by allowing them cut for domestic use for 10 years, up to and including 2008, at which stage all cutting would have to cease. When the NHAs were designated in 2004, a similar 10-year derogation was put in place, allowing cutting until 2014.

In a report commissioned by NPWS, Fernandez *et al.* (2006) examined the impact of turf cutting on these bogs. The main objectives of their work were to assess the impacts of turf cutting and to develop appropriate responses to such impacts. They noted that 2,660 turf cutting plots were cut in 2003 on these bogs.

The report offered a variety of options for cessation of turf cutting on the designated bogs, ranging from immediate and complete cessation (recommended) to phased cessation based on potential impact of cutting and related activities on sensitive areas (in particular Active Raised Bog and Bog Woodland habitats) and the status of the bog under designation. However NPWS believe that cessation of cutting in parts of bogs is not feasible or manageable and that the end of cutting in 2008 in SACs as required by Minister de Valera is the best option and this stage. Further restorative works will be required on many bogs.

Fernandez *et al.* (2006) also estimated that 20,000 turbary rights exist on all designated sites but that only a small proportion of those are currently active.

Although peat cutting recorded by Fernandez *et al.* (2006) is mainly for domestic purposes, peat cutting for semi-commercial purposes also occurred at a number of designated sites. Mechanical peat extraction, generally by Hopper machinery, for fuel purposes was the most common technique on the sites surveyed. This method of peat cutting also involved the insertion of drains of various width and depth generally perpendicular to the face-bank. Occasionally, high bog drains were also inserted close to the face-bank. Fernandez *et al.* (2005) noted that the common trend has been a reduction in the length of margin actively cut and a decline in number of cutters in the 1994/95-2004/05 reporting period. However, this trend has been accompanied by intensification in the amount of peat extracted as result of the mechanisation of cutting. This has involved an increase of the negative effects associated with this activity. This project estimated that the overall loss of high bog to peat cutting in the ten year reporting period was 1%.

### Turf Cutting Trend

Thus, unless a more restrictive approach (i.e. mandatory cessation of cutting coupled by compensation packages) is taken, turf cutting is likely to continue at current levels or even increase with increasing fuel prices.

## 6.2. Drainage

Drainage is intended to dry out the high bog surface and is generally used to facilitate the cutting of turf. It is found either on the high bog and/or the cutover area (Fernandez *et al.*, 2005).

The *Raised Bog Monitoring Project* (2005) recorded drainage on the high bog on 46 of the 48 raised bogs surveyed. The activity was considered to have high negative influence on high bog habitats (including Degraded Raised Bog) at 21 raised bogs and in several cases was considered to be the main reason for the decline in Active Raised Bog extent. Furthermore, 7 of the 10 raised bogs where Degraded Raised Bog habitat was assessed as Unfavourable Bad have high bog drainage deemed to have high negative influence on high bog habitats. Cutover drainage was deemed to have a high negative influence on the high bog at 29 out of 48 raised bogs. Most of these bogs also had extensive peat cutting, which generally correlates with cutover drainage maintenance. According to observations made by this survey, high bog drainage is rarely maintained and in-filling processes are frequent in many sites. However, natural blocking of drains is a very slow process and active blocking of drains is required to counteract the negative effects of this activity.

Arterial drainage directed at improving agriculture land and providing for improve bog drainage was also considered a serious threat to the hydrological status of the high bog and therefore the Active Raised Bog habitat.

The blocking of drains is considered essential for the recovery of the habitat, as highlighted by Fernandez *et al*. (2005).

### Drainage Trend

Although according to the findings of Fernandez *et al*. (2005) the insertion of new high bog drains on designated raised bogs is unusual. However, previous drains continues to have a serious impact on the raised bog habitats within designated sites. Data are not available for un-designated sites.

## 6.3. Burning

According to the finding of the *Raised Bog Monitoring Project* (2005), burning is a frequent activity occurring on raised bogs. It has occurred at 24 of the 48 raised bogs surveyed in the ten years reporting period. This activity is mainly associated with peat extraction and thus is more frequent in those sites with high intensity of cutting where the bog surface is burnt to facilitate marginal cutting.

Although the damage to high bog vegetation depends on the intensity and frequency of burning, it generally decreases the *Sphagnum* cover and thus the capacity to generate new peat. Burning was considered to have high negative influence at 8 raised bogs. Furthermore, burning was one of the main factors for the decline in Active Raised Bog habitat at 5 raised bogs surveyed by Fernandez *et al*. (2005). Degraded Raised Bog would have also been severely damaged at these bogs.

### Burning Trend

No previous records are available, however the 2005 project shows that this activity frequently occurs on raised bogs and its occurrence is mainly related to peat cutting. Thus any increase in peat cutting is likely to lead to an increase in fire events.

## 6.4. Afforestation

Forestry, which mainly consists of coniferous plantations, is found either on the high bog or on the cutover area adjacent to the high bog. Surface drainage is always associated with forestry plantations and has similar negative effects to that carried out to facilitate peat cutting. However, other impacts such as shading of vegetation and compression of the peat caused by heavy machinery are related to afforestation. Fernandez *et al*. (2005) recorded forestry on the high bog at 10 raised bogs and it was deemed to have high negative influence at 6 bogs. 31 of 48 raised bogs surveyed had cutover coniferous plantations adjacent to the high bog and these were considered to have high negative influence at 4 of these bogs.

Table 6.1 below illustrates the overall extent of coniferous plantations on raised bog in the Republic of Ireland. 4.36% (2,179ha) of the high bog has been afforested. A total of 8,040ha of *Secondary degraded raised bog* have been planted with conifers. This corresponds to areas of very degraded raised bog (i.e. highly drained, devoid of vegetation, cutover and cutaway) and subsequently planted. However, the actual extent of coniferous plantation on cutover raised bog is likely to be higher. These data has been obtained by intersecting Forest Inventory and Planning System (FIPS) 1998 maps with raised bog maps produced as part of this project. Coniferous plantations encompass three class categories within FIPS maps (i.e. Conifers forestry, Cleared and Planting Grant applications). The year 2000 aerial images confirm the presence of coniferous plantations within these categories. Egan (1998) mentioned that in 1987, Coillte initiated a major afforestation programme on cutaway bogland and up to 1998 over 4,000ha were planted.

**Table 6.1 Coniferous plantations on raised bog**

| | Extent (ha) | Coniferous plantations (ha) | % of planted high bog |
|---|---|---|---|
| *S*urveyed high bog (Active and Degraded Raised Bog habitat) | 18,423 | 682 | 3.70 |
| Un-mapped high bog (Presence of Active Raised Bog habitat unknown) | 31,588 | 1,497 | 4.74 |
| **Subtotal** | 50,011 | 2,179 | 4.36 |
| *Secondary degraded raised bog* | 157,787 | 8,040 | 5.1 |
| **Total** | 207,909 | 10,219 | 4.92 |

## Afforestation Trend

Grant aid for private forestry, which is administered by the Forest Service of the Department of Agriculture and Food, is now effectively withheld from designated peatlands. All grant-aided development in Ireland must also conform to the Forest Service Forest biodiversity guidelines, which set out measures to protect existing habitats and wildlife and to maximise the biodiversity of forest.

Coillte Teoranta, one of the major owners of peatland in the country, has ceased planting conifers on intact peatlands on its ownership, principally on economic grounds. It has also made strong commitments to the implementation of the Helsinki Process on Sustainable Forest Management and as part of their Nature Conservation Program. Coillte has initiated a *Raised Bog Restoration Project* that will result in the felling of coniferous plantations and drain blocking on some of their raised bogs.

The threat to raised bog from afforestation is therefore appears to be declining particularly on designated raised bogs. The current trend for un-designated sites is unknown.

### 6.5. Invasive Species

Although Fernandez *et al*. (2005) survey found invasive species at 35 of 48 raised bogs, they were not considered a major threat to raised bog habitats in general but can be important on specific sites. The most common invasive species are *Pinus contorta*, *Rhododendron ponticum* and *Sarracenia purpurea. Pinus sy*lvestris was deemed invasive when it was found encroaching on the high bog. In this case, its origin is mostly adjacent coniferous plantations and the spreading of pines is likely to indicate drying out of the high bog.

## Invasive Species Trend

Although the overall trend is likely to be an increase in invasive species in part as a result of the ongoing drying out process and the spreading of pines from adjacent plantations. Their impact is considered small compare to peat cutting, drainage and burning.

### 6.6. Site Inspection Form results

Regional NPWS Management is responsible for patrolling designated sites and enforcing relevant legislation (e.g. Habitats Directive 92/43 EEC or the Wildlife Act). NPWS Conservation Rangers are required to summarise information collected on the integrity of sites within their areas during the course of their duties. They are given the responsibility for reporting the information required under the Site Inspection Reporting (SIR) programme. Reporting is carried out on a three yearly cycle that began in 1998.

The Research Branch Monitoring Section (NPWS) developed the SIR programme to be used as a monitoring tool. Local NPWS staff log the following info: activities occurring on the site and their effects on the site's integrity, follow-up actions including all outcomes such as prosecutions, notifiable actions and positive management undertaken and site patrolling frequency and purpose.

The results given by the SIR reporting programme confirm that mechanical removing of peat, drainage, burning and invasion by species are the most frequently reported activities negatively affecting the habitat. However, a series of other negatively impacting activities were also reported with various degrees of intensity. These activities are:

| Activity | Code |
|---|---|
| ▪ Cultivation | 100 |
| ▪ Fertilisation | 120 |
| ▪ Overgrazing by cattle | 143 |
| ▪ Removal of scrub | 152 |
| ▪ Disposal of household waste | 421 |
| ▪ Energy transport | 510 |

The following activities were noted as impacting Active Raised Bog habitat and are also likely to have some negative effects on Degraded Raised Bog.

| | |
|---|---|
| ▪ Stock feeding | 171 |
| ▪ Taking/Removal of flora, general | 250 |
| ▪ Quarries | 301 |
| ▪ Pipe lines | 512 |
| ▪ Other pollution or human impacts/activities | 790 |
| ▪ Landfill, land reclamation and general drying out | 800 |

Although some of these activities were reported as affecting raised bog habitats, their actual impact and threat to the habitat is much smaller than that arising from the previously reported activities.

### 6.7. Other Impacting Activities

Impacting activities such as grazing, dumping, fertilisation, restructuring agricultural land, communication routes, cultivation, mowing/cutting, modification of inland water structures, sand and gravel extraction were reported within and around high bog at some of the raised bogs surveyed as part of the *Raised Bog Monitoring Project* (2005). These activity impacts were not assessed as part of the project and they were considered to have a minor influence on the high bog habitats compared to peat cutting, drainage, burning and forestry.

## 7. Future Prospects

### 7.1. Negative Future Prospects

Fernandez *et al*. (2005) project results indicates that the habitat Future Prospects at 30 of the 48 raised bogs surveyed were Poor and thus the long-term viability of the habitat is not assured. This generally indicates that impacting activities, particularly peat cutting still occurs at the raised bog and directly diminishes the extent of Degraded Raised Bog by cutting away high bog. A most dramatic scenario occurs at other 5 raised bogs where Future Prospects were deemed Bad and the habitat is severely threatened. Extensive peat cutting with high peat extraction rate indicates this trend within these 5 bogs. The habitat Future Prospects were considered good only at 13 raised bogs. This generally illustrates the absence of impacting activities and enhancements in habitat extent and quality as a result of restoration works.

As summarised in section 6.1, Fernandez *et al*. (2006) reported the occurrence of turf cutting at 84.2% of the raised bogs designated. He also mentions that the occurrence of drainage, burning and turf cutting is highly interrelated. Thus similar scenario as the one reported for the 48 raised bogs surveyed by Fernandez *et al*. (2005) is likely to occur in the remaining designated sites as regards habitat Future Prospects.

Climate change predictions of increases in temperatures accompanied by a decrease in summer rainfall would increase the summer moisture deficit of peatlands and potentially prevent peat formation. Therefore, resulting in reduction in habitat capability to develop Active Raised Bog habitat.

Habitat Future Prospects are likely to be even more negative outside a designation as certain degree of protection is expected from the designation of the site.

### 7.2. Positive Future Prospects

Only a few examples of restoration works have been undertaken on Irish raised bogs. NPWS commenced a *Raised Bog Restoration Project* in 1994, which ran up to the end of 1999 and included 10 sites. This project was assisted by the EU Cohesion Fund (Ryan and Streefkerk, 1998). Objectives of the project were the restoration of the bogs hydrology, acquisition of raised bog land, survey of high bog and lagg systems and establishment of a monitoring program. These restoration works consisted of the blocking of drains, mainly on the high bog, and the construction of dams. NPWS again carried out restoration works (i.e. blocking of drains) on three new sites in 2003 and one in 2006. The results of these restoration works are considered positive overall. Enhancement in Degraded Raised Bog habitat quality was noted and there is some expansion and new Active Raised Bog habitat formation occurring in many of the sites restored (Fernandez *et al.,* 2005).

Coillte Teoranta initiated a *Raised Bog Restoration Project* in 2004. This was funded by an EU Life - Nature Programme. This project will be completed in 2008 and forms part of Coillte's Nature Conservation Programme. The project will work towards restoring 571.2 hectares of raised bog habitat on its property in the midland counties. This project area will be managed with nature conservation as the primary management objective into the future. The project also involves the felling of 450ha of plantation forest, felling of naturally regenerated exotic trees on open bog, perimeter protection of vulnerable raised bog sites against fire, blocking of drains after felling and ongoing monitoring of vegetation and water levels on 14 sites (Coillte, 2005 - www.raisedbogrestoration.ie).

NPWS have operated two turf cutting cessation schemes since 1999 to buy out turbary rights in NHAs and SACs. Fernandez *et al*. (2006) considered that the schemes were relatively successful in dealing with obvious commercial activity (i.e. moss peat developments), but were less successful in dealing with small scale, semi-commercial to commercial fuel peat operations and had almost negligible impact on domestic cutting. They did not appear to have significantly reduced the numbers of cutters and thus the negative effects of cutting on raised bog priority habitats

### 7.3. Overall Habitat Future Prospects

Although certain positive management actions have been taken in recent year (raised bog restoration projects, Turf Cutting cessation schemes, land purchase and surveillance programs (e.g. SIR program)), these actions seem to have affected only a small portion of the habitat resource. A long-term programme of targeted restoration is needed.

Negative actions such as turf cutting, drainage and burning continue impacting the habitat: increasing its extent at the expense of Active Raised Bog habitat and degrading its structure and functions. The extent of the habitat in non-designated sites is unknown and similar impacting activities are likely to be present on these sites.

To summarise the habitat long-term viability is not assured and there are poor prospects for its future. The Future Prospects are deemed to be **Unfavourable Inadequate**.

## 8. Overall assessment of the habitat conservation status

The habitat conservation status has been assessed as Unfavourable Inadequate at two of the four main attributes at national level.

- The habitat range favourable reference value is considered to be similar to the habitat's current range and thus a Favourable assessment is given.
- The extent of Degraded Raised Bog habitat has increased by 8% in a ten year reporting period (1994-2005) within 15.92% of the national resource of raised bog known to support the habitat. This increase occurred at the expense of Active Raised Bog habitat. On the other hand, 1% of high bog within this

15.92% of national resource of raised bog were irreversibly lost to peat cutting. As both Active and Degraded Raised Bog habitats should be assessed independently the Degraded Raised Bog habitat extent is assessed as Favourable.

- An Unfavourable Inadequate assessment is given to the habitat structures and functions as the increase in marginal ecotope indicates. This decrease is illustrated by reduction in *Sphagnum* species cover, degradation the habitat microtopography and increase in the presence of negative indicators. This has been coupled by a decline in typical species, particularly good quality indicators (*Sphagnum fuscum, S. imbricatum*, *S. cuspidatum, S. auriculatum* and *Cladonia portentosa*).
- The habitat's Future Prospects are overall deemed to be Unfavourable Inadequate. Ongoing deterioration of the hydrological conditions of raised bogs at current rates caused by peat cutting, drainage, forestry and burning moderately threatens the viability of the habitat. In addition the peat cutting directly diminish the extent of the habitat. Major positive management actions: land and turbary purchase and restoration works are required.

Thus, considering the above assessment for the four main habitat's attributes the overall conservation status for Degraded Raised Bog habitat is **Unfavourable Inadequate**.

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# APPENDICES

# APPENDIX I

## HABITAT CONSERVATION STATUS ASSESSMENT PROJECT

The National Parks and Wildlife Service (NPWS) carried out a *Raised Bog Monitoring Project* (Fernandez *et al*., 2005) in the period 2004-05 with the aim of assessing the conservation status of a selection of raised bog habitats: Active Raised Bog (7110), Degraded Raised Bog still capable of regeneration (7120), Bog Woodland (91DO) and Depressions on peat substrates of the Rhynchosporion (7150).

A suite of 48 raised bogs, with an overall high bog extent of 7,961ha, was surveyed and an individual habitat conservation status assessment was produced for each raised bog. The extent of these selected raised bogs represents 43.21% of the overall extent of high bog within designated sites where a comprehensive ecological survey has been carried out (18,423ha). They account for 15.92% of the national resource of relatively *intact* high bog (50,011ha) and support 51.27% of the current national resource of Active Raised Bog habitat (1,945.18ha).

These 48 raised bogs were considered to be representative of the selected habitats' natural variation and range. Thus, the raised bog ecological - geographical variation was taken into account (i.e. Western raised and True Midland variant).

The assessment was done by comparing habitat attributes between a baseline survey (Kelly *et al*. 1995) with current values obtained by Fernandez *et al*. (2005).

These attributes are 1) Habitat extent, 2) Habitat quality and 3) Future prospects. Habitat range was also used as an attribute to assess habitat conservation status at national level but not at site level.

Habitat extent was calculated using changes in values within the reporting period (1994/5-2004/5).

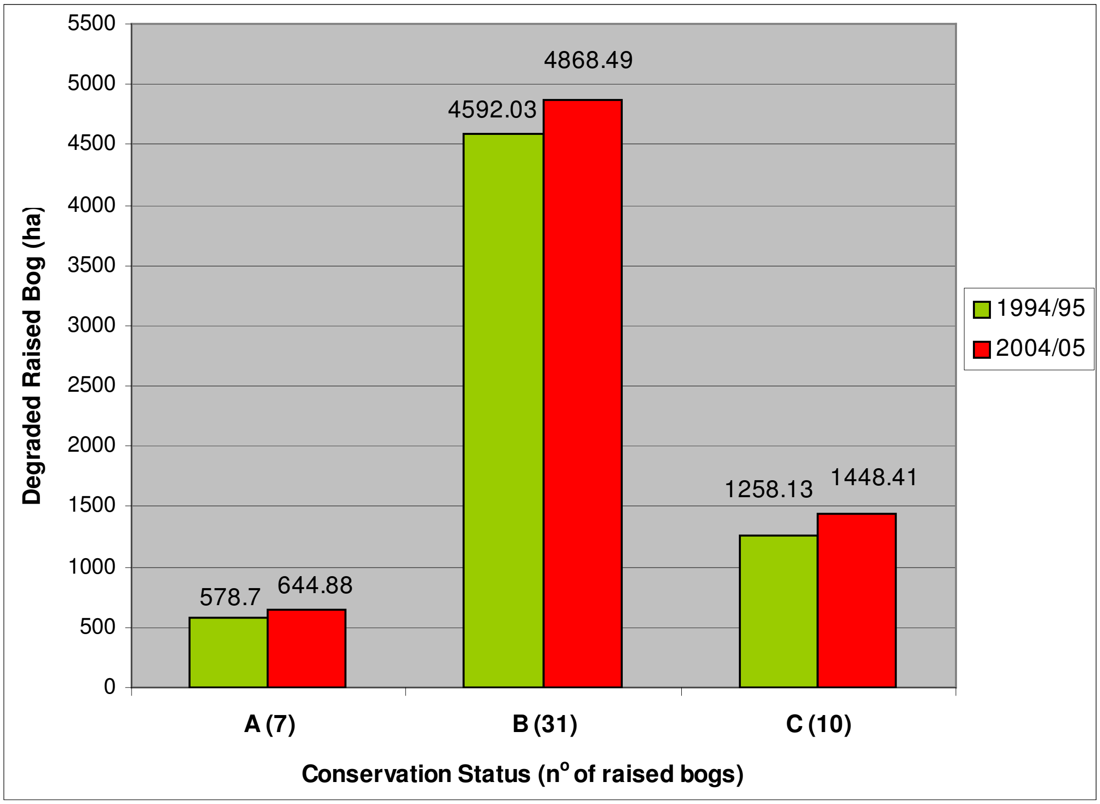
Habitat quality was assessed at two different levels:

a) Habitat functions and b) Habitat structures. Variations in ecotopes extent were considered indicative of changes in the habitat functions, as each ecotope indicates a different level of quality. Therefore the main target would be to increase the extent of good quality ecotopes. A series of attributes (e.g. quality indicators, *Sphagnum* cover, surface features, etc) were selected to ascertain changes in habitat structures. Changes in habitat structures may occur within an ecotope while the ecotope extent would remain unchanged during the reporting period.

Future Prospects for habitats present on a site were assessed by identifying impacting activities and them quantifying their intensity and influence. Examples of the most impacting activities on the habitats are turf cutting, drainage and burning.

The project results indicate that the conservation status of Active Raised Bog was A - Favourable at 7 raised bogs, B - Unfavourable Inadequate at 31 raised bogs and C - Unfavourable Bad at 10 raised bogs out of 48 raised bogs surveyed. Habitat extent increased and thus was deemed Favourable. However, this occurred at the expense of Active Raised Bog habitat. The overall habitat quality (Structure and Functions) has been assessed as Unfavourable Inadequate. The Future Prospects assessment (i.e. 30 raised bogs with Poor Future Prospects and 5 with Bad Future Prospects) overrides the favourable condition of the habitat extent and thus the overall habitat conservation status is considered **B - Unfavourable Inadequate**.

**Figure I.1 Results of Raised Bog Monitoring Project (2005)**




As figure I.1 illustrates 10 raised bogs fall into the C (Unfavourable Bad) conservation status assessment category. They represent 19.80% (1,576.25ha) of the total extent of the raised bogs surveyed as part of the *Raised Bog Monitoring Project* (2005) and there has been an increase in Degraded Raised Bog from 1,258.13ha in 1994/95 to 1,448.41ha in 2004/05. Degraded Raised Bog habitat has been assessed as B (Unfavourable Inadequate) at 31 raised bogs (68.93% - 5,487.53ha of raised bog extent surveyed). The habitat extent has increased from 4,592.03ha to 4,868.49ha within these bogs. Seven bogs fall into the A (Favourable) assessment and account for 11.27% of the raised bog extent surveyed. The extent of Degraded Raised Bog habitat within these bogs has increased from 578.7ha to 644.88ha.

**Note**

Active and Degraded Raised Bog pose an unusual conservation assessment situation as the latter should progress to an active peat forming state and as a result its extent would decrease. Despite their ecological interconnection Fernandez *et al*. (2005) considered the two habitats as independent as regards habitat conservation status assessment. Thus, an increase in Degraded Raised Bog habitat is assessed as favourable when in actually indicates unfavourable conditions for the high bog and particularly Active Raised Bog habitat.

# APPENDIX II

# SOURCES OF DATA

The following is a summary of the main sources of information employed to produce the habitat's distribution map, to evaluate its current range and extent and to carry out its conservation status assessment:

### A. Raised Bog Restoration Project - Kelly *et al.* (1995)

This project aimed to identify raised bogs that were suitable for declaration as National Reserves. It included a comprehensive ecological and hydrological investigation of a number of selected raised bogs. As a result a comprehensive report was written for each site and a series of maps (i.e. vegetation, drainage, hydrochemistry, slopes and land-use) were prepared. 45 sites were visited during the surveys. Clara (SAC 572) and Raheenmore (SAC 582) bogs were also included in the final assessment based in data collected during the Irish/Dutch Raised Bog study (Schouten. 2002).

The project botanical surveys mapped the vegetation at the community complex level. Each complex was characterised by a series of vegetation communities. These complexes were amalgamated into a series of ecotopes. These maps provided the basis for identifying the boundaries for Active and Degraded Raised Bog habitats.

This project resulted in the designation of 31 SACs.

### B. Raised Bog Restoration Project - A Continuation of the Investigation into the conservation and restoration of selected raised bog sites in Ireland - Derwin and MacGowan. (2000)

This project used the methodology established by Kelly *et al*. (1995) to assess 28 sites not surveyed in 1995 as potential Active or Degraded Raised Bog SACs. The sites assessed were selected from a total of 102 sites which were assessed, using aerial photography for their conservation potential.

As a result 6 sites were proposed as SACs as they comprised Active Raised Bog habitat. Other 17 were also proposed as SACs as they contained Degraded Raised Bog habitats. A further 10 sites were proposed by NPWS. The latter sites were surveyed as part of the 1995 survey but were not included in that original list of proposed SACs. The habitat maps produced by this survey were also used to compile the final habitat distribution map and calculate habitat extent.

### C. Raised Bog Monitoring Project - Fernandez *et al.* (2005)

This project aimed to monitor the conservation status of raised bog habitats included in the Annex I of the Council Directive 92/43/ECC. A total of 48 of designated sites that represent the habitat's range were selected for this purpose based mainly on the original sites investigated by Kelly *et al*. (1995). These sites were resurveyed using similar methods and the vegetation descriptions and maps of Kelly *et al*. (1995) were used as a baseline to identify changes which will occurred in he intervening period. The main outcomes of the project were individual site's habitat and overall habitat conservation status assessments as well as detailed impacts and habitat (i.e. ecotopes) maps.

The habitat maps were used to produce the final habitat distribution map and estimate habitat extent within this project.

### D. Assessment of impacts of turf cutting on designated Raised Bogs 2003-06 Project - Fernandez *et al.* (2006)

This project initiated in 2003 and completed in 2006, assessed the impacts of turf cutting in all designated raised bogs and proposed appropriate responses to such impacts (i.e. prioritising program to phase out this activity). Comprehensive botanical surveys were carried out in those sites not surveyed previously. Turf cutting was described for all those sites where priority habitats (i.e. Active Raised Bog or Bog Woodland) were recorded. A comprehensive turf cutting impact assessment was carried out at 93 bogs where priority habitats are present and cutting was recorded in 2003. Detailed maps of turf cutting plots and sensitive margins were produced.

**E. Corine Land Cover Map (2000)**

Corine Land Cover (CLC) is a map of the European environmental landscape based on interpretation of satellite images. It provides comparable digital maps of land cover for each country for much of Europe. The CLC 2000 project in Ireland forms part of the update of land cover maps for the whole of Europe, which is being co-ordinated by the EEA (European Environmental Agency) with the co-operation of national competent authorities in contributing states. The Environmental Protection Agency (EPA) is the national competent authority for CLC 2000 data in Ireland. The CLC 2000 database was created by first assessing and correcting the existing CLC 1990 land cover database and images for geometric and thematic content, followed by mapping land cover changes using 2000 satellite imagery and ancillary data. The CORINE project provides a coarse quantification of land cover in Ireland (EPA, 2004).

CLC is based on a simple 3-level hierarchy classification system consisting of 44 land cover classes. The land cover inventory was conducted at a scale of 1:100,000 and the minimum area digitised in the updated version, CORINE 2000 is 25 ha. Additional work was undertaken for some habitat on the hierarchical levels 4 & 5 of raised bog and up to level 6 of blanket bog (http://www.epa.ie/OurEnvironment/Land/CorineLandCover).

Raised bog land cover was divided into two subtypes:

a) **Exploited raised bog (Code 41211)** mainly corresponds to cutaway, cutover, reclaimed agriculture land with peat soils (e.g. surrounding either cutaway, cutover or intact raised bog). These areas are mostly deemed Secondary degraded raised bog. Bord na Mona extensive cutover bogs areas have been classified as *Secondary degraded category*. Thse areas of *Secondary degraded* of geographical importance (i.e. isolated sections of raised bog in counties outside the main concentration of raised bog) have been remapped as part of this project with the aids of the year 2000 aerial photographs. These areas occasionally included small areas of reclaimed agriculture land were all the peat may have been removed. These areas would therefore not be considered raised bog.

b) **Intact raised bog (Code 41212)** corresponds to either Degraded Raised Bog habitat (7120) or Active Raised Bog habitat (7110). Occasionally large drained areas of high bog where the raised bog vegetation remains are included in this type. These areas correspond to Degraded Raised Bog habitat (7120). However those areas where the top vegetation layer has been removed and mapped as 41212 by Corine are allocated to *Secondary degraded raised bog* within Exploited raised bog (41211) as part of this project. They generally grade into cutover and reclaimed land with peaty soils.

**CLC map shortcomings**

CLC maps are the most current comprehensive source of information to produce raised bogs distribution and range maps. However, it has certain land cover assignment and class boundary mapping shortcomings that we have try to minimise by processing their data (i.e. reclassifying or adjusting high bog boundaries). The use of 2000 year aerial images where raised bog boundaries are discernible was essential for processing CLC polygons.

- In several occasions CLC 2000 map classed small sections of intact raised bog as other sort of habitat (e.g. land occupied by agriculture with areas of natural vegetation). These areas were re-classed as Degraded Raised Bog habitat as part of this project.
- Raised bog afforested with conifers where frequently mapped as conifers and not as raised bogs. These areas were mapped within this project and classed as Degraded Raised Bog habitat. However this was not systematic within this project and there are still some afforested areas not included in the final habitat map.

- Those raised bog areas mapped by Corine as Exploited raised bog (41211) where the high bog vegetation is *intact* has been promoted to Intact raised bog (41212). The presence of Active Raised bog habitat is unknown here.

Those CLC raised bog areas already mapped more comprehensibly by any of the other sources were eliminated from the final habitat map. Those areas not mapped by any of the other sources were classed as a) *intact* high bog areas or b) *Secondary degraded* areas. *Intact* high bog areas were divided those within or outside designated sites. Furthermore, they were classed as Degraded Raised Bog where the possibilities of finding Active Raised Bog habitat are minute or those where the presence of Active Raised Bog habitat is unknown.

**F. Year 2000 aerial photographs**

The year 2000 orthorectified aerial imagery (Ordnance Survey of Ireland) was used to aid mapping habitat boundaries or in the case of raised bog habitats to confirm the presence of the habitat once it was identified by other sources (e.g. Corine Land Cover maps 2000).

**G. The distribution on a 10k grid of selected habitats in the Republic of Ireland - Conaghan, J. (2000)**

This consisted on a desktop survey of the distribution, on a 10km basis, of 9 nationally important habitats within the Republic of Ireland. The author used a series of sources to determine the presence or absence of the selected habitats.

Conaghan (2000) reported the occurrence of raised bogs in grid squares that were not recorded by any of the other sources (e.g. Corine Land Cover map, NPWS records, etc). In those cases, the use of the year 2000 aerial images have been essential to identify the location of the reported record and digitised the high bog boundary. A total of 8 *intact* raised bog records and 13 records of *Secondary degraded raised bog* were reported exclusively by this source.

**H. Habitat Assignment Project (NPWS 2006)**

This desktop project was undertaken by NPWS and the main aim was identifying and listing habitats listed in the Annex I of the Habitats Directive (92/43/EEC) reported within a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, aerial photographs, NGOs shadow list, etc. A total of 17 records of raised bog were exclusively obtained from this resource.

**I. Digitised Peatland Map of Ireland - Hammond (1979)**

Hammond's *Peatland Map of Ireland* (1979) is the most comprehensive over-view of the distribution of peatlands in Ireland at the end of the 1970s. Hammond mapped the mire subtypes described by Moore (1962).

Hammond's map is based on data from several sources, principally the detailed soil map data from the National Soil Survey carried out by An Foras Talúntais since 1968, these maps covered 10 counties fully and 2 counties partially. Aerial photographs from 1973/74 together with site visits covered the rest of the country. No aerial cover existed however for county Donegal and parts of counties Sligo, Cork, Waterford and Louth. Hammond acknowledges that the these counties were not covered by the same detailed reconnaissance field sheets as the other counties and were mapped principally on the basis of the far cruder 1920 peat map for Ireland. However, these deficiencies seem to apply more to blanket bog than to raised bog and Hammond's map is regarded as the only peatland map which has been methodically produced and which specifically targets peatlands.

Raised bog, was divided into seven subtypes:

1- Raised Bog –Machine Peat

2- Raised Bog – Milled Peat

3- Raised Bog – Moss Peat

4- Raised Bog – Man Modified

5- Raised Bog – True Midland Type

6- Raised Bog – Transitional Type

7- Raised Bog – Potential Industrial Areas

Although Hammond maps categorised mires (i.e. blanket bog, raised bog and fen) according to the level of disturbance (i.e. man modified, milled peat, moss peat) the current status of those sites considered unmodified is likely to have changed since 1979. Hammond's maps are therefore not reliable for identifying the current site status due to the impact of the Turf Development Act (1981-1995) supported projects and private afforestation grant aids. However, Hammond's map is considered to be the most accurate national map available for indicating the location of raised bog peat soils.

The Soils Division of Teagasc has now digitised the original Hammond's *Peatland Map of Ireland* (1979). This was used to refine the habitat distribution map produced from other sources by overlaying the Hammond's digital map on it. This provided further validations for those sites already mapped and most importantly identify raised bog areas in grid squares where they had not been identified by other sources. Only three records of *intact* raised bog not recorded by any of the other sources were given by Hammond's (1979) map. However Hammond's map extremely useful for mapping some areas of *Secondary degraded raised bog* not shown by Corine 2000.

It was found that some raised bog areas reported by Hammond in 1979 are not visible on the aerial images. This is likely to be due either to the complete transformation of the landscape through land reclamation or in some cases to errors in Hammond's maps. These areas were not included in the final map but it is probable that at least some of these areas still contain raised bog peat soils.

## J. NPWS Enquiries Database

This is a comprehensive NPWS internal database, which includes data on habitats and sites designated. This source reported a total of 26 raised bogs within designated sites that were not reported by any of the other sources.

# APPENDIX III

# GLOSSARY

ACTIVE PEAT FORMING - According to the Interpretation Manual of the Habitats Directive, the term active must be taken to mean still supporting a significant area of vegetation that is normally peat forming. Bogs where active peat formation is temporarily at a standstill, such as after a fire or during a natural climatic cycle e.g., a period of drought, are also included.

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

BASIN - A depressed area of the Earth's surface, in which sediments accumulate.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

COMMUNITY COMPLEX – This is the most simple level of vegetation classification described within this survey. A community-complex is made up of a characteristic mosaic of stands of different community types. They are identified by the dominance of one to three plant species; acrotelm (presence and depth); *Sphagnum* cover and the presence of pools. The community complexes are pooled into ecotope types.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CUTAWAY BOG - This term describes areas where peat has been removed systematically by industrial means. Any peat remaining can no longer be considered as economically removable (Irish Peatland Conservation Council).

CUTOVER BOG – An NPWS habitat classification that describes areas of bog which have been previously cut (by hand or by mechanical means), although not down to the underlying mineral soils or bedrock. Remaining peat can still be an economic reserve. Cut-over areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DEHLG - Department of Environment, Heritage and Local Government

DESICCATION - Drying out.

DOMESTIC PURPOSES - Used in relation to the cutting of peat. Peat that is cut for domestic purposes is not for commercial sale and is cut at the rate of one year's supply for a household per year.

DRAINAGE DITCHES - An NPWS habitat classification which refers to water channel systems with moving or stagnant water bodies, artificial in origin. Most ditches are cleared cyclically, although this category also includes ditches that are overgrown with wetland plants.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ECOTOPE - The abiotic environment or habitat of a particular biotic system (Kulcher, 1967; Whittaker et al., 1973). According to work carried out by Kelly (1993) on Clara and Raheenmore raised bogs vegetation can be assigned to five different ecotopes. Sub-central and central ecotopes with Active peat formation (Active Raised Bog habitat) and marginal, sub-marginal and facebank ecotopes with little or no peat formation (Degraded Raised Bog habitat).

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

FENS AND FLUSHES - An NPWS habitat classification. Fens are peatlands fed by calcium rich water, either from groundwater or from inflowing surface water. Flushes are wet areas maintained by the seepage of water down slopes of various gradient, and are usually local features. Both are characterised by an abundance of small sedge forming species-rich mosaics with other species. Orchid species are particularly noticeable in fens and butterworts are more typical of flushes. According to Cross (1990) flushes are areas where nutrient enrichment occurs, usually as a result of more concentrated horizontal water movement. They are particularly common near the bog margin and at the base of low mineral ridges and are characterised by the presence of *Molinia caerulea, Myrica gal*e and often *Sphagnum recurvum.*

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT. - Refers to traditional cutting of peat using a slean or spade.

HIGH BOG – This is the area of bog which have not been previously cut and generally its vegetation is characterised by the presence of ericoid and *Cyperaceae* species and an abundant of *Sphagnum* species.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

INTACT HIGH BOG: refers to uncut high bog still supporting typical high bog vegetation (Active or Degraded Raised Bog). No completely intact raised bog remains in Ireland and all have been damaged to a certain degree by activities such as turf cutting, drainage, burning and afforestation.

LAGG - A term used to describe the transition from bog to mineral soil around a raised bog.

LIMESTONE - Sedimentary rock composed predominantly of calcium carbonate, often containing fossils.

MARGIN WITH LOW SENSITIVITY TO CUTTING (or None sensitive margin) - Section of high bog margin that is within more than 250m of priority habitat (i.e. Active Raised Bog or Bog Woodland).

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MICROTOPOGRAPHY – This is the small scale variation in surface level and the following terms used by Kelly (1993) and Schouten (2002) are used to describe it:

- Pools - Depressions in the bog surface where the water table remains above surface level all year round or below surface level for only very short periods of time. They are characterised by the presence of aquatic plant species such as *Sphagnum cuspidatum* and *Cladopodiella fluitans*.
- Hollows - These are shallow depressions in the bog surface where surface water collects, or where the water table reaches ground level or lies just above ground level, depending on seasonal conditions. Marginal hollows tend to be elongated as they are focus points for surface water run off. They are often dominated by *Narthecium ossifragum*. On the high bog they take many forms but are often eye shaped.

- Lawns - These are shallow hollows or flat areas where one species dominates to form a lawn. This is frequently a *Sphagnum* species, such as *Sphagnum magellanicum*, which can completely fill in a hollow to form a small lawn.
- Flats - These are more or less flat areas which are intermediate between hollow and hummock communities. They tend to be drier than the above situations.
- Hummocks - These are mounds on the bog surface which can range from a few centimetres to more than a metre in height. They are usually composed mainly of *Sphagnum* species, such as *Sphagnum magellanicum, S. capillifolium, S. imbricatum* and *S. fuscum* but other bryophyte species such as *Hypnum jutlandicum* and *Leucobryum glaucum* are also important, especially as the hummock grows taller and becomes drier. *Calluna vulgaris* is another important element, as it flourishes where the water table is not at surface level.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PEAT CUTTING BY HAND. - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

RAISED BOG - An NPWS habitat classification characterised by an elevated dome of peat, the surface of which is isolated from the surrounding ground water table and receiving water solely from precipitation. The peat surface is wet, often with pools and hummock hollow systems and is usually dominated by *Sphagnum* mosses and bushy heather, with Deer-grass, Bog Cottons and other associated species. Raised bogs can be distinguished from blanket bogs by their paucity of grasses which typify blanket bog.

SECONDARY DEGRADED RAISED BOG - This includes highly drained high bog devoid of vegetation (including the majority of Bord na Mona sites), cutaway bog, cutover and occasionally reclaimed agriculture land with peaty soils. Although this sub-type of Degraded raised bog does not correspond with the strict definition of the Habitats Directive Interpretation Manual, re-establishment of vegetation with peat forming capability, it may be possible and may even more feasible to restore to Active bog than in some areas of Degraded bog.

SENSITIVE MARGIN (or Margin with high sensitivity to cutting) - Section of high bog margin that is within 250m of priority habitat (i.e. Active Raised Bog or Bog Woodland).

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

TURBARY – Turbary is the term used to describe the ancient right to cut turf on a particular area of bog. These rights came about with the resettlement of confiscated land or by prescription. Prescription is a legal term meaning that if a person is able to demonstrate that they cut turf without secrecy, without permission and without force continuously for a period of 30 years they have a turbary right. This implies that not all turbary rights will be formally registered.

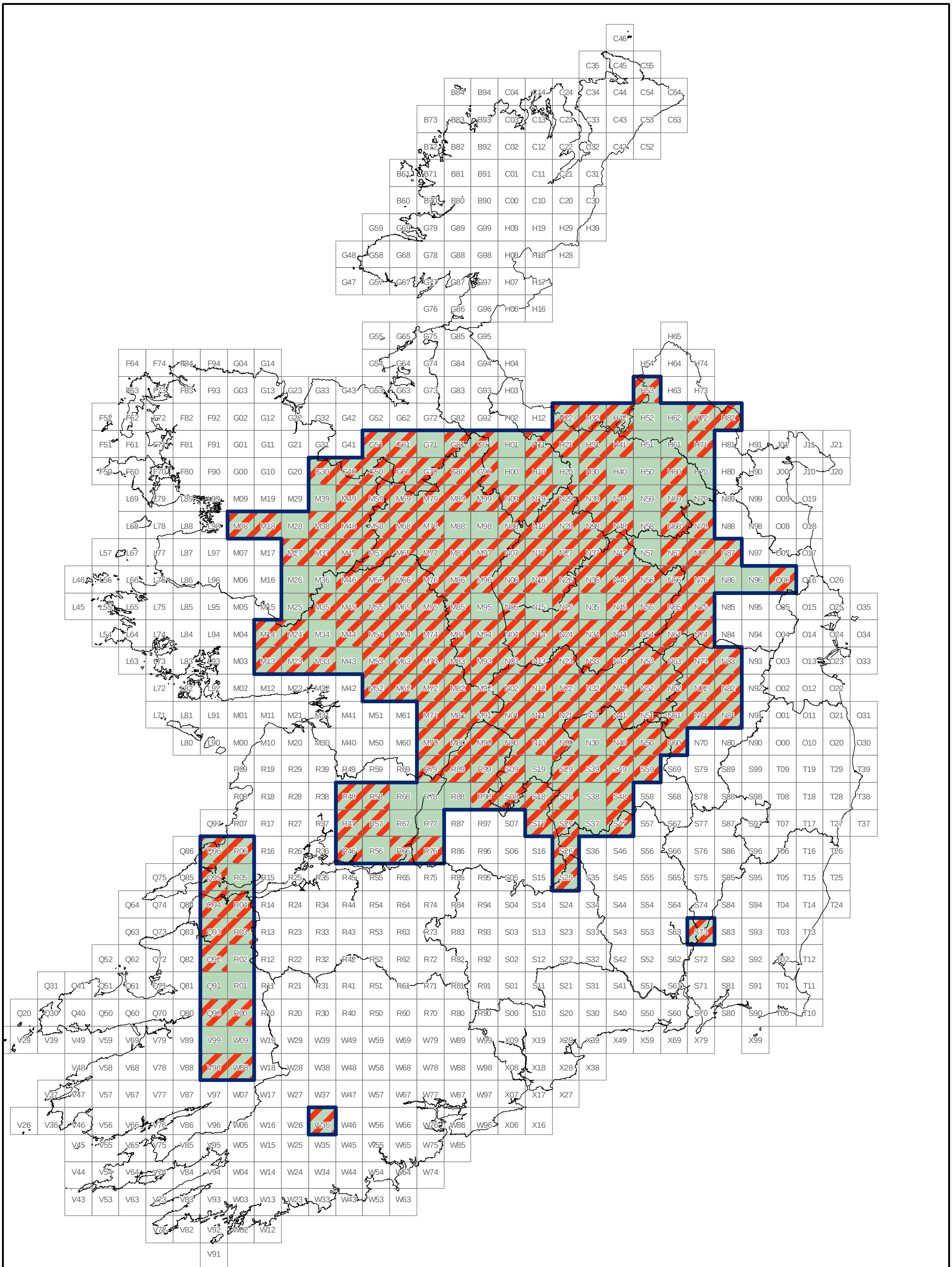
# **7120** Degraded Raised Bog still capable of regeneration

| National Level | |
|---|---|
| **Habitat Code** | 7120 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | ▪ Charles, S. 1996. *The Peat Resource of Ireland*. Global Peat Resource. Eino Lappalainen. International Peat Society.<br>▪ Derwin, J. & MacGowan, F. 2000. *Raised Bog Restoration Project: A Continuation of the Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland.* Unpublished report, Dúchas the Heritage Service, Dublin.<br>▪ Fernandez, F., Fanning, M., Mccorry, M. & Crowley, W. 2005. *Raised Bog Monitoring Project 2004-05*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.<br>▪ Fernandez, F., MacGowan F., Crowley, W., Farrell, M., Croal, Y., Fanning, M. & McKee, A. 2006. *Assessment of impacts of turf cutting on designated Raised Bogs 2003-06*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage Local Government, Dublin.<br>▪ Hammond, R.F. 1979. The Peatlands of Ireland. Soil and Survey Bulletin. No. 35. An Foras Taluntais (Teagasc), Dublin.<br>▪ Hammond, R.F. 1984. *The Classification of Irish peats as surveyed by the National Soil Survey of Ireland*. 7th International Peat Congress, Dublin.<br>▪ Kelly, L., Doak, M. & Dromey, M. 1995. *Raised Bog Restoration Project: An Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland.* Unpublished report, National Parks & Wildlife Service, Department of Arts, Heritage, Gaeltacht and the Islands, Dublin. |
| **Range** | Concentrated in the lowlands of central and mid-west Ireland with disjunct areas occurring in the south-west. Two isolated records are found in counties Carlow and Cork. |
| Surface area | 20,100km² (201 grid cells x 100km²) or 24,600km² (area of the polygon derived from the grid cells) |
| Date | 09/2006 |
| Quality of data | 3 = good (based on extensive surveys) |
| Trend | Stable |
| Trend-Period | 1994 - 2005 |
| Reasons for reported trend | No changes |
| **Area covered by habitat** | 480.7km² |
| Surface area | 480.7km² |
| Date | 1994 - 2005 |
| Method used | 3 = ground based survey |
| Quality of data | 3 = good (based on extensive surveys) |

| | |
|---|---|
| Trend | +8% = net increase by 8% (within 15.92% of the national resource of raised bogs known to support the habitat). This increase occurred at the expense of Active Raised Bog habitat. On the other hand, 1% of high bog within this 15.92% of national resource of raised bog were irreversibly lost to peat cutting. |
| Trend-Period | 1994 - 2005 |
| Reasons for reported trend | 3 = direct human influence |
| Justification of % thresholds for trends | |
| Main pressures | 150 Restructuring agricultural land holding<br>160 General Forestry management<br>161 Forestry planting<br>180 Burning<br>310 Peat Extraction<br>311 Hand-cutting of peat<br>312 Mechanical removal of peat<br>810 Drainage<br>954 Invasion by a species |
| Threats | 150 Restructuring agricultural land holding<br>160 General Forestry management<br>180 Burning<br>312 Mechanical removal of peat<br>810 Drainage<br>954 Invasion by a species |
| ***Complementary information*** | |
| **Favourable reference range** | 20,100 km² (201 grid cells x 100 km²) or 24,600km² (area polygon derived from grid cells) (The Favourable Reference Range is considered to be the same as the Current Habitat Range) |
| **Favourable reference area** | 285km² (based on the area of Degraded Raised Bog habitat outside designated areas) |
| **Typical species** | Vascular plants*: Andromeda polifolia, Calluna vulgaris, Drosera anglica, D. intermedia, D. rotundifolia, Erica tetralix, Eriophorum angustifolium, E. vaginatum, Menyanthes trifoliata, Narthecium ossifragum, Rhynchospora alba, R. fusca, Trichophorum cespitosum, Utricularia minor, Vaccinium oxycoccos.*<br>Mosses, Liverworts and Lichens: *Aulacomnium palustre, Cladonia spp (C. ciliata and C. portentosa), Leucobryum glaucum, Sphagnum auriculatum, S. capillifolium S. cuspidatum, S. fuscum, S. imbricatum, S. magellanicum, S. papillosum, S. pulchrum, S. subnitens.*<br><br>Methods: all the species above are characteristic of both Active Raised bog and good quality Degraded Raised Bog habitats in Ireland but only a small number were used as habitat quality indicators The main difference between ARB and DRB is a change in the relative proportions of species with those characterising wetter microhabitats decreasing and those of drier microhabitats increasing as the bog dries out.<br><br>Indicator species whose abundance increases in drier mire degraded conditions: *Trichophorum caespitosum, Calluna vulgaris, Narthecium ossifragum* and *Eriophorum vaginatum.* |

| | |
|---|---|
| Typical species assessment | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Characteristic species were assessed as unfavourable/inadequate (Fernandez et.al. 2005). |
| **Other relevant information** | The favourable reference values of the Active (ARB) and Degraded Raised Bog (DRB) are linked as DRB is described in the Interpretation Manual as restorable to peat-forming capability in 30 years. However we do not consider that the final value for DRB habitat should be zero, i.e. that all the current DRB must be restored to ARB as in some cases this will not be technically feasible. Ireland is obliged to ensure that Favourable Conservation Status is achieved for ARB habitat and to that end designated 195.7 $km^2$ of DRB within protected areas. It is considered that this, approximately 10 times the current ARB area, should be the theoretical target value for the restoration. The areas targeted for restoration will be those deemed most favourable and will be spread throughout the range of raised bogs. However priority will be given to areas within currently designated sites which possess ARB so as to support the conservation of these sites and maximise biodiversity values of the restored areas.<br><br>Restoration initiatives have been undertaken by:<br>• The National Parks and Wildlife Service (NPWS): *Raised Bog Restoration Project* (1994, 2003 and 2006). The overall result is positive with the expansion or new formation of Active Raised bog habitat. These works took place in 14 sites.<br>• Coillte Teoranta initiated in 2004 a Raised Bog Restoration Project founded by an EU Life -Nature Programme that will be completed in 2008. The project aim is to restore 571.2ha of raised bog with actions such as tree felling, protection against fire and blocking of drains in 14 SACs.<br><br>The ambitious targets above are for restoration of habitats substantially damaged before the Habitats Directive came into force. The resources required for restoration considerably exceed what is currently available or foreseen. |
| ***Conclusions*** ***(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) - The favourable reference range is considered to be similar to the habitat's current range |
| **Area** | Favourable (FV) - 8% habitat increase in the period 1994-2005 within 15.92% of the national resource of raised bogs known to support the habitat. However at the expense of Active Raised Bog. Current habitat extent is above the favourable reference value. |
| **Specific structures and functions (incl. typical species)** | Inadequate (U1) - increase in marginal ecotope between 5 and 25% in 23.04% of the 1994/95 habitat resource assessed (i.e. at 13 raised bogs (1,481ha of habitat) out of 48 bogs - (6,428.8ha)). Increases in marginal ecotope >25% at 6 raised bogs (914ha of habitat (14.22% of 6,428.8ha)). This decrease indicates declines in good habitat quality indicators (*Sphagnum fuscum, S. imbricatum*, *S. cuspidatum, S. auriculatum* and *Cladonia portentosa*). |
| **Future prospects** | Inadequate (U1) - ongoing deterioration of the hydrological conditions of raised bogs at current rates caused by peat cutting, drainage, forestry and burning moderately threats the viability of the habitat. |
| **Overall assessment of CS** | Inadequate (U1) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

# Degraded raised bogs still capable of natural regeneration 7120

Current Distribution (201 cells)
Current Range (246 cells)
Favourable Reference Range (246 cells)
W48 10km grid cells

Date: October 2007

# 7130 Blanket Bog (and Active* Blanket Bog)

**CONSERVATION STATUS ASSESSMENT REPORT**

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**APPENDICES**

## 1. Habitat Characteristics in Ireland

Irish blanket bogs are divided into three main sub-categories. These bog types differ from each other in their ontogeny, morphology, climatic regimes (where annual precipitation, number of raindays and average annual temperature are determining factors) and floristic composition. The three sub-categories are as follows:

1. **Lowland Atlantic Blanket Bog** (*sensu* Moore 1962) or **Oceanic Blanket Bog** (Lindsay *et al.* 1983). It is confined to altitudes less than 150m (Schouten 1984) rain-days in excess of 250 days *per annum* and rainfall > 1,250mm/year (Hammond, 1981, Doyle 1982). According to Hammond (1979) peat depths vary according to underlying topography from less than 1.0m to greater than 6.0m within this sub-category. <u>Note</u>: Shallow peat (15 – c. 75 cm) denotes Wet Heath a separate Annex 1 Habitats Directive habitat. Hammond mapped areas > 30 cm as blanket bog and thus included an unknown extent of Wet Heath habitat within the blanket bog mapped class. Hammond (1979) referred to the practical difficulties of separating Blanket Bog from intrinsically linked Wet Heath

   Irish Lowland Atlantic Blanket Bogs are of very particular importance in a European context, as the only other area of Western Europe which possesses large areas of Lowland Blanket Bog is Scotland. However, Irish Lowland Blanket Bogs are characterised by the abundance of Black Bog-rush (*Schoenus nigricans*) (Lindsay *et al*. 1983) and are considered to be a rare hyper-oceanic variant of the habitat.

2. **Highland Blanket Bog** (*sensu* Schouten 1984). It is characterised by altitude range of 150 to 300m (Schouten 1984) and rainfall 1200 -1,250mm/year (Hammond, 1981).

   **Mountain or Upland Blanket Bog** (sensu Moore 1962). It occurs in plateau areas all over Ireland at elevations above 300m where annual precipitation rates exceed 1,250mm (Schouten 1984). Hammond (1979) did not distinguish between Highland and Mountain Blanket Bog and he reported that peat depths on these subtypes can be 2 - 3m but as a general rule the average is 1.2m.

Along the western seaboard, the division between Lowland Atlantic Blanket Bog and Highland Blanket Bog/ Mountain Blanket bog is made at the 152m contour, while the Mountain type occurs above 212m in the midland Slieve Bloom Mountains and above 330m, further east, in the Wicklow Mountains (Hammond 1981). In the midland mountain ranges such as the Slieve Blooms (Offaly/Laois) and the Silvermines (Tipperary) the character species of the midland raised bogs, i.e. *Andromeda polifolia* and *Vaccinium oxycoccos*, are also to be found (Schouten 1984). *Andromeda polifolia* and more locally *Vaccinium oxycoccos* is also found in the Wicklow Mountains.

Schouten (1984) found that the blanket bogs in Irealnd varied considerably along an east-west gradient, which he related principally to a climatic gradient. Differences occur along a north-south gradient also, for example elements of Mountain Blanket Bog flora, occur at a lower altitude in the north.

Within all blanket bogs several vegetation communities occur in response to differences in hydrology, hydrochemistry and local topographic features. The priority habitat ***Active*** **Blanket Bog** includes among other communitites; *Erico-Sphagnetalia magellanici* (areas of mire expanse): *Pleurozio purpureae-Ericetum tetralicis* (Lowland Atlantic Blanket Bog areas of mire expanse), *Vaccinio-Ericetum tetralicis* (Mountain and Highland Blanket Bogs); *Scheuchzerietalia palustris* (areas of patterning), *Utricularietalia intermedio-minoris* (pool systems) and *Caricetalia fuscae* (areas of soligenous influence) *inter alia* (O'Connor, 2000).

***Active* or peat-forming Blanket Bog**

The conservation assessment applies to **Blanket Bog** that has not undergone land-cover conversion  (i.e the bog has not been completely removed nor the vegetation changed completely). ***Active*** **Blanket Bog** is a part of the matrix of **Blanket Bog** habitat. Trends and assessments apply to **Blanket Bog** and in general similar trends are expected for ***Active*** **Blanket Bog**.

**Blanket bog** is listed on Annex 1 of the EU Habitats Directive. However only ***Active*** **Blanket Bo**g is listed as a <u>priority</u> habitat. (Priority status is given to habitats and species in danger of disappearance in the EU).

According to the Interpretation Manual of the Habitats Directive the term ***Active*** must be taken to mean a bog still supporting a significant area of vegetation that is normally peat-forming. This definition does not specify what the percentage cover of peat forming vegetation should be. In the particular case of Active Raised Bog habitat (7110) only bog moss (*Sphagnum*) species are taken as peat forming, but in the case of *Active* Blanket Bog habitat ericoids and cyperaceous species are also recognised as being peat-forming.

(Derwin *et al*. (2004) defined *active* blanket bog as being indicated by greater than 25 ha of a bog site with pools, hummock/hollow complexes and wet flushes (Table 1.1). However this definition is likely to exclude considerable areas of *peat-forming* blanket bog as for blanket bogs, ericoid and cypercaeous species are generally accepted as being peat-forming.

## 2. Habitat Mapping

For this assessment a national map of the distribution of the habitat on a 10km grid basis was produced. The map is based on a combination of habitat maps (e.g. Peatland Map Hammond, 1979), Corine 2000 Land Cover, Teagasc Soils Map (2006)), available in a format compatible with GIS, coupled with maps of ecological factors that determine the occurrence of blanket bog (e.g. rainfall and altitude). The map was supplemented with data from NPWS blanket bog habitat surveys (1987, 1989, 1990, 1991) that located and assessed conservation value of a significant proportion of Ireland's blanket bogs. All these sources are to some degree incomplete and none of them accurately depict the national resource of blanket bog. The map produced is however considered to be a good reflection of the distribution of Ireland's blanket bog resource.

**Mapping sources employed in the composition of the Blanket Bog Distribution Map (Map I) were as follows:**

- *Peatland Map of Ireland*. Hammond (1979)
- *Land Cover Map*. Corine (2000)
- *The Distribution, on a 10km square basis, of Selected Habitats in the Republic of Ireland*. Conaghan et al. (2001)

Other sources of data related to ecological factors that determine the occurrence of blanket bog used to produce Map I were:

- *National Soils and Parent Material Map.* Teagasc (2006)
- Annual average rainfall data. Met Eireann
- Elevation contour lines. Discovery Series – Ordnance Survey (1995)

Records from the following sources completed the mapping of blanket bog:

- *Commonage Framework Plans* (CFPs) maps (2006)
- *NPWS Blanket Bog NHA Survey*.(Derwin *et al*., 2003)
- *NPWS Blanket Bog Surveys (1987* – 1991)
- *Habitat Assignment Project*. (NPWS, 2006)
- NPWS Enquiries Database
- Digitised SAC Management Plans - Indicative Habitat Maps (NPWS)

The use of the year 2000 orthophotographs was essential in determining possible occurrence of blanket bog for grid squares that no maps source had registered its occurrence and to validate its presence when it was reported by any of the above sources.

The process adopted to produce Map I is detailed in Annex I, the above sources are described in Annex II.

Determination of the exact extent and distribution of blanket bog in Ireland is rendered difficult because of the inherent difficulties of defining a minimum depth of accumulated organic material that constitutes blanket peat. Doyle (1982) considered that peat of at least 1.5 metres in depth should be considered to constitute blanket bog, whereas Hammond (1979) mapped as blanket bog all areas of peat depth greater than 0.45 metres and thus includes some areas of Wet Heath. On the other hand Soils Map (Teagasc 2006) classified as bog peat soils with depth greater than 1m. The Commonage Framework Plan Manual (Duchas and DAFF 1998) include guidelines to distinguish heath from blanket bog as follows:

<u>Peat depth <0.15m to indicate Dry Heath, 0.15 - 0.75m for Wet Heath and > 0.75m to indicate Blanket Bog.</u>

Mapping of the distribution of *Active* Blanket Bog (7130) habitat as described in the Habitats Directive has not been possible as only a few of the sources mentioned above (e.g. Derwin *et al*. 2003) overtly map the extent of *Active* bog and this applies only to the 73 sites designated as NHAs for blanket bog. Unfortunately the definition of ***active*** used is considered too narrow for blanket bog being more appropriate for raised bog.

The mapping of the habitat range is defined by the smallest polygon size containing all grid squares, where the habitat was recorded, drawn using a minimum number of 90 degrees angles. Gaps in the habitat distribution of at least 2 square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range.

## 3. Habitat Range

Blanket bog is largely restricted to the counties along the western seaboard and upland areas elsewhere in the country with annual rainfall in excess of 1250 mm falling on more than 250 rain days per year. The current range of *Active* Blanket Bog habitat as defined in the Habitats Directive Interpretation Manual is unknown although areas of intact or uncut blanket bog occur across the geographic range of blanket bog although highly fragmented in many locations by various land use activities.

Several authors have given a detailed description of the distribution of the three sub-types:

**Lowland Blanket Bog**

Lowland blanket bog is chiefly situated in coastal plains and inter-mountain valleys of the west of Ireland (Doyle, 1982) where it covers large areas below an altitude of 150 metres..

The best-developed and most extensive area of the Lowland Atlantic habitat subtype occurs in north-west Co. Mayo, the second largest area occurs in the Connemara region of Co. Galway. Co. Donegal also contains a large area of Lowland Atlantic Blanket Bog. Lesser areas of this habitat sub-type occur in counties Kerry, Cork, Sligo and west Leitrim. Areas of counties Limerick (in the vicinity of Killfinane) and Leitrim indicated as Lowland Atlantic Blanket Bog on Hammond's map must be regarded with caution as much of this area lies outside the 1,250mm isohyet.

Furthermore, Corine (2000) Land Cover Map also indicates the occurrence of this habitat sub-type in counties Clare, Tipperary, Kilkenny, Wexford, Carlow, Monaghan and Louth. Some of these sections may correspond to Highland or Mountain Blanket Bog however.

Map I illustrates an almost continuous distribution of blanket bog along the western seaboard, whereas it becomes more scattered, as it is mainly confined to mountain ranges, along the mid south, south-east and north-east of the country. The 10km grid blanket bog distribution map illustrates obvious gaps within the blanket bog range. Some of these areas would not have the required ecological conditions (e.g. average rainfall) for the development of the habitat. Map I also shows the absence of blanket bog in the drier central lowlands where the habitat never developed.

**Highland Blanket Bog**

Highland Blanket Bog is confined to areas above 150m and below 300m in the west of Ireland (Schouten, 1984). Hammond (1979) did not distinguished between Mountain and Highland Blanket Bog. Perhaps the best-developed area of Highland Blanket Bog occurs in the Ox Mountains in western Co. Sligo. Central and south-east parts of Donegal and Kerry also contain several areas of Highland Blanket Bog (O'Connor, 2000). Conaghan et al. (2001) stated that in Kerry this type of blanket bog occurs as smaller, more discrete units.

Corine (2000) Land Cover map indicates potential areas of Highland Blanket Bog along the western counties Leitrim, Mayo, Galway, Clare and Cork. In mountain ranges in counties Wicklow, Tipperary, Waterford and Limerick, Blackstairs Mountains in counties Carlow, Kilkenny and Wexford as well as isolated areas in counties Laois, Louth, Cavan and Monaghan.

**Mountain Blanket Bog**

By Hammond's definition of >150m the largest areas of Mountain Blanket Bog occur in the upland regions of Donegal and other counties with a high percentage of the Mountain Blanket Bog resource include; Cork, Mayo, Kerry and Clare. Based on Schouten's definition of >300m altitude the most extensive areas of Mountain Blanket Bog occur in the Wicklow Mountains, Mangerton Mt., (Co. Kerry), the Slieve Bloom Mountains (Co. Laois and Offaly) and the Cuilcagh/Slieve Anieran Mt. and Boleybrack Mt. of counties Cavan and Leitrim and the Ox Mts. of counties Sligo/Msyo. Corine (2000) Land Cover map also illustrates areas of this habitat at elevations above 300m in counties Sligo, Kilkenny, Wexford, Waterford, Louth and Tipperary.

### 3.1. Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between Current Habitat Range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

As detailed in section 4.1, the extent of the national resource of **Blanket Bog** and ***Active* Blanket Bog** declined more rapidly after – 1948 via industrialisation of peat cutting and via afforestation and also after 1980 with the introduction of afforestation grants and tractor-mounted peat-cutting machines. Afforestation and peat extraction have considerably reduced the extent of **Blanket Bog** and ***Active* Blanket Bog.** However although the extent has significantly declined there would still be at least some **Blanket Bog** existing in part of each 10km sq and thus the range for **Blanket Bog** would not appear to have changed at the 10km sq. resolution**.** The trend in the range for **Blanket Bog** since 1980 is considered to be stable. The trend in the range for ***Active* Blanket Bog** is considered to be negative as although this cannot be quantified such a trend is wide-ranging extent of impacting activities.

## 4. Habitat Extent

Three different mapping sources: Hammond (1979), Corine (2000) and Teagasc soils map (2006) have directly or indirectly attempted to estimate the overall extent of blanket bog. None of these sources can be taken as definitive to estimate the current extent of the habitat for various reasons; in the particular case of Hammond's Peatland Map (1979) changes in the habitat have occurred since the production of the map. This map also has inaccuracies as it amalgamates data from several sources for different counties and thus each county was mapped at different level of detail. According to Conaghan et al. (2001), significant areas of blanket bog were not included in the map and it is considered to be underestimating the extent of blanket bog. However in another way Hammond may overestimate blanket bog extent (as a peat depth definition of > 30 cm would include Wet heath areas within his mapped blanket bog class).

Differences in the criteria used to define peatland habitats (mainly peat depth) between all the sources were also found. Corine (2000) assigns certain areas as blanket bog when the 2000 aerial photograph reveal a different type. Corine Land Cover map was produced in a coarse resolution and blanket bog land cover contains other habitats (e.g. upland grasslands, reclaimed land) and thus overestimates the extent of blanket bog. Only two soil sub-types (63 & 65) from the Teagasc soils map were considered to assess the extent and distribution of the habitat. Although these subtypes largely correspond to blanket bog some sections of other peaty soil subtypes not included may also support the ecosystem. Hence, it is considered more appropriate to provide a range of values for blanket bog habitat extent.

Blanket bog is often associated with other habitats such as Wet Heath or Dry Heath and thus it is generally difficult to define clear boundaries between these habitats. Hence areas allocated to blanket bog by the mentioned sources frequently contain a mosaic of habitats and thus overestimate the actual extent of blanket bog.

The following Table summarises data on extent of blanket bog provided by the three main mapping sources for the Republic of Ireland. The values have been refined through eliminating those areas not considered suitable (climatic factors) for the development of the habitat to provide more accurate figures, as reported in Appendix I.

**Table 2.1 Extent of Blanket Bog According to Different Sources**

| **Hammond (1979) [1]** | | | | **Corine Land Cover Map (2000)** | | **Teagasc Soils Map (2006)** | |
|---|---|---|---|---|---|---|---|
| **Original** | | **Digitised by Teagasc** | | | | | |
| **Unmodified** | 564,670 | **Intact High Level Montane Type (Highland + Montane Schouten, 1984)** | 339,104 | **Intact** | 570,227 | **Blanket Bog (Intact and Degraded)** | 636,530 |
| | | **Intact Low Level Atlantic Type** | 263,823 | | | | |
| **Modified** | 209,190 | **Man modified Montane Type** | 134,247 | **Exploited** | 343,542 | | |
| | | **Man modified Atlantic Type** | 90,399 | **Forestry on Blanket bog** | 149,730 | **Forestry on Blanket bog** | 145,613 |
| | | **Milled Peat** | 7,085 | | | | |
| | | **Machine Peat** | 667 | | | | |
| **Total** | **773,860** | | **835,325** | | **1,063,499** | | **782,143** |

[1]There is a 61,465ha difference between Hammond (1979) digitised map and the original extent given in the 1979 report. This is likely to be due to errors in the digitising process.

<u>To summarise the estimated total extent of blanket bog, including modified habitat (e.g. cutaway and afforested) ranges from 773,860 to 1,063,499 ha.</u>

Table II.1 in Appendix II provides a breakdown of blanket bog extent according to Corine (2000) on a county by county basis for the Republic of Ireland. Table III.2 (Appendix III) also gives a breakdown of the extent of blanket bog per county according to Hammond (1979) and CFPs.

Based on digital land uses and soil maps Connolly (2006) used a rules based-methodology to estimate the total area of **blanket bog** to be 655,054 ha excluding milled blanket peat. Correcting this estimate by adding the estimated milled peat blanket bog (6,833 ha) increases the figure to 661,887 ha. No data on modified blanket bog.

The overall extent of **Blanket Bog** (as per Habitats Directive definition) is likely to be overestimated by both Hammond (1979) and Corine (2000).

In addition overstocking by sheep (and sometimes cattle) has degraded substantial areas of un-modified blanket bog in the west of Ireland.

Large areas of **Blanket Bog** have been afforested and cutaway since the production of Hammond's Map (1979).

Furthermore, large areas of blanket bog deemed 'intact' by Corine have been severely cut away as the 2000 aerial photographs illustrate.

In 1984 Cross & Ryan (1984), working with Hammond's (op.cit.) baseline estimate, calculatedthe remaining area of <u>intact</u> (i.e. not modified by peat extraction or afforestation) bog to be 517,231 ha.

**Blanket Bog Ownership**

Coillte Teoranta is one of the major landowners in the Republic of Ireland. According to O'Connor (2000), Coillte owns 162,332ha of blanket bog (>45cm in peat depth), which also contain other associated habitats (e.g. Wet Heath and Dry Heath). Coillte owns approx. 126,000ha of western peatland. These are mainly blanket bog with some raised bog and Wet Heath and Dry Heaths (Tiernan pers. comm., 2006). NPWS owned in full ownership 34,339ha in 1999 and Bórd na Móna owns 8, 597ha in a total of three counties (Co. Mayo, Kerry and Donegal). Common ownership of large areas of unfenced bogland is the principal type of land ownership in the western peatland and upland peatland of Ireland. According to data from the Commonage Framework Plans (CFPs) the estimated extent of commonage land in Ireland is 438,000ha and approx. 241,000ha of these commonages land contain blanket bog and associated habitats, in a total eighteen counties (see Table II.2 – Appendix II).

**Estimated Extent of Blanket Bog Designated**

73 sites are designated under national law (Wildlife Amendment Act, 2000) as Natural Heritage Areas (NHAs) and 50 as Special Areas of Conservation (SACs) under EU law (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, more commonly known as The Habitats Directive).

It is estimated that these designated SACs contain a total of 150,750ha of **blanket bog** and the estimated area within designated NHAs is 31,313ha, including 26,106ha of un-modified **blanket bog** (Derwin *et al.*, 2003). Thus, the current estimate for the overall extent of **blanket bog** is 182,063ha in designated NHAs and SACs. However, the actual extent of blanket bog within designated sites may be slightly larger as the sites included in this estimate are only those containing **blanket bog** as the main habitat of qualifying interest. Other SACs and NHAs sites also contain areas of **blanket bog** but were designated primarily for other habitats such as Wet Heath. The extent of **blanket bog** in these sites is not included in the total estimate provided above.

**Extent of *Active* Blanket Bog Habitat (7130)**

The extent of *Active* Blanket Bog habitat as defined in the Habitats Directive Interpretation Manual is unknown. At present an estimated 182,063ha of blanket bog including an unknown extent of ***Active*** **Blanket Bog** occur in NHAs and SACs with blanket bog as a qualifying interest. However, the actual extent of the habitat ***Active*** **Blanket Bog** within this designated land is unknown. If the best extant examples are considered to be confined to the SACs and NHAs designated for blanket bog then the area of **Active** is likely to be considerably less than the 182,063 ha (estimated area of blanket bog within NHAs and SACs specifically designated for this habitat).

Estimation of the amount of **active blanket bog** remaining is problematic due to a number of factors, most notably the exact definition of active; the difficulty in differentiating blanket bog areas from wet heath due to inter-gradations between the occurrences of these two habitats and possibly also dry heath; and the unknown extent of impact on ***Active*** **blanket bog** of overgrazing and trampling caused by overstocking particularly since 1980.

Ryan and Cross (1984) estimated that there was approximately 517,231 ha of relatively intact blanket bog (meaning not cutaway nor afforested) remaining in 1982. However, there is no reliable estimate of what area of the original resource remains in a relatively intact state at present. To summarise the extent of the **Blanket Bog** is likely to be considerably less than 500,000ha, and the extent of ***Active*** **Blanket Bog** markedly less again. The extent of ***Active*** is however unknown and research directed towards assessing its value is required.

- **Area covered by the habitat:** The extent of **blanket bog** ranges from 7,739 $km^2$ to 10,635 $km^2$ (including degraded and intact); the extent of ***Active*** **Blanket bog** habitat is **Unknown**.
- **Favourable Reference Area:** FRA for Active Blanket Bog is unknown as active is not defined in sufficient detail for blanket bog and can cover a range of community types. In addition different parts of a bog system can be active or inactive at different stages even over very long periods of time depending on topographic and climatic variables as well as anthropogenic factors.

### 4.1. Conservation Status of Habitat Extent

Although the actual trend in habitat extent and thus its conservation status cannot be assessed, a summary of the derivation of blanket bog extent is given below. This gives a general overview of the trend in relation to the extent of for blanket bog that reflects the trend for ***Active*** **Blanket Bog.**

There was a slow but significant decline in the resources of blanket bog and associated habitats (e.g. Wet Heath, Dry Heath) until middle of the 20th century, mainly due to hand cutting of peat and small areas of agricultural reclamation. Indeed by the inception of Bórd na Móna in 1946, it was estimated that the area of **Blanket Bog** had been reduced to approximately 675,190 hectares. From 1946 onwards the decline in the progressed at a greatly accelerated rate as a result of the dramatic increase in the level of agricultural reclamation, peat extraction, ESB utilisation of blanket bog peats as fuel for electricity production (1940s onwards) and blanket bog afforestation (1950's onwards). The Turf Development Act (1981) encouraged private blanket peat extraction by supporting the construction of turbary roads, drainage of turf plots and mechanisation of peat cutting. Forestry Grant schemes lead to very extensive habitat loss via afforestation. Some Agricultural support schemes (e.g. introduction of Ewe Premium (1981)) lead to degradation by overstocking which has resulted in the erosion of extensive blanket bog areas especially in uplands.

All of these activities indicate that the estimate of uncut, unafforested blanket bog proposed by Ryan and Cross (1984) may now be much reduced. Damage from afforestation, peat cutting, wind farms and other infrastruture (since early 1990) is likely to have significantly diminished the extent of the habitat.

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the extent of a habitat can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat extent in the reporting period (a decrease in habitat extent greater than 1% per year is deemed **Unfavourable Bad**). The second is based on the relation between current habitat extent and the Favourable Reference Area (FRA) (if current habitat extent is 10% below FRA the habitat extent is considered **Unfavourable Bad**).

As mentioned previously the current extent of the habitat is unknown. However, decreases in habitat extent greater than 1% per year are expected considering the impacting nature of the activities damaging the habitat particularly since 1980 (agriculture (overstocking), afforestation,mechanised cutting) and since 1994 agriculture (overstocking), afforestation, mechanised cutting, windfarm and infrastructural developments, quarrying, erosion and peat slides. Thus, the conservation status of the habitat extent is deemed **Unfavourable Bad**.

## 5. Structures and Functions

### 5.1. Habitat Structures and Functions

As reported in section 4.1, an increase in the intensity of impacting activities on the habitat has occurred since the 1950’s, this increase has been more acute from 1980’s onwards for peat extraction, afforestation and overstocking and since early 1990s for wind farm developments. A decrease in sheep stock numbers implemented may bring about a halt in degradation caused by overstocking in some areas or a slow down in the rate of degradation in others and the commencement of recovery however areas in damage classes MS, S and S* are likely to continue to erode as recovery potential is likely to have been seriously impaired or lost in many of these areas. This increase in impacting activities indicates that the decrease in the extent of *Active* Blanket Bog has been coupled by a decline in the habitat structures and functions.

Drainage and fertilisation. associated with agriculture reclamation, have often resulted in the complete elimination of the peatland flora and fauna.

Peat extraction seriously interrupts the bog hydrology and depending on the extraction technique finally causes the complete removal of the peat substrate and/or the top vegetation.

Overstocking by sheep (less often cattle) has damaged a large portion of intact blanket bog. The results provided by the CFP indicates that approximately 40% of the land containing blanket bog and associated habitats (96% of it is commonage land) has some level of damage. This damage varies from the removal of the plants and moss layer that can result in severe erosion (e.g. bare soils and poaching) to finally the complete removal of the peat.

According to the result of the commonages surveys 37,964 ha (>15%) of the land containing blanket bog and associated habitats (96.14% of it is commonage land) was assessed as significantly to very severely damaged (i.e. MS to S* - see Table 6.2). This would have substantially decreased the bog capacity to be peat-forming and therefore the extent of ***Active* Blanket Bog**.

A comparison between the estimated maximum extent of blanket bog unmodified in 2006 (by afforestation and not cutaway) of 390, 727ha (basis of this estimate explained in the Assessment Form), and the commonage land containing blanket bog with significant to very severe damage caused by overstocking, shows that almost 10 % belongs in this category. This figure is indicative only as condition classes and not habitat were mapped in the commonages survey and presence of habitat was indicated within the mapped condition classes. In addition blanket bog habitat often occurs in mosaic with other habitats in particular wet heath habitat.

Burning causes the creation of bare peat areas, the reduction in the water holding capacity of the peat and the ultimate dominance of bog species more typical of dry conditions.

Wind farm developments also result in the fragmentation of the habitat, may causes much damage to the hydrology of the blanket bog and may affect the stability of peat deposits resulting in some cases in peat slides or bog bursts.

#### 5.1.1. Conservation Status of Habitat Structures and Functions

All the above activities seriously alter the habitat quality. The variation in the conservation status of the structure and functions of *Active* Blanket Bog cannot be quantified. Nonetheless, the increase in intensity of impacting activities and their ongoing negative effects in the last two decades indicate that the structure and functions of the habitat are likely to be **Unfavourable Bad**.

**Typical Species**

Areas of blanket bog are often comprised of a complex mosaic of different plant communities. The occurrence, composition and extent of these communities is dependent on various environmental factors such as peat depth, slope, height of watertable, mineral content of flushing water and the influence of damaging operations such as grazing and burning (Conaghan et al., 20001).

The 2003 version of the Interpretation Manual of the Habitats Directive divides the habitats in two sub-types and provides a list of characteristic species:

1. Hyper Atlantic Blanket bogs in the western coastlands of Ireland, western Scotland, Cumbria and North Wales. These bogs are locally dominated by Sphagna (*Sphagnum auriculatum*, *S. magellanicum*, *S. compactum*, *S. papillosum*, *S. tenellum*, *S. subnitens*), or, particularly in parts of western Ireland, mucilaginous algal deposits (*Zygogonium*).

   <u>Characteristic plant species</u>

   *Calluna vulgaris, Campylopus atrovirens, Carex panicea, Drosera rotundifolia, Erica tetralix, Eriophorum vaginatum, Molinia caerulea, Myrica gale, Narthecium ossifragum, Pedicularis sylvatica, Pinguicula lusitanica, Pleurozia purpurea, Polygala serpyllifolia, Potentilla erecta, S. pulchrum, S. strictum, S. compactum, S. auriculatum.*

2. Blanket bogs of high ground, hills and mountains in Scotland, Ireland, Western England and Wales

   <u>Characteristic plant species</u>

   *Calluna vulgaris, Diplophyllum albicans, Drosera rotundifolia, Empetrum nigrum, Erica tetralix, Eriophorum vaginatum, Mylia taylorii, Narthecium ossifragum, Rubus chamaemorus, Scirpus cespitosus, Vaccinium myrtillis.*

**According to different authors the following are the species characterising the three main habitat sub-types:**

**Lowland Blanket Bog**

According to Schouten (*op. cit.*) Lowland Blanket Bog is characterised by a low *Sphagnum* cover (< 10%), a high cover of a surface algae (between 10 and 50%), the dominance of *Schoenus nigricans* and *Molinia caerulea* and the presence of *Eriocaulon aquaticum* and *Lobelia dortmanna* (both of which are confined to pools and lake margins). In addition to the dominant species, *Erica tetralix, Potentilla erecta, Narthecium ossifragum* and *Rhynchospora alba* also prominent in lowland Blanket Bogs. Hummock/hollow topography is not as well developed as in raised bogs and high *Sphagnum* cover is restricted to depressions where there is impeded drainage of surface water Schouten (*op. cit*.). Plant species such as *Pinguicula lusitanica, Pleurozia purpurea, Polygala serpyllifolia* and *Pedicularis sylvatica* tend to be more frequent in this bog type than in others.

The most common vascular plants, mosses and liverworts species recorded by NPWS during surveys of ombrotrophic Lowland Blanket Bog in Ireland are listed below (only those with % of occurrence greater than 41% are listed and in order of constancy):

- Vascular plants: *Calluna vulgaris, Carex echinata, Carex panicea, Drosera anglica, D. intermedia, D. rotundifolia, Erica tetralix, Eriophorum angustifolium, E. vaginatum, Molinia caerulea, Menyanthes trifoliata, Myrica gale, Narthecium ossifragum, Pedicularis sylvatica, Polygala serpyllifolia, Potentilla erecta, Rhynchospora alba, Schoenus nigricans, Trichophorum caespitosum, Dactylorhiza maculata, Eleocharis multicaulis, Juncus bulbosus, Pinguicula vulgaris, Utricularia intermedia, Succisa pratensis, Carex rostrata.*

- Mosses, Liverworts and Lichens: *Campylopus atrovirens, Cladonia ciliata, C. portentosa, C. uncialis, Hypnum cupressiforme, Odontoschisma sphagni, Pleurozia purpurea, Racomitrium lanuginosum, Sphagnum auriculatum, S. capillifolium, S. cuspidatum, S. magellanicum, S. papillosum, S. subnitens, S. tenellum, Campylopus brevipilus, Kurzia pauciflora, Sphagnum imbricatum, Aulocomium palustre, Breutelia chrysocoma, Campylopus introflexus, Cephalozia connivens, Cladopodiella fluitans, Hylocomium splendens, Sphagnum palustre.*

**Highland Blanket Bog**

Highland Blanket Bog that is also primarily confined to the wetter western half of the country and is restricted to altitudes of between 150 and 300m where it forms the transition between Lowland and Mountain Blanket Bog. The floristic composition of Highland Bog is broadly similar to that of lowland blanket bog, however there are some elements of Mountain Blanket Bog in the vegetation. The main floristic differences between Highland and Lowland Blanket Bog are the absence of *Eriocaulon* and *Lobelia* and the presence of the lowland species *Schoenus nigricans* alongside upland species such as *Empetrum nigrum, Vaccinium myrtillus* and *Diplophyllum albicans*, albeit at a low frequency (Schouten 1984).

**Mountain Blanket Bog**

Mountain Blanket Bogs in general show less variation in surface features and vegetation than Lowland or Highland Blanket Bogs and much of the vegetation variety may be understood to be a function of burning and grazing regimes. Uneroding or intact examples are rather rare but do exhibit considerable microtopographic variation including pool systems and hummock hollow complexes.

The most prominent vascular plant species in Mountain Blanket Bog are *Calluna vulgaris, Vaccinium myrtillus, Erica cinerea*, *Eriophorum angustifolium, E. vaginatum*, *Trichophorum caespitosum* and *Empetrum nigrum*, while the most common bryophytes are *Sphagnum capillifolium, Racomitrium lanuginosum* and *Hypnum cupressiforme*.

Species of Lowland Blanket Bogs such as Purple Moor Grass (*Molinia caerulea*) and Cross-leaved Heath (*Erica tetralix*) are, in general, very scarce. The lichen flora of Mountain Blanket Bogs may be diverse and lichens such as

*Cladonia ciliata* var. *tenuis* and *Cladonia uncialis* are important components in Mountain Blanket Bogs (Cross and Douglas, unpublished report Dúchas).

Schouten (*op. cit.*) further sub-divided Mountain Blanket Bog into western and eastern types. The western type is characterised by a low *Sphagnum* cover, high surface algae cover and the increased presence of species such as *Molinia caerulea, Euphrasia micrantha, Pedicularis sylvatica, Pleurozia purpurea, Potentilla erecta, Polygala serpyllifolia, Carex panicea* and the moss *Campylopus atrovirens*. Western Irish Mountain Blanket Bogs often contain a rich bryophyte and lichen component in comparison to Eastern Irish Mountain Blanket Bogs (A. McKee, pers comm.). Eastern Mountain Blanket Bog has a higher *Sphagnum* cover, low surface algae cover and contains *Vaccinium oxycoccus* and *Andromeda polifolia*. Areas of Mountain Blanket Bog in the east of the country also tend to be characterised by more extensive development of *Erica-Sphagnum* vegetation.

In areas of blanket bog which are wet and intact, the bryophyte layer can be well developed. The dominant moss species is usually *Sphagnum capillifolium* with *S. papillosum* while *Hypnum cupressiforme* and *Racomitrium lanuginosum* are frequent.

The most common vascular plants, mosses and liverworts species recorded by NPWS during the surveys of ombrotrophic Mountain Blanket Bog in Ireland (only those with % of occurrence greater than 41% are listed below in order of constancy):

- Vascular plants: *Calluna vulgaris, Eriophorum angustifolium, E. vaginatum, Empetrum nigrum, Vaccinium myrtillus, Erica tetralix* and *Trichophorum caespitosum.*
- Mosses, Liverworts and Lichens: *Sphagnum capillifolium, Hypnum cupressiforme, Racomitrium lanuginosum* and *Sphagnum papillosum.*

The following were deemed negative indicators: abundant *Trichophorum caespitosum* and *Molinia caerulea*, abundant *Narthecium ossifragum*.

### 5.1.2. Conservation Status of Typical Species

An accurate assessment of the conditions of typical habitat species can not be carried out in the absence of a specific monitoring program. However, the assessment of the condition of the habitat structures and functions based on impacting activities and the influence of these activities on the habitats typical species will let us ascertain the conservation status of the latter. Furthermore, a decline on the habitat's structure and functions as mentioned previously already indicates a decline in the habitat typical species.

One of the most negatively impacting effects of the main activities affecting the habitat is the lowering of the water table levels. This leads to the initial dominance of bog plant species which are tolerant of lower and more fluctuating water tables, such as *Molinia caerulea, Calluna vulgaris* and *Potentilla erecta* (Doyle and Moore, 1982). Plant species of smaller stature and which demand a constantly high water table, e.g. *Drosera* spp., *Narthecium ossifragum* and *Rhynchospora alba*, disappear (Conaghan et al., 2001).

As reported by Conaghan et al. (2001) at altitude (c. 100m) intact blanket bog/wet heath vegetation dominated by *Molinia caerulea* with frequent *Calluna vulgaris, Erica tetralix, Trichophorum caespitosum* and *Sphagnum capillifolium* is replaced by vegetation dominated by *Nardus stricta* and *Carex panicea* as a result of overstocking. At an altitude of 350m, heavy grazing intensity results in a change from vegetation dominated by *Eriophorum vaginatum, Calluna vulgaris, Vaccinium myrtillus* and *Empetrum nigrum* to a much more species-poor vegetation dominated by *Eriophorum vaginatum* while species such as *Vaccinium myrtillus, Empetrum nigrum* and *Deschampsia flexuosa* are either absent or have a greatly reduced cover.

MacGowan and Doyle (1997) studied the changes in species composition of blanket bog in relation to overstocking in Connemara and found that a large number of plant species have a much reduced cover or are absent in overgrazed areas. Plant species which disappear under heavily grazed conditions include *Pedicularis sylvatica, Pinguicula vulgaris, P. lusitanica, Sphagnum magellanicum, S. tenellum, S. pulchrum, S. cuspidatum* and *Leucobryum glaucum*, while species such as *Hypnum jutlandicum, Drosera rotundifolia, D. anglica, Sphagnum papillosum* and *Calluna vulgaris* have a much reduced cover. Overall overstocking reduces the cover of dwarf species such as *Calluna vulgaris* and *Erica tetralix* and increases the cover of graminoid species such as *Molinia caerulea* and *Eriophorum vaginatum.* If the high level of grazing continues, erosion of the surface occurs and *Nardus stricta* and *Eriophorum angustifolium* colonise.

Burning also leads to a decrease in the cover of bog mosses e.g. *Sphagnum imbricatum* and vascular plant species typical of very wet conditions, e.g. *Vaccinium oxycoccus* and *Drosera anglica.* It also encourages the dominance of tussock-forming graminoid species, i.e. *Eriophorum vaginatum* and *Molinia caerulea*, while in the long term, particularly in areas of Mountain Blanket Bog, the dominance of *Calluna vulgaris* may result.

Agriculture reclamation completely dramatically modifies the vegetation through removal of peat and fertilisation that encourage a completely new arrange of species.

To summarise, the species succession varies depending on the type of blanket bog and intensity and nature of the impacting activity. However, overall it can be seen a reduction in peat forming species including Sphagna and lichens and a decline in the presence of species associated with wet peat. Overstocking which has affected a large portion of the remaining intact blanket bog has resulted in a decrease in heather cover and increase in Mat grass (*Nardus stricta*), bare peat and peat erosion. Hence, taking into account the intensity and influence of the reported impacting activities in the last twenty years the conservation status of typical species is likely to be at least Unfavourable Inadequate.

## 6. Impacts and Threats

Conaghan et al. (2001) provided an overview of the main damages influencing blanket bog areas, the main ecological effects, approximate extent and likely future trends (see Table 6.1). This is based on estimations given by Foss in 1998. A more detailed and up to date description of these activities is given in further sections within the report.

**Table 6.1 Damaging activities affecting blanket bog, main ecological effects and their approximate extent and future trends.**

| Damage type | Main ecological effects | Approximate % of original blanket bog area affected | Likely future trends of damage |
|---|---|---|---|
| **Extraction of peat (Hand-cutting)** | Severe damage to hydrology of peatland, however some plant survival. Regeneration to *Calluna* heath and wet *Sphagnum* pools in places. | 45% | Rapidly declining in intensity. Has been replaced by mechanical extraction in most areas. |
| | | | |
| **Overstocking** | Where very severe, complete erosion of peat occurs with very poor prospects for recovery. Spread of unpalatable species, e.g. *Nardus stricta*. Detrimental effect on aquatic life of rivers and streams due to peat run-off. | 10-15% | Though stock may be reduced erosion is likely to continue on poorly vegetated or on bare areas. Recovery potential unknown. |
| **Burning** | Repeated burning leads to high cover of graminoids and low *Sphagnum* cover. Generally not a common occurrence in deep peat areas. | <5% | Future incidence uncertain. Risk greatest in areas close to urban areas, e.g. Wicklow Mountains. |
| **Agricultural reclamation** | Usually results in the total elimination of the resident peatland flora and fauna. | <5% | Probably declining in intensity mainly due to the discontinuation of grant aid for the practice |
| **Mechanical peat extraction** | Severe damage to hydrology of peatland, however some of the less specialised plant species may survive. | 3% | Increasing in intensity. Practice dependent on fuel prices. |
| **Wind farm development** | Although much intact surface can remain, roadway and turbine base construction can leads to severe hydrological impact on peatland and can also lead to peat slippage. Can cause the displacement of resident bird populations. It can also increase access to the bog and the risk of accidental fires. | <<1% | Scale and rate of development set to increase very rapidly. |

Corine land cover map (2000) gives the most recent overview of the current level of damage of blanket bog. Corine map categorised blanket bog according to the level of conservation (i.e. Bog Exploited or Intact). The resolution of the areas mapped by Corine according to this aspect is too coarse and occasionally areas deemed “Exploited” include pristine areas of blanket bog and vice versa. Therefore, this data cannot be used to give any accurate assessment of the conservation status of blanket bog. Appendix II contains statistics of blanket bog damage according to Corine 2000 sorted by county.

Hammond (1979) also provided data on level of damage on blanket bog (incl.wet heath) however this data is considerably out of date.

O’Connor (2001) devised a questionnaire to assess threats and damage to peatland habitats and to identify any regional trend in problems associated with the conservation of blanket bog systems. This questionnaire was given to NPWS regional staff (33 rangers). The following are some of the results of the questionnaire in descending order of priority (the Habitats Directive (92/43/EEC) activity code is given in brackets):

- Accidental and deliberate burning (180)
- Overgrazing by sheep (142)
- Afforestation (161)
- Peat extraction (Mechanical) (312)

- Drainage (810) / Land reclamation (800)
- Increased access to the bog by all terrain vehicles (A.T.Vs.) (623)
- Tourism / Trackway erosion (501)
- Trampling (720)
- Tourism (622)
- Wind Farm Development (514)
- Peat extraction (manual) (311)
- Abuse of grazing rights (140)

Other threats identified by Foss and O' Connell (1996) and Tallis *et al.* (1997), O'Connor (2000) should be added to the list:

- Climate change (791)
- Spread of invasive species (e.g. *Rhododendron ponticum*) (954)
- Air pollution (702)
- Large scale construction (industrial development) (410)

### 6.1. Overstocking

Overstocking with sheep (less often cattle) is one of the major damaging activities affecting blanket bog. Overstocking significantly alters structure and composition of blanket bog vegetation (MacGowan and Doyle, 1996). Moreover, trampling is a major factor in damage to blanket bog, trampling by cattle is more damaging than by sheep. Bleasdale (1995) found the area of north-west Connemara Co. Galway and south west Mayo to be the most densely stocked areas of upland-grazings in the country with a sheep stocking density of over 2 ewes per ha. These areas are among the most severely eroded areas of Wet Heath and blanket bog, resulting from overstocking in Ireland.

The EU sheep meat subsidy or ewe premium was introduced in 1980. By 1991 the sheep population had risen to 8.8 million from the 1980 level of 3.3 million. Douglas (1998) stated that acutely degraded landscapes could be found extensively in Mayo, west Galway and Kerry although at that time the degree and scale of the damage remained unquantified. High numbers of sheep were being maintained on overgrazed lands by way of supplementary feeding. Douglas (1998) reported on a survey in 1997 of the uplands of south Mayo and north Connemara that estimated that as much as 27 % or an area of 93.7 km sq. was extremely degraded (Geering and Geestel 1997). Some of the most acutely degraded areas occur in districts that, because of high rainfall and poor trafficability of soil (bog and wet heath) have fewer than 100 grazing days per year. Reports of peat slides are increasing from these areas and a major landslide occurred in January 2007 at Bengorm Mt. in south Mayo and other landslides have been reported from Clare Island, Mayo, Leenane also in the Twelve Bens, Connemara (these may involve predominantly wet heath).

Foss (1998) estimated that 10-15% of the original blanket bog areas was affected by overstocking (Table 6.1). The increase in sheep flock number is related to EU policy decisions made in the 1970s and 1980s. The scheme that has had the greatest effect on the increase of sheep numbers on blanket bog commonage has been the EC Ewe premium (O'Connor, 2000).

The serious problems of degraded blanket peatlands, predominantly commonage areas, resulting from joint Irish Government European Union funded Agricultural Schemes prompted the European Union to seek urgent action to redress the environmental damage caused by the overstocking of hill farms and rough grazing (predominantly blanket bog and Wet Heaths).

A revised and subsequently amended Rural Environment Protection Scheme (REPS) was introduced in May 1999. As a result, degraded commonages and designated areas were assessed according to guidelines in "Manual for the Production of Commonage Framework Plans" and recommendations on stocking reductions made as necessary n order to facilitate the restoration of these areas. Within the scheme, damage is assessed according to a 6 point scale ranging from U (undamaged) to S* (very severely damaged) and each point on this scale has an associated destocking level (see Appendix III). In addition to mapping the extent and severity of grazing damage within commonages, the habitats occurring within these areas was also indicated (see Appendix III). This appendix includes a break down of land containing blanket bog mapped as part of the CFP per county with % of commonage land and private land.

The following are some of the results produced by the CFPs as regards damage on commonage land and some private land containing blanket bog on its own or as a mosaic with other habitats:

**Tables 6.2 Grazing damage on land with 10km habitat distribution containing blanket bog mapped by CFP (2006).**

| Grazing damage | Commonage land extent (ha) | % | Private land extent (ha) | % | Total extent (ha) | % |
|---|---|---|---|---|---|---|
| U | 140,128 | 58.05 | 8,094 | 83.73 | 148,222 | 59.04 |
| MU | 43,205 | 17.90 | 673 | 6.97 | 43,878 | 17.48 |
| MM | 20,081 | 8.32 | 313 | 3.24 | 20,394 | 8.12 |
| MS | 15,860 | 6.57 | 226 | 2.33 | 16,086 | 6.41 |
| S | 10,052 | 4.16 | 70 | 0.73 | 10,122 | 4.03 |
| S* | 12,052 | 4.99 | 290 | 3.00 | 12,342 | 4.92 |
| | | | | | | |
| **Total** | 241,378 | 100 | 9,667 | 100.00 | 251,045 | 100.00 |

A total of 251,045ha of land were mapped by the CFP as containing blanket bog and other associated habitats (e.g. heath, grassland). As illustrated in table 6.2, 59.04% of these commonage land was assessed as undamaged and the remaining (40.96%) had certain level of damage, including 8.95% severally damage (S, S*). As illustrated in Table III.3 (Appendix III) counties Mayo and Galway, were the most impacted by overstocking with sheep, followed by Cork, Sligo, Leitrim and Donegal, etc.

**Tables 6.2: Damage from Overstocking affecting the National Resource of Blanket Bog.**

| | Extent (ha) | % of overall blanket bog containing land mapped as part of CFP (250,834ha) | % of overall blanket bog containing land with certain level of damage as mapped by the CFP (MU, MM, MS, S&S*) (102,644 ha) | % of overall blanket bog containing land assessed as severely damage by CFP (S&S*) /22,452ha) |
|---|---|---|---|---|
| **Hammond (1979) original report** | 773,860 | 32.41 | 13.26 | 2.90 |
| **Hammond (1979) digitised by Teagasc** | 835,325 | 15.98 | 12.29 | 2.70 |
| **Corine Land cover map (2000) (Intact + Exploited)** | 913,769 | 14.6 | 11.23 | 2.45 |
| **Teagasc soils map (2006) (Intact + Degraded)** | 636,530 | 20.95 | 16.13 | 3.53 |

As Table 6.2 shows the percentage of land containing blanket bog and associated habitats (e.g. Wet Heath and Dry Heath) with some level of damage from overstocking ranges from 11.23 to 16.13%. Furthermore, the level of damage was assessed as serious to very serious and the destocking level recommended is above 85% at approximately 3% of land containing blanket bog. It should be highlighted that 96.14% of the land mapped by the CFP is commonage.

In addition overstocking occurred mainly on many areas that would have been relatively intact prior to the increases in stocking rates from the early 1980s. According to Ryan and Cross (1984) the estimated area of intact bog remaining in the early 1980's was 517, 213ha. The percentage of blanket bog with some level of damage caused by overstocking is 19.84% and where damage has been assessed as in the severe to very severe condition classes it is 4.34%.

**Overstocking Trend**

The Rural Environment Protection Scheme (REPS) and National Farm Plan Scheme include measures devised to address the impacts of overstocking. Full implementation of these two schemes would be required to begin to reduce the widespread damage caused by overstocking. However in practice there are many factors that retard the rate of implementation of these schemes. Monitoring the results of stock reduction on one SAC revealed that although heather height showed an increase the spatial extent of erosion had registered also increase. It is considered likely that on reducing stock numbers vegetation cover will improve on areas that have not incurred severe damage however on actively eroding sites it is less optimistic.

**Wind Farm Developments**

There is a very significant overlap between sensitive upland areas (i.e. blanket bog and wet heath) and areas of highest average annual wind speeds, which therefore have a high potential to produce wind energy. The sensitive blanket peatlands are located in the west of Ireland or on high mountain ranges scattered throughout the country and many have been targeted for wind farm development. A competitive tendering process for the guarantee of electricity being purchased for the national grid strongly influences the siting of windfarms on the highest wind speed areas (coastal , uplands and western).

The main damage to blanket bog from the construction of wind energy farms is caused by the associated new roads that open these areas to vehicular access and a variety of potential damaging activities such as dumping of household waste, accidental fires, peat extraction or placement of grazing stock. Damage is also caused by service structures, drainage, soil conduits for power cables, turbine foundations and the erection of the route of support pylons for the power cable connection to the national grid. This damage, can spread over a large area of an upland site and caused significant hydrological disruption to blanket bog causing the commencement of erosional processes and the loss of *Active* peat growth in some areas.

The actual impact of wind farm developments on peat soils is occasionally underestimated as the major landslide event that occurred on Derrybrien (Co. Galway) in October 2003 illustrates, where almost half a square kilometre of bog travelled 2.5km down the mountain as a result of the excavations for the wind farm towers. An independent report by peatland scientists (Lindsay and Bragg 2005) concluded that the environmental impact assessment failed to consider the implications of constructing major infrastructure on peat bog.

Furthermore by building on blanket bog (massive carbon stores) greenhouse gases are released to the atmosphere by direct degradation (excavation and removal of bog vegetation and peat, erosion or peat slides) or by disruption of bog hydrology and capacity to form peat /store carbon). Thus, by impacting on carbon dynamics in peat soils in this way the construction of wind farms on blanket bog is likely to release greenhouse gases and impair the carbon sequestering function of the bog by impairing or causing the cessation of peat-formation. Recent results from a study, of a blanket bog at Ballygisheen, Co. Kerry funded by the EPA, show that this blanket bog is a carbon sink. (Kiely G.,…) Despite the fact that this site is relatively intact and of high conservation value it has been somewhat modified in significant areas by various activities (O' Connor 2006) and thus its carbon sequestering functioning is likely to be below potential.

**Wind Farm Developments Trend**

Development of wind energy projects has increased since the first windfarm was constructed in the early 1980s. O'Connor reported a total of 14 large scale wind farms developed in the Republic of Ireland in 2000. According to recent data provided by EirGrid (see Appendix IV, Appendix V-Map II) a total of 62 wind farms were connected to the national grid in September 2006 and additional projects are under *Active* consideration by planning authorities throughout the country. There has been a steady increase in the numbers of wind farms built and connected in the last five years, for instance 10 wind farms were connected to the grid within the first 9 months of 2006. Only two of the wind farms erected are contained within a designated site. However 18 of these project, which are built on peat soils, are located within a short distance (i.e. <2km) from a designated blanket bog and five additional wind farms are also located close to designated blanket bog but the exact location was not available. 39 of 56 wind farms mapped are located on blanket bog and within them 20 correspond to areas of relatively intact blanket bog. County Donegal, followed by Cork, Tipperary and Kerry are the counties with the higher number of connected wind farms. Carrane Hill Bog (NHA 2415) and Corrie Mountain (NHA2321) in the Leitrim-Sligo border are some of the sites with the higher pressure from wind farm developments.

To summarise, although blanket bog included in designated sites (i.e. NHA or SAC) are currently less affected by wind farm developments, on numerous occasions wind farms are located at the edge of designated sites that may have significant impacts on the status of blanket bog. Furthermore, wind farms have had serious impacts on undesignated blanket bogs and this is considered an increasing threat.

NPWS contributed to the formulation of Department of Environment, Heritage and Local Government Guidelines on Windfarms 2006 (for Local Authorities, planners, developers etc.).
**www.environ.ie/en/DevelopmentandHousing/PlanningDevelopment/Planning/PlanningGuidance/**

### 6.2. Peat Cutting

It has been estimated that approximately 45% of the blanket bog habitat has been lost or severely damaged by peat extraction (Foss, 1998) – see table 6.1. Most of this cutting has been carried out by private individuals for domestic consumption. Cutting by hand was the main method of extraction in the past. However, a decline in the production of hand cut turf has occurred since the early 1980's. The introduction of the Turf Development Act (1981), where scheme payments were made until 1993/94, intensified the harvesting of peat by providing grants for the development of privately-owned bogs. The grants supported the construction of turbary roads, drainage of turf plots and the purchase of machinery. New machinery was specially designed to exploit smaller areas of bogland. The use of sausage machines became widespread and it has a high negative ecological impact as the sub-vegetation layer of the bog is lost and the hydrology of the living layer of the bog surface (i.e. acrotelm) destroyed.

O'Connor (2000) mentioned that a greater amount of peat was extracted from small bogs by private enterprise than by either Bórd na Móna or other large scale commercial enterprises. The main large-scale commercial exploitation of blanket bog in Ireland was to supply peat-fuelled stations. Furthermore Conaghan et al. (2001) reported the dramatic rise in the use of the excavator method and hopper method of peat extraction on both blanket and raised bog since the mid-1980's.

Hammond in 1979 reported large areas of Lowland Blanket Bog cut for fuel purposes. Since the inception of Bord na Mona in 1946, 8,173ha of this peat type have been also developed for milled peat production.

**Peat cutting Trend**

As summarised by O'Connor (2000), manual peat extraction is declining, mechanical peat extraction is less quickly declining. However, the current increasing fuel prices may increase the demand for peat and make commercial peat exploitation competitive. Blanket peats are not longer used for peat-fuelled power stations.

### 6.3. Afforestation

Extensive, large-scale afforestation commenced in the early 1950's. A large amount of this planting was carried out on areas of Lowland Blanket peat in counties along the Atlantic seaboard (especially Galway, Mayo and Kerry). However substantial areas of upland blanket bog in the Wicklow Mountains, the Slieve Bloom Mountains, the Slieve Aughty Mountains, the Stacks and Mullaghareirk Mts, the Ballyhoura Mts., the Nagles Mts., the Blackstairs Mts, the Comeragh Mts, the Cuilcagh/Anieran mts, Boleybrack Mts, and extensive upalnds in Cork and Kerry and Limerick A dramatic increase in the area of forestry planted by private forestry companies has occurred since the mid-1980's and much of this planting has been grant-aided by the European Union. The afforestation of blanket bog has lead to the fragmentation of the habitat, which has been particularly severe in the eastern half of Connemara, the north-east of Co. Mayo and along the border between Kerry and Cork (Conaghan et al., 2001).

The afforestation of land marginal to agriculture was favoured by the Irish Government policy until the early 1990's. Planting was principally carried out in upland peat bog areas. The main tree species planted in the blanket bog habitat were Sitka Spruce (*Picea sitchensis*) and Lodgepole Pine (*Pinus contorta*).

By 1982 approximately 18% (c. 140,000 hectares) of the original blanket bog area had been lost to afforestation (Feehan and O' Donovan, 1996), while Foss in 1998 estimated that approximately 27% (c. 209,300 hectares) of the habitat had been afforested by the mid-1990s. Calculations based on the intersection of several GIS layers of data indicate that the extent of plantations prior to 1998 on blanket bog has a minimum value of 150,000ha (see Appendix VII). However, the latter figure is underestimating the actual extent of forestry on blanket bog.

As reported by Conaghan et al. (2001), Coillte Teoranta figures from 1999 show that 37% (i.e. 187,092 hectares) of the land in their possession can be classified as either virgin blanket bog or cutover blanket bog. Approximately 152,000 hectares of this land have been planted with conifers.

**Afforestation Trend**

Since the late 1990's there has been a significant reduction in the area of intact blanket bog planted due mainly to an EU stipulation that afforestation in receipt of EU grant aid must not damage the natural environment. Indeed, EU grant aid for private forestry, which is administered by the Forest Service of the Department of Agriculture and Food, is now withheld for some designated peatlands. According to the Forestry Service biodiversity strategy, areas designated as SAC or SPA are not considered for afforestation grants. NHAs may also be excluded if the proposed development is incompatible with their protection (McAree, 2002). Forest Service Forest Biodiversity Guidelines cite measures to protect existing habitats and wildlife and to maximise biodiversity of plantation forests.

Coillte Teoranta, has made a recent policy decision to cease planting on intact peatlands in its ownership principally on economic grounds. In addition, Coillte has also stated its commitments to the implementation of the Helsinki Process on Sustainable Forest Management (Coillte 1999). Nonetheless, private companies and individuals may still afforest designated blanket bog areas without albeit grant-aid and non-designated areas of blanket bog are still likely to be afforested with grant-aid.

In addition, any replantation on blanket bog may have serious negative effects on adjacent intact blanket bog (e.g. drying out processes, roads construction, heavy machinery circulation, etc). According to the Forest Service policy (Forestry and Wildlife Act 1946), any area of afforested land that is harvested should be replanted, including blanket bog, unless a derogation from the Forest Service is provided.

As summarised by O'Connor (2000), although the threat to blanket bog from afforestation is officially declining, private plantations are likely to occur on areas of non-designated blanket bog and are a threat to the habitat. Intact blanket bogs that lie outside NHAs and SACs are the most threatened.

### 6.4. Burning

According to O'Connor (2000), periodic controlled burning is a traditional management system of blanket bog and wet heath pasture in Britain and Ireland. This burning is carried out to promote new plant growth for grazing animals. This is carried out in the summer months and is associated with areas of high sheep stock densities. In Ireland the grazing animals are principally sheep and to a lesser extent cattle. Burning has declined in the west due to overstocking and overgrazing having remove much of the heather vegetation of the hills however in the Wicklow uplands it is an extensive and damaging activity that continues unabated. Its likelyhood of occurrence is increased by long dry periods as its damaging impact in terms of extent and penetration.

Controlled burning of peatlands for the management of Red Grouse is very limited in the Republic of Ireland in comparison to Britain and Scotland and is largely only conducted in eastern counties particularly in Co. Wicklow and to some extent in Co. Waterford and Co. Tipperary.

According to Conaghan et al. (2001) burning is a more serious problem in areas of Lowland Blanket Bog which have a relatively shallow (<2m) peat depth or have had their water table lowered by drainage. Burning is also more frequent in areas of upland blanket bog, such as the Wicklow Mountains, and heath areas adjoining Lowland Blanket Bog, where drier conditions exist and the cover of woody dwarf shrubs, especially *Calluna vulgaris*, may be high. A study of satellite imagery (MODIS EVI) reported by Connolly and Holden (IPS 2006) to determine if either peatland cover conversion or modification was occurring in the Wicklow Mts., detected possible change in a number of pixels (unspecified). Ground truthing of these discovered that 40 % of them were impacted, predominantly, by fires. Deliaberate burning and accidental fires are known to occur frequently and over extensive areas in this upland region in particular.

**Burning Trend**

With predicted climate change the loss of (10-15%) of summer precipitation may adversely affect the even spread of rain days throughout the year, important in the maintenance of *Active* blanket bog, and cause generally longer periods of summer drought. Summer drought will invariably cause a drying out of the bog surface, oxidation of peat, increased acidification of peat, an increase in aerobic microbial activity/decomposition and eventually a loss of *Active* peat formation, perhaps even initiating erosion of peat soils.

Summer drought and desiccation associated with predicted climate change is likely also to increase the likelihood of more frequent and more extensive, penetrating and hence damaging fires (Douglas pers.comm).

### 6.5. Land Reclamation for Agrciulture

Reclamation of areas of blanket bogland and associated habitats (e.g. Wet Heath) has been carried out since the early nineteenth century (Feehan and O' Donovan 1996). Hammond (1979) estimated that the total area of modified blanket bog in the country, which included large areas reclaimed to pastureland, was approximately 27% of the original by the end of the 1970s. Those areas of shallow peat and deep glacial and relict soils underlying peat soils, have been most reclaimed and are at most threat of future reclamation. Hammond also reported large areas of Lowland Blanket Bog around the Mullet peninsula and other location e.g. Co. Donegal have been reclaimed for agriculture in the past, after hand cutting ceased. In more recent times, the flat peatlands have been reclaimed for grassland.

O'Connor (2000) reports large areas of county Kerry as more suitable for reclamation and under greater threat than other areas. However, overall the threat of reclamation of these areas, which is not supported directly by EU or government subsidy, is considered to be low.

**Land Reclamation Trend**

To summarise, the threat to blanket bog arising from this activity is considered to be declining. However impacts from housing, industrial developments, quarries, urbanisation, windfarms and other infrastructural developments including roads and road improvements, are increasing..

### 6.6. Trackway Erosion/Tourism

The utilisation of tractor-drawn mechanical peat extraction machinery and All Terrain Vehicles (ATVs) on blanket bog has increased the occurrence of moderate to severe trackway erosion on areas of bog. Trackway erosion caused by tractors and tractor mounted machinery is intimately linked with turf -cutting activities. These activities are still confined to areas of the bog which are near to roadways and usually confined to within 500m – 1km of the nearest road. Meanwhile, trackway erosion caused by ATVs extends into the central regions of blanket bog complexes and in particular have an impact on areas of patterned mire. Use of four-wheel drive vehicles for recreational use in areas of upland blanket bog is also becoming popular.

Trackway erosion of blanket bog caused by tourist use of popular walking routes has been highlighted as a problem in Ireland since the beginning of the 1990s. Problems with erosion of upland blanket bog and Wet Heath habitats are for example associated with Wicklow Way walking route and along popular walking routes in the Connemara National Park. MacGowan (2000) has discovered that similar vegetation loss and erosion processes are associated with areas of heavily used walking trails as that for areas of seriously overgrazed blanket bog. The increase in popularity of hill walking in Ireland in recent years is likely to have increased the pressure on sensitive upland peatland and Wet Heath habitats. Paths and /or boardwalks to allow recovery of eroded walking paths though blanket bog and wet heath areas have in recent years been constructed by NPWS in Killarney National Park, Connemara National Park and by a co-operative initiative between the Mountaineering Council of Ireland and NPWS in the Wicklow Mountains National Park

**Trackway Erosion/Tourism Trend**
Trackway erosion is considered to an increasing threat to blanket bog habitat.

### 6.7. All terrain vehicles and increased access

Ease and speed of access to the most remote areas of the blanket bog has become possible with the arrival of ATVs. This increased access has encouraged shepherding of flocks deep in bogland, in areas that were previously lightly stocked. Increased access has also assisted the ease of illegal shepherding of flocks grazing on lands beyond the legal ownership of the shepherds. The ATV machines are also particularly damaging to areas of deep quaking and patterned blanket bog. Furthermore, the recent increased recreational use of ATVs further increases pressure on sensitive peatland habitats.

**All terrain vehicles and increased access Trend**

There is an increase in the threat to the habitat associated with this activity.

### 6.8. Climate Change

As summarised by O'Connor (2000) and noted by Sweeny (1997), the scenario developed for greenhouse-led changes in Irish Climate will have a pervasive effect on many aspects of environmental concern in Ireland over the next fifty years. Sweeny (1997) has produced a summary of a projected scenario of the Irish Climate for 2050 based on current climate trends and an analysis of past climatic processes:

**Table 6.3 Projected changes in Climate Pattern for Ireland for 2050 (Sweeny 1997)**

| | |
|---|---|
| Average annual temperature change ($^{o}$C) | +1.0 |
| Average annual precipitation | Little change |
| Average winter temperature change ($^{o}$C) | +0.5 |
| Average winter precipitation change | +5-10% |
| Average summer temperature change ($^{o}$C) | +1.5 |
| Average summer precipitation change | -5-10% |

Streefkerk and Casparie (1989) note that 'unconfined' or landscape level bog systems do not occur where the mean annual temperatures exceeds 11$^{0}$C (Schouten, Streefkerk and van der Molen 1992). The annual distribution of 'rain days' throughout the year is also important and an even spread of 'rain days' exceeding >200days per annum is needed for the maintenance of blanket bog systems. Specific climatic conditions in the western seaboard of Ireland where most areas of blanket bog occurs include, an average of >200 wet days, 1941-1960, (i.e. days with rainfall equal to or more than 1 mm per day), a mean annual air temperature of 10.0 $^{O}$C, 1951-1980 (Collins and Cummins 1996) and annual mean rainfall of *circa* 1359 mm (Fitzgerald, 1984).

Therefore the impact of the expected change in Irish climate may have a deleterious effect on the conditions favourable to the *Active* blanket bogs which pertain at present in the west of Ireland.

Changes of a general 1$^{o}$C rise in annual temperature may push Ireland to the very limit of conditions favourable for the development of blanket peatlands, as 11$^{o}$C mean annual temperature has been found to be the limit for the development of blanket bog systems (Schouten, Streefkerk and van der Molen 1992). The loss of (10-15%) of summer precipitation may also adversely affect the even spread of rain days throughout the year, important in the maintenance of *Active* blanket bog, and cause generally longer periods of summer drought. Summer drought will invariably cause a drying out of the bog surface, oxidation of peat, increased acidification of peat, an increase in aerobic microbial activity/decomposition and eventually a loss of peat forming capacity and in combination with increased extreme weather events is likely to lead erosion of blanket bog

**Climate Change Trend**

Climate change is an increasing threat to Blanket Bog, through predicted increases in average temperatures, possible decreases in summer precipitation and increases in winter precipitation.

Non-native or non-blanket bog species may colonise the blanket bog habitat in response to drying out. These could include conifers from forest plantations on blanket bog such as Lodgepole pine (*Pinus contorta*) and Sitka spruce (*Picea sitchensis*) or Birch (*Betula pubescens*) or other tree species. Wet Heath species may come to dominate at the expense of the more hydrologically sensitive species such as certain *Sphagna* (especially lawn and pool species) and Sundews (*Drosera anglica* and *D. intermedia)* and other aquatics such as *Utricularia* sp. and *Potomogeton polygonifolius*.

The UK/Ireland MONARCH (Modelling Natural Resources Responses to Climate Change) Research Program supported by NPWS and UK nature conservation agencies assessed future climate suitability for selected species and habitats and included a case study of blanket bog habitat in an SAC that occurs on the border between the North of Ireland and the Republic of Ireland at Cuilcagh Mts/Pettigo Plateau (counties Donegal/Cavan/Fermanagh/Leitrim). Of the plant species modelled (*Empetrum nigrum, Eriophorum vaginatum, Sphagnum cuspidatum, Scirpus cespitosum, Rhynchospora alba, Betula pubescens,* and *Pteridium aquilinum*) all except 2 two were predicted by the model to experience a reduction in suitable climate space especially in the southwest of Ireland. The exception was *R. alba and P. aquilinum* which was predicted to gain suitable climate space*. P. aquilinum* and *B. pubescens* were included as potentially invasive species on blanket bog. However MONARCH emphasises that assessments of impacts requires consideration of many other factors including phenology, community compositions, land use, competition from invasive species and the effects of extreme weather events. It also states that there will be many other indirect impacts on biodiversity as other sectors, such as agriculture, forestry planning, water and coastal management adapt in the face of climate change. Policies must include conserving and restoring the existing biodiversity resource; reducing other sources of degradation such as pollution and inappropriate habitat management and developing ecologically resilient landscapes through reducing habitat fragmentation. MONARCH reports are available on www.ukcip.org.uk.

The susceptibility of eroding or poorly vegetated tracts of blanket bog to major landslides has been demonstrated by a number of recent landslide events and such events are likely to increase with predicted extremes of weather accompanying climate change. For example drought periods are likely to cause desiccation and peat shrinkage resulting in fissuring of peat especially on areas with depleted vegetation cover or impaired hydrology e.g. resulting from overstocking, drainage or other damaging activivity. If drought periods are followed by extreme rainfall events rain can rapidly infiltrate fissures and lead to peat slides.

### 6.9. Site Inspection Form Results

Regional NPWS Management is responsible for patrolling designated sites and enforcing relevant legislation (e.g. Habitats Directive 92/43 EEC or the Wildlife Act). NPWS Conservation Rangers are required to summarise information collected on the integrity of sites within their areas during the course of their duties. They are given the responsibility for reporting the information required under the Site Inspection Reporting (SIR) programme. Reporting is carried out on a three yearly cycle that began in 1998.

The Research Branch Monitoring Section (NPWS) developed the SIR programme to be used as a monitoring tool. Local NPWS staff log the following info: activities occurring on the site and their effects on the site's integrity, follow-up actions including all outcomes such as prosecutions, notifiable actions and positive management undertaken and site patrolling frequency and purpose.

The results given by the SIR reporting programme confirm that mechanical removing of peat, drainage and burning are some of the most frequently reported activities negatively affecting the habitat. However, a series of other negatively impacting activities were also reported with various degrees of intensity. These activities are:

| Activity | Code |
|---|---|
| ▪ Cultivation | 100 |
| ▪ Mowing/cutting | 102 |
| ▪ Fertilisation | 120 |
| ▪ Grazing | 140 |
| ▪ Overstocking with cattle | 143 |
| ▪ Removal of scrub | 52 |
| ▪ Stock feeding | 171 |
| ▪ Taking/Removal of flora, general | 250 |
| ▪ Quarries | 301 |
| ▪ Disposal of household waste | 421 |
| ▪ Energy transport | 510 |
| ▪ Pipe lines | 512 |
| ▪ Other pollution or human impacts/activities | 790 |
| ▪ Landfill, land reclamation and drying out, general | 800 |
| ▪ Management of aquatic and bank vegetation for drainage purposes | 811 |
| ▪ Invasion by a species | 954 |
| ▪ Other natural processes | 990 |

## 7. Future Prospects

### 7.1. Negative Future Prospects

Peat cutting: Although , peat cutting by hand has greatly declined, widescale mechanical extraction continues to impact on the habitat and intensity may increase in responsee to any increases in fuel prices. Predicted drought periods accompanying climate change may also encourage this activity as easier drying would reduce the effort, labour and time involved in the drying process.

Overgrazing: Notwithstanding reductions in grazing levels, peat erosion is likely to continue on heavily damaged sections of blanket bogs Furthermore climate change predictions, of somewhat drier summers and wetter winters and rain on fewer raindays but with more intense ranfall events, pose a major threat to the stability of damaged blanket bog via landslides. A number of landslides including one major one have occurred in the winter of 2006/07 in north Connemara and south Mayo; both regions are severely damaged by overstocking.

The likelihood of pine and spruce trees (*Pinus contorta* and *Picea sitchensis*) spreading, from the extensive plantation on blanket bog, through seeding out onto unplanted areas of blanket bog is high if climate change predictions result in a drier bog surface. New plantations on blanket bog are unlikely to occur to any significant extent although there is as yet no officially stated forestry policy against this.

Damage from motorised vehicles, roads and tourism/recreation is an increasing problem.

### 7.2. Positive Future Prospects

Blanket bogs are protected through designation, the EIA Directive and national planning law. Management plans for bog habitats have been drawn up and more are in preparation and consultation. Local authority biodiversity plans, now being formulated, may increase the status of blanket bogs and list them for protection in Development Plans. Guidelines on forestry developments may also limit damage to non-designated blanket bog.

Stocking rates of livestock in Ireland, particularly in more remote areas, are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (SFP). As long as the market value of hill sheep remains low, there is little incentive for farmers to maintain large flocks in the uplands.

Payment under the SFP requires the farmer to keep lands in "Good Agricultural and Environmental Condition".

### 7.2.2. Rural Environment Protection Scheme (REPS)

REPS is an EU-funded scheme for environmentally sensitive farming, introduced in 1994, that operates in 5-year contracts with the farmer. It includes agreed prescriptions for grazing of blanket bog and related habitats. The Scheme is administered by Department of Agriculture, Food and Forestry.

Implementation of CFP recommendations on stock reductions is obligatory in REPS.

Recovery potential varies but it is expected that moderately damaged areas will improve vegetation cover within a reasonable time frame. It is not clear as yet whether the measures will be sufficient for actively eroding areas.

### 7.2.3. National Farm Plan Scheme (NFPS)

In February 2006 NPWS launched a 5 year National Farm Plan Scheme (NFPS) for designated areas (SACs, SPAs) and commonage. The Scheme is intended as a complementary initiative to REPS, aimed ast farmers who do not to join the REPS scheme.

The implementation of the Farm Plan Scheme has the potential to further reduce damage on blanket bog caused by farming activities, particularly overstocking.

In the Owenduff/Nephin SAC, farmers were required by law in 2006 to enter into a farm plan under REPS or the NPWS scheme in order to reduce the effects of overgrazing. Such measures may be introduced in other areas if monitoring shows that the current, voluntary measures are insufficient.

### 7.2.1 Afforested Blanket Bogs Restoration Project

#### Redesigning Western Peatland Forests Project (Developing Management Guidelines)

This project aims to identify areas in the western seaboard from Donegal to Kerry, where forestry should be replaced with alternatives more in keeping with the local sensitivities and EU Directives. In the western seaboard Coillte own approximately 126,000ha of western peatland that contains mostly planted land with a small portion unplanted. These are mainly blanket bog with some raised bog and wet and dry heath habitats. 43,000ha of the previously mentioned land are deemed uneconomic and unsustainable forest. The *Redesigning Western Peatland* project looks for alternatives to continued forest activity within this land, including habitat restoration. Some of these areas are in or adjoining statutory designated areas. According to the prescriptions for western peatland forest approximately 3,500ha of these 43,000ha will be managed for bog restoration and protection. A similar extent is being considered for the purpose of creating wider buffer zones for rivers for or establishing native woodland along riparian zones.

The management strategy for these 43,000ha was agreed in principle in 2004 with the Forest Service in the document "Strategy for the Future Managements of Low Production Forests (Western Peatland Forest)". However there is not operational agreement with the Forest Service on how this strategy will be put in place (Coillte, April 2006).

#### Restoring *Active* Blanket Bog irishbogsrestorationproject.ie

This project, initiated 2002 and due for completion end 2007, is included within the EU LIFE Nature Programme for the promotion of nature conservation. It was set up by Coillte Teo. (semi-state forestry company) and is aimed at restoring *Active* bog on 20 Coillte properties, partially or wholly afforested, within or adjacent to candidate SACs and encompassing 1988 ha.

This project attempts to reverse degradation processes on these sites and over time create a high quality area of *Active* blanket bog by:

- Fencing to gain stock control of open bog areas,
- Ditch blocking to improve the integrity of the bog hydrological systems,
- Deforestation to arrest degradation of the blanket bog,
- Removal of seeding plantation trees from areas of open bogs.

This project may serve to demonstrate that restoration of degraded blanket bog to *Active* blanket bog is a feasible management options on certain areas of afforested blanket bog (depending on degree of original nature of site and the impact of afforestation etc).

### 7.2.4. Industrial Blanket Bog Restoration Project

In 2006 Bord na Móna completed blanket bog rehabilitation works in the area of Oweninny (north-west Mayo) that started in 2001. This area, whose approx. extent is 6,500ha, was harvested for milled peat to supply the electricity generating station at Bellacorick that commenced in the 1950's and ceased operating in 2003. The restoration works included the blocking of drains and ridging of gravel hills and slopes which encourage the stabilisation of peat through acceleration of re-vegetation, mitigation of silt run-off and restoration of peat-forming conditions through rewetting of suitable areas. The report of this work states that a monitoring program of the results of the project will take place and that core areas of peat forming vegetation are already emerging within the cutaway bog (Farrell, 2006). Some drain blocking work has also been carried out by Bord na Mona on blanket bog at the former peat harvesting sites at Bangor Erris also in north Mayo.

### 7.3. Overall Habitat Future Prospects

Many positive management actions have been put into place in order to protect blanket bog and encourage the formation of new areas of Active Blanket Bog habitat. However a series of impacting activities (i.e. overstocking, peat cutting and wind farm developments) continue threatening the habitat particularly in undesignated sites. Furthermore, climate change predictions may reduce the capacity of peat areas to *Active*ly form peat, which increases the importance of current areas covered by the habitat.

It is too early to say that the measures will have sufficient effect in the reporting period 2007-13. Therefore it is concluded that the habitat is still moderately threatened and slowly declining. Long-term viability is not yet not assured and thus its conservation status is assessed as **Bad**.

## 8. Overall Assessment of the Habitat Conservation Status

The habitat conservation status has been assessed at four different levels or attributes:

- The Range is taken to be favourable.
- The Area however has declined since 1994 and is assessed as Unfavourable-Bad.
- An assessment of Unfavourable-Inadequate has been given to the habitat structure and functions and typical species as a result of damage in the 1980s and 1990s especially, followed more recently by measures to protect the habitat and reverse damage.
- Because recovery may be very slow, and some measures in place are not yet proven to work, future prospects for the habitat are considered to be poor and rated as Unfavourable-Bad. Hence, the overall habitat conservation status of Blanket Bog and Active Blanket Bog is **Bad**.

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**APPENDIX I**

**BLANKET BOG DISTRIBUTION MAPPING**

The mapping of the distribution of blanket bog in a 10km grid has been mainly based on a combination of a suite of mapping sources (e.g. Hammond (1979), Corine Land Cover (2000) and Teagasc soils map (2006)) and ecological factor maps (altitude and rainfall requirements necessary for the development of the habitat). All these sources were available in a digital format compatible with Arcview 3.2.

The following are the main ecological requirements considered essential for the development of blanket bog employed in the mapping of its distribution for which digital maps were available:

- Average rainfall greater than 1200mm per year. Met Eireann provided average rainfall maps in a 1km grid format and those grids with average rainfall greater than 1200mm were selected.
- The three blanket bog sub-categories, described by Schouten (1984), develop at different altitudes: Lowland Blanket Bog below 150m, Highland Blanket Bog between 150 and 300m and Mountain Blanket Bog above 300m. Contour lines maps were provided by the Ordnance Survey and those corresponding to 150m and 300m were selected.

Those grids containing blanket bog as mapped by any of the main mapping tools (i.e. Hammond (1979), Corine (2000), Teagasc soils map (2006) and Conaghan et al. (2001)) where the appropriate ecological conditions occur were selected as potential areas of blanket bog. The opposite process was also undertaken; those areas deemed blanket bog by the mapping sources where the appropriate ecological conditions do not occur were ruled out after its absence was confirmed on the 2000 aerial photographs. On the other hand, the pre-selection of areas suitable for the habitat based on average rainfall and altitude has been essential to find records of the habitat not reported by any of the mentioned sources.

The following are the steps taken to produce the 10km grid square distribution map for blanket bog:

1. Grid squares containing blanket bog according to Hammond (1979), Corine (2000) and Teagasc soils map (2006) and in addition feature an average rainfall over 1200mm/year and altitude over 150m (where Highland and Mountain bog develop) are considered to definitely contain the ecosystem. Furthermore, the presence of blanket bog was visually verified on the 2000 aerial photographs. Conaghan et al. (2001) also verified the occurrence of blanket bog on all these grid squares but 29, where the occurrence of the habitat is confirmed by the 2000 aerial photograph. The presence of blanket bog in areas below 150m was assessed under point 5 below.
2. Grid squares where none of the above occur (none of the 4 sources indicate the presence of blanket bog and the rainfall average is less than required) were excluded. Blanket bog is deemed absent in these grid squares.
3. Conaghan et al. (2001) reported the occurrence blanket bog in 63 grid squares where some of the other three mapping sources do not show the presence of the ecosystem. Hammond (1979) did not record blanket bog at 29 of these 63 squares; Corine does not indicate the presence of blanket bog at 11 squares and the Teagasc soils map does not indicate the presence of the ecosystem on 17 of the 63 squares. Hence, the presence or absence of the habitat on these 63 grid squares had to be verified on 2000 aerial photographs.

4. The 2000 aerial photographs have been essential to confirm the presence of the ecosystem in those grid squares where only one or some of the mapping sources indicate the occurrence of blanket bog. A wide range of situations were found:

- Blanket bog only recorded by one of the sources:

  a) Hammond (1979): Grid square M59 at Mullaghanooe - Co. Roscommon; R71 - Co. Limerick; H50&N59 (E 259055 - N 299802) - Co. Cavan. Hammond considered the later area as "Man modified montane blanket bog". Currently scattered pieces of peaty soil are visible on the 2000 aerial photograph. However the average rainfall ranges between 1030-1050mm/year and thus is less than required for blanket bog, the altitude is greater than 200m and thus more typical for blanket bog than raised bog.

  b) Corine land cover (2000): W29 - Co. Cork; R43 (E 144615 - N 136262) - Co. Limerick; S88, 89, 96 & T29 - Co. Wicklow; N79 "Cairr Mountain" (E 272158 - N 295923), H40 (E 246257 - N 300752) & N49 (E243700- N 296914) in Co. Cavan. In the latter, Corine illustrates the presence of blanket bog in two isolated areas above the 300m the first one and above 250m the second one. The rainfall average is below required (1050 – 1070mm/year). H72 (E 278448 - N 326582) in Co. Monaghan. Corine also indicates the presence of blanket bog in this grid square. However, the average rainfall, that is approx. 1050mm/year, is below the typical for blanket bog and the altitude is just above 150m. Although it is mapped as part of Map I, this site is likely to correspond to transitional raised bog along a south–north variation instead the typical east-west transition. Thus, further fieldwork is required to determine the type of habitat present on this site.

  c) According to Conaghan et al. (2001), Foss and O'Connell reported the presence of blanket bog at M79 -Co. Sligo/Roscommon in 1996. None of the other sources indicate the presence of the habitat in this location and mires present within this square are more likely to correspond to transitional raised bog as indicated by Corine land cover (2000). In addition, the average rainfall, which ranges between 1080 and 1130mm/year, is less than 1200mm, necessary for the development of blanket bog.

     Foss and O'Connell (1996) also reported the presence of blanket bog at the south-east of Co. Cork (W97). None of the other sources indicate the occurrence of the habitat within this square grid. There is an area on the north-western corner of this grid square where the appropriate average rainfall (>1200mm/year) and altitudinal (>150m) conditions occur. However, blanket bog is absent on the aerial photograph and thus the habitat is not present in this grid square. Corine indicates the presence of Highland Blanket bog at X08, to the north-east of W97. This area also features the conditions necessary for the development of blanket bog. Furthermore, the 2000 aerial photograph shows an area that resembles blanket bog. The 1900's 6 inch map also illustrates peat soils on this section of East Cork. Hence, this section is likely to correspond to very degraded blanket bog. An area of conifer forestry to the west of this section named Ballycolman (W98 / E199800 – N84070) is also likely to correspond to very degraded - afforested blanket bog. These sections of blanket bog are part of a much larger blanket bog area stretching west-east along Cork and Waterford, which is partially allocated within the Nagle's mountains. Further records of degraded blanket bog are also found in adjacent grid squares as part of the same complex. They are listed in point f below.

- Blanket bog recorded by more than one source:

  a) Conaghan (1979) and Teagasc soils map (2006): M46&56 "Slieve Dart" - Co. Galway. Here blanket bog corresponds to the Lowland subtype and features borderline characteristics with transitional raised bog (i.e. average rainfall 1170-1190mm/year and altitude < 150m). W47-Co. Cork that contains scattered and degraded sections of blanket bog, which form the eastern boundary of a large area of blanket bog

  b) Conaghan et al. (2001) and Corine (2000): L56 - Co. Galway; L68 - Co. Mayo and O20, 21, T18 - Co. Wicklow.

  c) Conaghan et al. (2001) and Hammond (1979): R72 - Co. Limerick

  d) Hammond (1979) and Teagasc soils map (2006): S67 - Co. Laois. Only the Teagasc soils map recorded the presence of what is likely to be a very degraded (afforested) blanket bog area at S56 "Mountnugent" (E 257939 – N 164726) in Co. Kilkenny, located to the south-west of grid square (S67). Scattered sections of blanket bog are likely to also occur at S66 (east of S56). The Teagasc soils map indicates the occurrence of blanket bog and the average rainfall is appropriate to develop the habitat (i.e.>13000mm/year). The altitude of this area indicates that this section of degraded blanket bog may support both Highland and Mountain Blanket Bog.

  e) Hammond (1979) and Corine land cover (2000): S39 - Co. Laois

  f) Corine land cover (2000) and Teagasc soils map (2006): although Conaghan et al. recorded blanket bog at J11- Co. Louth. Corine and soil maps indicate that it stretches further into two other grid squares (J01& J10). Thus, blanket bog is found covering large areas of Anglesey Mountain, Black Mountain and Carlingford Mountain. R 83&87, S02 - Co. Tipperary; S74&75 - Co. Carlow. Grid squares X18, 19&28 - Co. Waterford and R80, W59, 69, 79, 58, 68, 78&88 (part of Nagle's Mountains) - Co. Cork, contain areas that are likely to be very a large complex of degraded blanket bog. The annual average rainfall and the altitude are the appropriate to support Highland Blanket Bog.

  g) Conaghan et al. (2001), Corine land cover (200) and Hammond (1979): M08 - Co. Mayo; Q73 - Co. Kerry where the bog stretches right to the seashore in Q63 and across Q72, R51, V82, 92 - Co. Cork; R62 - Co. Limerick; R9, S32&33 - Co. Tipperary; S11 - Co. Tipperary/Waterford, and T17- Co. Wicklow.

h) Conaghan et al. (2001), Corine land cover (2000) and the Teagasc soils map (2006): L63&66, M05, 51, 61&70 - Co. Galway; V39 - Co. Kerry; R31, W27& 37 - Co. Cork and S98 - Co. Wicklow**.**

i) Conaghan et al. (2001), Hammond (1979) and Teagasc soils map (2006): Q85 - Co. Clare; V73&W23 - Co. Cork where the habitat is rather degraded and scattered.

All the grid squares mentioned above contain sections where the appropriate average rainfall (> 1200mm/year) occur and the altitude is adequate to develop both Highland Blanket Bog and Mountain Blanket Bog (>150m).

Hammond (1979) reported the occurrence of blanket bog in a series of grid squares where the digitised version of Hammond's map does not show the presence of the habitat. However, Corine land cover (2000) and/or the Teagasc soils map (2006) indicate the occurrence of the habitat within some of these grid squares. The discrepancy between records on Hammond's digitised map and those found by Conaghan et al. (2001) in the hard copy of the Hammond map may be due to errors in the digitising process. As can be seen on the 2000 aerial photograph many of these areas of blanket bog, not recorded in the digitised copy of the Hammond Map, occur at the edge of extensive areas of the ecosystem and the grid squares only contain small sections of blanket bog.

5. The occurrence of blanket bog in areas where the adequate average rainfall occur and the altitude is less than 150m (appropriate to hold Lowland Blanket Bog) was also illustrated by some of the mapping sources and subsequently visually verified on the 2000 aerial photographs.

a) Reported by all the four mapping sources: B71, G12, 14,21,33, H28, F63, L55, 82, 92, M12, 14, 22, 23, R05, 15, 25.

b) Hammond (1979) and the Teagasc soils map (2006) indicate the presence of Lowland Blanket Bog at F62 (An Geata Mhor - Co. Mayo). As it can be appreciate on the aerial photograph and indicated by Hammond, this area of blanket bog is highly modified.

c) Hammond (1979), Teagasc soils map (2006) and Corine (2000): R78 - Co. Clare; G53&65 - Co. Sligo; F61, 64& 74 - Co. Mayo.

d) Corine (2000) and Teagasc soils map (2006): B94, C04, 20, 21, 29, 31& 35 - Co. Donegal.

e) Corine (2000): L46 - Co. Galway; V59 - Co. Kerry. Corine map also indicates the presence of scattered sections of blanket bog at S52&62 (Co. Kilkenny). These sections however are above 150m are characterised by an average rainfall ranging between 1130 and 1160mm/year that is slightly less than the one required.

6. Special attention was given to those grid squares where only one of the mapping sources indicates the occurrence of the habitat. Occasionally these areas do not correspond to blanket bog:

- Corine land cover (2000) indicates the occurrence of small sections of blanket bog on the southeast of Roscommon). The average rainfall is less than required and these areas correspond to raised bog habitat not blanket bog. Similar scenario was found in some grid squares in Co. Westmeath & Longford.
- Although Hammond (1979) digitised map indicates the presence of Low-Level Atlantic Blanket at H10&11 (Co. Leitrim). The average rainfall is below 1000mm/year and the altitude is more appropriate for raised bog. Thus, this peatland area that is mainly reclaimed land, is likely to be a degraded raised bog rather than blanket bog. The Hammond digitised map also indicates the presence of blanket bog at W34 (Co. Cork). Although the average rainfall seems adequate for the occurrence of the habitat, the 2000 aerial photograph does not show peat soils. Hammond also illustrated the presence of blanket bog in Q64, 74&96 (peninsula of Loop Head (Co. Clare)). Only reclaimed agriculture land is currently found on these areas previously allocated to blanket bog.

d) The Teagasc soils map (2006) illustrates the presence of peat soils along the eastern border of Co. Roscommon (soil type 63 – cutaway), which stretches towards the centre of Co. Sligo. The average rainfall is 1,250mm/year and the altitude is mostly below 150m. Hence, only those areas above 150m are likely to contain blanket bog (i.e. Highland subtype). Those areas below 150m are likely to correspond to transitional raised bog, and so were depicted by Hammond in 1979. The corresponding grid squares are G40,50,60&61; M 15,16.

Conaghan et al. (2001) reported the presence of blanket bog in 351 grid squares, whereas after following the process underlined above at total of 442 squares were found to potentially contain blanket bog. Although, he mentioned the high accuracy of the results, he also pointed out certain limitations such as the lack of representation of cutaway or reclaimed blanket bog for a long period of time (i.e. greater than 100 years) in his final map.

Discrepancies between Hammond (1979), Corine and Teagasc soils map (2006) were frequently found. In some of the geographical locations one of the previous maps may depict more accurately the extent of blanket bog, whereas the other maps either under or overestimate blanket bog. In certain locations (e.g. northwest Mayo) all the three maps show a rather similar extent and distribution of the habitat.

# APPENDIX II

## SOURCES OF DATA

### A. Digitised Peatland Map of Ireland - Hammond (1979)

Hammond's *Peatland Map of Ireland* (1979) is the most comprehensive over-view of the distribution of peatlands in Ireland at the end of the 1970s. Hammond mapped the mire subtypes described by Moore (1962).

Hammond's map is based on data from several sources, principally the detailed soil map data from the National Soil Survey carried out by An Foras Talúntais since 1968, these maps covered 10 counties fully and 2 counties partially. Aerial photographs from 1973/74 together with site visits covered the rest of the country. No aerial cover existed however for county Donegal and parts of counties Sligo, Cork, Waterford and Louth. Hammond acknowledges that the these counties were not covered by the same detailed reconnaissance field sheets as the other counties and were mapped principally on the basis of the far cruder 1920 peat map for Ireland. Indeed, as noted by O'Connor (2000), obvious gaps occur in these counties. For example the Nagle's Mountains Co. Cork and Carlingford Mountain Co. Louth are some areas of upland blanket bog that were not included (note that Corine (2000) and the Teagasc soils map (2006) recorded these areas – Appendix I). Some areas outside these poorly inventoried counties include some large examples of blanket peat, e.g. to the north of Doughruagh hill Connemara, which were overlooked by Hammond's study (J. Conaghan pers comm.). Areas of central Co. Limerick, near Killfinnane which are outlined as areas of Lowland Atlantic Blanket Bog and also some areas of central Co. Leitrim also mapped as areas Lowland Atlantic Blanket Bog are well outside the 1,250mm isohyet line which delineates areas of sufficient rainfall for blanket bog development. Therefore, these delineated areas must also be considered as inaccuracies in the peatland map.

The Peatland Map of Ireland (1979) divided Blanket bog into six sub-types:

1. Blanket bog Machine Peat
2. Blanket bog High Level Montane type (>150m)
3. Blanket bog Low Level Atlantic type (<150mm)
4. Blanket bog Man Modified Atlantic type
5. Blanket bog Man Modified Montane type
6. Blanket bog Milled Peat

Hammond (1979) defined blanket bogs as having peat depth of >45cm on undrained land and at a depth >30cm on drained land. According to O'Connor (2000), this definition poses problems as includes very large areas of the related wet-heath habitat. Some areas of dry-heath habitat were also accidentally mapped, e.g. parts of Bere Island, Co. Cork where Dry Heath occurs as in mosaic with areas of Wet Heath. All these related habitats were mapped in with the blanket bog categories of the Peatland Map of Ireland.

It is thus apparent that there are some problems with the overall accuracy of the Peatland Map of Ireland. In some areas it appears that the peatland cover is underestimated and in some areas overestimated. However, it must be regarded as a very well informed estimate of peatland cover for Ireland and as the only national peatland map, which has been methodically produced and which specifically targets peatlands.

Although Hammond maps categorised mires (i.e. blanket bog, raised bog and fen) according to the level of disturbance (i.e. man modified, milled peat, moss peat) the current status of those sites considered unmodified is likely to have changed since 1979. Hammond's maps are therefore not reliable for identifying the current site status due to the impact of the Turf Development Act (1981-1995) supported projects and private afforestation grant aids. However, Hammond's map is considered to be the most accurate national map available for indicating the location of peat soils. In the particular case of blanket bog and associated habitats (e.g. Wet Heath and Dry Heath) serious widespread over-stocking of uplands which occurred since the 1980s.

The soil division of Teagasc digitised the original Hammond's Peatland Map of Ireland (1979) and this copy was used as part of this project assessment. There are discrepancies in the extent of the habitat between both versions. According to the original figure given by Hammond (1979) the overall extent of blanket bog was 773,860ha and as per the digitised map by Teagasc 835,325ha.

### B. Corine Land Cover Map (2000)

Corine land cover (CLC) is a map of the European environmental landscape based on interpretation of satellite images. It provides comparable digital maps of land cover for each country for much of Europe. The CLC 2000 project in Ireland forms part of the update of land cover maps for the whole of Europe, which has been co-ordinated by the EEA (European Environmental Agency) with the co-operation of the Environmental Protection Agency (EPA). The CLC 2000 database was created by first assessing and correcting the existing CLC 1990 land cover database and images for geometric and thematic content, followed by mapping land cover changes using 2000 satellite imagery and ancillary data. According to the EPA (2004), the CORINE project provides a coarse quantification of land cover in Ireland.

CLC (2000) is based on a simple 3-level hierarchy classification system consisting of 44 land cover classes. The land cover inventory was conducted at a scale of 1:100,000 and the minimum area digitised in the 2000 version of CLC is 25 ha. Additional work was undertaken for some habitats, as regards blanket bog at levels 4, 5 & 6.

Blanket bog was divided into Upland, Lowland and Mountain Blanket Bog at level 5 and these sub-classes were again divided into Exploited and Intact (level 6). According to (O'Connor, 2000), Hammond's (1981) definition of blanket bog as being peatland areas with >45cm peat depth were included into the blanket bog category and much use was made of the Peatland Map of Ireland (1979) in the allocation of peat bog coverage. Although Heaths and Wet Heaths up to 45 cm depth were covered by the land cover category "Moors and Heathland" the blanket bog category includes areas of these habitat with peat depths inferior than 45cm (O'Connor, 2000).

It has been found that Corine Mountain Blanket Bog, which generally is above 300m, mainly corresponds to Mountain Blanket Bog according to Schouten (1984) and that Corine Upland Blanket bog is likely to be Highland Blanket bog defined by Schouten (altitude between 150-300m). This comparison is rather broad as East-West and North-South geographical variations should be considered.

As reported by O'Connor (2000), ground-truthing of the satellite data for this project was limited and the scale of land cover as 1:100,000 was of broad resolution. Therefore, the resulting map cannot be taken as representing a wholly accurate map of Irish land cover categories for any mapped land cover category e.g. for Peat bogs or Moors and Heaths.

Corine land cover map for blanket bog can only be taken as an indicative representation of the distribution and extent of the habitat. Thus, the overall extent of the habitat given by Corine should only be taken as part of a range of extent values. The total extent of blanket bog, once rectified its values by eliminating those areas outside its distribution (see Appendix I) is 913,769ha. The extent of conifers on blanket bog[1] (149,730ha) should be added to this figure. Therefore, the total extent of blanket bog according to Corine land cover is 1,063,499 ha (see table II.1 below). A detailed breakdown of blanket bog figures per county is given below in table II.1.

**Table II.1 Summary of Corine (2000) blanket bog land cover and level of damage sorted by County.**

| County | Corine blanket bog area (ha) | Intact blanket bog (ha) | % of total blanket Bog | Exploited blanket bog (ha) | % of total blanket bog | Corine afforested blanket bog (ha) | Total blanket bog degraded (exploited + afforested) | Total blanket bog extent (ha) |
|---|---|---|---|---|---|---|---|---|
| Carlow | 3,234 | 1,363 | 42.16 | 1,870 | 57.84 | 319 | 2,190 | 3,553 |
| Cavan | 15,926 | 8,154 | 51.20 | 7,773 | 48.80 | 1,138 | 8,910 | 17,064 |
| Clare | 22,427 | 7,398 | 32.99 | 15,029 | 67.01 | 18,765 | 33,794 | 41,192 |
| Cork | 68,271 | 37,913 | 55.53 | 30,358 | 44.47 | 7,770 | 38,128 | 76,041 |
| Donegal | 185,523 | 137,227 | 73.97 | 48,296 | 26.03 | 28,523 | 76,819 | 214,046 |
| Dublin | 3,258 | 2,531 | 77.67 | 728 | 22.33 | 29 | 757 | 3,287 |
| Galway | 116,020 | 88,263 | 76.08 | 27,758 | 23.92 | 24,757 | 52,515 | 140,778 |
| Kerry | 160,867 | 110,619 | 68.76 | 50,248 | 31.24 | 15,396 | 65,644 | 176,263 |
| Kilkenny | 1,420 | 570 | 40.12 | 850 | 59.88 | 380 | 1,230 | 1,800 |
| Laois | 4,571 | 4,107 | 89.85 | 464 | 10.15 | 2,540 | 3,004 | 7,111 |
| Leitrim | 22,492 | 14,832 | 65.94 | 7,660 | 34.06 | 4,180 | 11,840 | 26,672 |
| Limerick | 10,877 | 3,236 | 29.75 | 7,641 | 70.25 | 4,001 | 11,642 | 14,878 |
| Louth | 2,146 | 1,834 | 85.47 | 312 | 14.53 | 21 | 333 | 2,167 |
| Mayo | 191,017 | 88,101 | 46.12 | 102,915 | 53.88 | 28,131 | 131,046 | 219,148 |
| Meath | 31 | 31 | 100.00 | 0 | 0.00 | 0 | 0 | 31 |
| Offaly | 1,797 | 1,710 | 95.17 | 87 | 4.83 | 551 | 638 | 2,348 |
| Roscommon | 876 | 472 | 53.84 | 404 | 46.16 | 357 | 761 | 1,233 |
| Sligo | 29,134 | 14,981 | 51.42 | 14,153 | 48.58 | 7,407 | 21,559 | 36,540 |
| Tipperary | 16,946 | 12,899 | 76.12 | 4,047 | 23.88 | 2,503 | 6,550 | 19,449 |
| Waterford | 10,914 | 9,104 | 83.42 | 1,810 | 16.58 | 690 | 2,500 | 11,604 |
| Westmeath | 35 | 35 | 100.00 | 0 | 0.00 | 0 | 0 | 35 |
| Wexford | 2,943 | 1,259 | 42.79 | 1,684 | 57.21 | 75 | 1,758 | 3,018 |
| Wicklow | 43,047 | 23,590 | 54.80 | 19,457 | 45.20 | 2,197 | 21,654 | 45,244 |
| **Sub-total** | **913,769** | **570,227** | **62.40** | **343,542** | **37.60** | **149,730** | **493,272** | **1,063,499 *** |

**Note:** *This figure is obtained by adding the overall Corine blanket bog area (913,769ha) to the estimated Corine afforested blanket bog (149,730ha).

[1] Corine does not include conifers on blanket bog as part of the blanket bog category. It was found that land-cover classes "Coniferous forestry" and "transitional woodland scrub" contained conifers on blanket bog. Thus, the intersection of these two land cover classes with soil types (63 & 65) was used as one of the methods to estimate the cover of coniferous plantations on blanket bog. The results show that 149,730ha of peat soils 63 and 65 are covered by coniferous plantations. Although, this figure is only an estimate, it is rather similar to the one obtained in section 6.4. Thus, it can be use to calculate the overall extent of blanket bog (see section 4).

### C. National Soils and Parent Material Map – Teagasc (2006)

Teagasc recently (2006) finalised the "National Soils and Parent Material Map" under the Irish Forest Soils Project. This research utilised up to date satellite Imagery, aerial photogrammetry and ground-truth investigations to produce an accurate and up to date assessment of the soil cover of Ireland with a aim of highlighting areas suitable for forestry development in the Republic of Ireland. Areas of bog with peat depths greater than 1m were mapped by this survey (O'Connor, 2000). Mapping of peat was based on "parent material dominates"; this means that any peat classes that appears in the soil map has been transferred directly from the sub-soils map. Peat soils were classed as:

**Table II.2 Peat soils**

| IFS code | IFS soil | |
|---|---|---|
| **61** | RsPt | Raised Bog (the 1995 1:40,000 aerial photography) |
| **63** | BktPt | Blanket peat unless cutover/cutaway |
| **65** | Cut | Cutaway/cutover peat (blanket or otherwise) |
| **66** | FenPt | Fen Peat (from Duchas database of fen sites) |

Soil types 63 and 65 are found to largely represent blanket bog and thus are used to assess the distribution and extent of this ecosystem. However, they also contain areas allocated to other ecosystems and these areas were subtracted in order to depict exclusively blanket bog soils. The process followed to select blanket bog areas is outlined below:

**Selection of areas of peat soil type 63 as potential areas of blanket bog:**

This peat soil type highly corresponds with areas where blanket bog has developed and is currently present (including the three subtypes considered by Schouten (1984): Lowland, Highland and Mountain).

Once a comprehensive blanket bog distribution map has been produced (following process outlined in Appendix I) those sections of soil type 63 included in grid squares where blanket bog was proved to be absent were ruled out and therefore not considered to calculate the overall blanket bog extent. Within those grid squares where blanket bog is present, it is possible that sections of 63 within grid squares where the blanket bog is present those sections of soil type 63 where the average rainfall in less than required (1200mm/year) were also excluded (2621ha). The original extent of this soil subtype was 760,908.3 ha and the rectified extent is 755,916.79ha.

**Selection of areas of peat soil type 65 as potential areas of blanket bog:**
This soil type represents both blanket and raised bog and within the former it seems to mainly represent areas of Lowland Blanket Bog than of Highland or Mountain Blanket Bog. The selection has consisted in an eliminatory process:

1. Those sections of this peat soil type where the average rainfall is less than 1,250mm/year were ruled out, as this is the average rainfall required for the occurrence of Lowland Blanket Bog.
2. Only those areas of type 65 falling into 10km grid squares where the presence of blanket bog has been confirmed were kept (Appendix I). Those areas where blanket bog was proved to be absent were ruled out. The absence of blanket bog in these grid squares has been confirmed by other sources (e.g. 2000 aerial photographs).
3. Those sections of type 65 that overlay under the raised bog category of peatlands according to Hammond (1979) peat soils were also excluded.

The overall extent of soil type 65 is 568,692ha. As a result of the selection process only 26,226ha of soil type 65 were considered to correspond to blanket bog soils.

Soil types 41 (AminPDPT) "Poorly drained mineral soils with peaty topsoils derived from mainly non-calcareous parent materials" and 43 (AminSRPT) "Shallow, lithosolic-podzolic type soils potentially with peaty topsoils - predominantly shallow soils derived from non-calcareous rock or gravels with/without peaty surface horizon" also contain large sections of blanket bog. However, they also include large areas of mineral outcrops, and low depth peat soils that will be allocated to other habitats (i.e. Wet Heath, Dry Heath, and grasslands). Because of the difficulty to differentiate those areas with deeper peat soils from the rest, (task that is outside the scope of this project). It was deemed inappropriate to include these two soil types as part of the extent of blanket bog as it would definitely overestimate its value. Hence, only type 63 & 65 are taken into account to estimate the extent of the habitat.

**D. The distribution, on a 10km square basis, of selected habitats in the Republic of Ireland - Conaghan, J. (2001)**

This consisted on a desktop survey of the distribution, on a 10km basis, of 9 nationally important habitats within the Republic of Ireland. The author used a series of sources to determine the presence or absence of the selected habitats. In the particular case of blanket bog, much of the distribution was obtained from the blanket bog surveys conducted by NPWS in the late 1980's and early 1990's and the Peatland Map of Ireland (Hammond, 1979).

The data was available on a Word document and was input in an excel sheet that was converted into a dbf file which eventually was exported to Arcview 3.2. This allowed us to visualise the Conaghan et al. (2001) records on a 10km grid.

**E. Annual average rainfall - Met Eireann**

The Irish National Meteorological Service (Met Eireann) provided these data which consists of 1km-resolution annual average precipitation values. These were derived from approximately 400 Met Eireann stations covering the period 1961-90. The gaps between the 400 stations were filled using a trend surface based regression approach.

The files were received in an adf format and they were converted into shp format compatible with Arcview 3.2.

These data have been essential to refine Map I by pre-selecting those areas within the three main mapping sources (Hammond (1979), Corine (2000) and Teagasc soils map (2006)), where the average rainfall is appropriate for the development of blanket bog. Those areas where the precipitation is not the appropriate for the development of blanket bog were ruled out.

**F. Commonage Framework Plans – Department of Agriculture & Food and the National Parks and Wildlife Service (NPWS).**

The Department of Agriculture & Food and the NPWS have produced the Commonage Framework Plans (CFPs) and NHA/SAC/SPA stocking and damage assessments. These plans crudely describe the habitats, condition of the land (level of damage - see Appendix III), land use and plant species found in each sub-unit of each agricultural unit. Depending on the condition of the land, a % de-stocking is recommended and a time-frame suggested for recovery of the land.

Common ownership of large areas of unfenced bogland is the principal type of land ownership in the western peatland and upland peatlands of Ireland. Thus, up to 80% of all land in Connemara and west Mayo is commonage (O'Connor, 2000). According to the maps produced by the CFP the overall extent of commonage land in Ireland is approximately 438,000ha (see table III.2 below). As per our calculations 241,167ha of the mentioned commonage land contains blanket bog on its own or as a mosaic with other habitats (e.g. Wet Heath, Dry Heath, upland grassland, etc) within a total of 18 counties. It should be pointed out that blanket bog has been mainly mapped as a mosaic with other habitats. In addition, the mapping of the habitat was done at a crude level and the main mapping criteria was damage level and not habitat type. Thus, the extent of blanket bog within commonage land given previously is overestimated.

The CFPs provide an indication of the damage status of blanket bog on commonage land, which can be used to ascertain the conservation status of structure and functions of this habitat.

Dúchas and the Department of Agriculture (1999) included a pragmatic use of peat depth to separate bog and heath as part of the methodology adapted for the assessment of stock impacts on blanket bog (O'Connor, 2000). Peat depth was one of the main factors used to distinguish these habitats as illustrated in the following table.

**Table II.3 Peat depths in relation to habitat category**

| Peat depth | Habitat |
|---|---|
| <15cm Peat | Dry Heath |
| 15-75cm Peat | Wet Heath |
| >75cm Peat | Blanket Bog |

From 'Manual for Production of Commonage Framework Plans
Dúchas and Department of Agriculture and Food (1999)

**G. Blanket Bog NHA Survey Derwin *et al*. (2003)**

The objective of this project was to propose, map and describe blanket bogs for formal NHA designation.

80 sites were identified as meriting NHA designation, which encompass a total area of 43,109ha. In addition to habitats such as heaths, fens, turloughs and woodlands, these sites contain a total of c. 34,074ha of blanket bog habitat, of which 27,704 ha are estimated to consist of relatively unmodified blanket bog.

As reported by Derwin *et al.* (2004) there are 50 SACs designated for protection of blanket bog habitat. The estimated area of blanket bog within this suite of 50 SACs was 150,750 ha. This is equivalent to c. 19% of the original resource of 773,860 ha as estimated by Hammond (1979).

Habitat maps produced as part of Derwin *et al*. (2003) project were added to Map I.

**H. Habitat Assignment Project (NPWS, 2006)**

This desktop project was undertaken by NPWS and the main aim was identifying and listing habitats listed in the Annex I of the Habitats Directive (92/43/EEC) reported within a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, Aerial photographs, NGO proposals, etc.

As regards blanket bog all the records listed within the "Habitat Assignment Project" were already mapped on Map I (see Appendix I). Derwin *et al.* (2003) survey already reported many of these records. Nevertheless, blanket bogs listed within this project were mapped by generating centroids of the designated site boundary (using NHA, cSAC or SPA digitised files) where the habitat is present. It was decide not to consider the whole site boundary as representing the habitat as it would skew the result to over-representing the amount of blanket bog present (as each site does not contain 100% blanket bog). Due to the difficulty to distinguish blanket bog present on the 2000 aerial photographs and thus produce habitat maps, a site centroid was considered adequate to depict the location of the habitat.

The "Habitat Assignment Project" identified 7 locations of blanket bog (included in designated sites) for which a digitised boundary was never produced. A centre point was drawn roughly in the centre of the site using the hard copy of the site boundary as a reference and with the aid of the 6" (1900s) map overlaid. These 7 sites are: Derrean Bog pNHA (1887) (Cork/Kerry) / Glencar Cliffs pNHA (628) (Sligo) / Liffey Head Complex pNHA (726) (Wicklow) / Ballynultagh Bog (1896) (Wicklow) / Brockagh Bog (1949) (Wicklow) / Cloghoge Bog (1951) (Wicklow) / Nagles Mountains pSPA (4163) (Cork).

**I. NPWS Enquiries Database**

This is a comprehensive NPWS internal database, which includes data on designated sites and habitats contained within them. As regards blanket bog, 4 entries were used from this database as all other entries were already reported by previous sources such as the Habitat Assignment Project (NPWS 2006) and/or Commonage Framework Plans.

These 4 records of blanket bog were mapped as part of the Map I.

**J. Management Plans maps digitised (Management Plans Support Unit - MPSU)**

MPSU provided digitised habitat maps for 16 sites containing blanket bog. These maps, which were available in a vector format suitable for GIS – Arcview 3.2, were also added to the Map I.

**K. 2000 Aerial photographs**

The 2000 orthorectified aerial imagery provided by "Ordnance Survey of Ireland" was essential to confirm the presence of blanket bog on areas where other sources already indicated its occurrence and/ or the annual average rainfall and altitudinal conditions indicate so.

**L. The distribution, ecology and conservation of Blanket Bog in the Republic of Ireland (Conaghan et al., 2001).**

This report presents an overview of the information gathered through seven blanket bog surveys carried out by the Wildlife Service between 1987 and 1991.

The main purpose of these surveys was to assess the extent, composition and condition of blanket bog sites, with a view to identifying the best areas for conservation. These surveys were mainly concentrated in the more extensive Lowland/Highland Blanket Bogs of counties Mayo, Galway, Donegal and Kerry, however a selection of Mountain Blanket Bog sites were also visited.

All the locations of blanket bog contained in this report were already given by other sources mentioned above e.g. Management Plans or "*The distribution, on a 10km square basis, of selected habitats in the Republic of Ireland"* (Conaghan, 2001).

## APPENDIX III

## COMMONAGE FRAMEWORK PLANS DATA

The CFPs mapped the extent and severity of grazing damage within agricultural sub-units. The criteria use to assess the level of damage and the resultant destocking levels is given below (table III.1). In addition the habitats occurring within these areas were also mapped. The following habitats were recognised during the Commonage Framework Plan surveys and their symbols are indicated within brackets:

| | |
|---|---|
| (I) | Blanket bog |
| (II) | Wet Heath |
| (III) | Dry Heath (includes maritime) |
| (IV) | Upland grassland |
| (V) | Other habitats |
| (VI) | Improved grassland |
| (VII) | Dune |
| (VIII) | Unimproved wet grassland |
| (IX) | Unimproved dry grassland |
| (X) | Fen/Marsh/Swamp |
| (XI) | Saltmarsh |
| (XII) | Beach/Shingle/Reef/Shore |
| (XIII) | Limestone Pavement / Grassland |
| (XIV) | Limestone Pavement (>75%) |
| (XV) | Scrub |
| (XVI) | Permanent open water (turlough) |

**Table III.1 Criteria for the assessment of damage and the resultant destocking levels (Conaghan et al., 2001).**

| Damage category | Condition of vegetation/amount of bare soil | Suggested destocking level |
|---|---|---|
| Undamaged (U) | Vegetation not grazed or only very lightly grazed. No bare ground present. | 0% destocking |
| Moderate to undamaged (MU) | <5% bare ground. Grazing usually evident, but damage only just detectable. | 30% destocking |
| Moderately damaged (MM) | <5% bare ground. Signs of damage intermediate in intensity between MU and MS. | 50% destocking |
| Moderate to severely damaged (MS) | <5% bare ground. Damage widespread and obvious. | 65% destocking |
| Severely Damaged (S) | >5% bare ground. Damage due to grazing obvious and widespread. | 85% destocking |
| Very Severely Damaged (S*) | >10% bare ground with abundant evidence of high grazing levels. | 100% destocking |

Commonage land containing blanket bog either on its own or as a mosaic with other habitats was mapped by the CFP surveys at eighteen counties. The CFP also mapped blanket bog on its own or as a mosaic within private land at three counties (see table III.2). Overall 250,834ha of land was mapped by the CFP as containing blanket bog or blanket bog mosaic and levels of damage was given to these areas. Within this figure 241,167ha correspond to commonage land.

Although the CFP maps also illustrate some areas of blanket bog outside the blanket bog map of range and distribution (Map I). These areas, which extent is 1,984.59ha, correspond to raised bog instead blanket bog and are not included table III.2.

The extent of blanket bog per county calculated by Hammond in 1979 is also included in table III.2 in order to give an estimation of the proportion of blanket bog contained within commonage land per county.

**Table III. 2 Commonage Framework Plans Statistics within mapped Blanket Bog Habitat Range**

| County | Hammond report area (ha) | % of total extent of blanket bog | Hammond digitised (Teagasc) | % of total extent of blanket bog | Total CFP (ha) | CFP units containing blanket bog (ha) | CFP blanket bog on Commonage land (ha) | CFP blanket bog on Private land (ha) |
|---|---|---|---|---|---|---|---|---|
| **Carlow** | 850 | 0.11 | 860 | 0.1 | 2,638 | 68 | 68 | 0 |
| **Cavan** | 3,185 | 0.41 | 9,587 | 1.15 | 5,064 | 4,216 | 4,216 | 0 |
| **Clare** | 46,831 | 6.05 | 47,738 | 5.72 | 5,817 | 2,431 | 2,431 | 0 |
| **Cork** | 74,198 | 9.59 | 81,548 | 9.78 | 22,645 | 19,882 | 19,882 | 0 |
| **Donegal** | 149,033 | 19.26 | 160,307 | 19.22 | 79,770 | 49,156 | 49,156 | 0 |
| **Dublin** | 469 | 0.06 | 1,634 | 0.2 | 2,320 | 747 | 747 | 0 |
| **Galway** | 96,831 | 12.52 | 103,382 | 12.4 | 70,194 | 43,938 | 43,812 | 126 |
| **Kerry** | 81,157 | 10.49 | 88,731 | 10.64 | 66,436 | 44,650 | 44,650 | 0 |
| **Kildare** | 0 | 0 | 0 | 0 | 1,520 | 192 | 192 | 0 |
| **Kilkenny** | 405 | 0.05 | 694 | 0.08 | 662 | 26 | 26 | 0 |
| **Laois** | 5,241 | 0.68 | 5,201 | 0.62 | 1,635 | 1,462 | 1,462 | 0 |
| **Leitrim** | 35,513 | 4.59 | 36,915 | 4.43 | 13,261 | 10,152 | 10,152 | 0 |
| **Limerick** | 18,827 | 2.43 | 18,998 | 2.28 | 2,373 | 1,025 | 1,025 | 0 |
| **Longford** | 0 | 0 | 0 | 0 | 365 | 0 | 0 | 0 |
| **Louth** | 0 | 0 | 0 | 0 | 3,158 | 1,762 | 1,762 | 0 |
| **Mayo** | 182,494 | 23.59 | 194,832 | 23.36 | 108,801 | 66,091 | 61,944 | 4,147 |
| **Meath** | 0 | 0 | 0 | 0 | 111 | 0 | 0 | 0 |
| **Monaghan** | 1,416 | 0.18 | 1,500 | 0.18 | NA | 0 | 0 | 0 |
| **Offaly** | 2,533 | 0.33 | 2,977 | 0.36 | 335 | 37 | 37 | 0 |
| **Roscommon** | 1,190 | 0.15 | 958 | 0.11 | 1,590 | 551 | 551 | 0 |
| **Sligo** | 29,562 | 3.82 | 31,809 | 3.81 | 13,702 | 4,920 | 4,920 | 0 |
| **Tipperary** | 14,691 | 1.9 | 15,357 | 1.84 | 11,071 | 2,889 | 2,889 | 0 |
| **Waterford** | 11,343 | 1 | 12,272 | 1.47 | 6,499 | 3,885 | 3,885 | 0 |
| **Westmeath** | 0 | 0 | 0 | 0 | 113 | 0 | 0 | 0 |
| **Wexford** | 162 | 0.02 | 1,141 | 0.14 | 2,350 | 133 | 133 | 0 |
| **Wicklow** | 15,633 | 2.02 | 17,485 | 2.1 | 15,340 | 21,903 | 12,711 | 9,192 |
| **Other machine areas** | 2,075 | 0.27 | | | 0 | 0 | 0 | 0 |
| **Totals** | **773,638** | **100** | **833,926** | **100** | **437,770** | **280,117** | **266,651** | **13,466** |

*Note that these figures represent blanket bog and other habitats (e.g. Wet Heath, Dry Heath and upland grasslands) mapped as a mosaic within each agricultural sub-unit.

**Table III. 3 Grazing impact assessment on land with blanket bog as mapped by CFPs within mapped Blanket Bog Habitat Range**

| County | U | | MU | | MM | | MS | | S | | S* | | Total (ha) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (ha) | % BB* | (ha) | % BB* | (ha) | % BB* | (ha) | % BB* | (ha) | % BB* | (ha) | % BB* | |
| **Carlow** | 2 | 6.97 | 30 | 93.03 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 33 |
| **Cavan** | 3,092 | 81.01 | 494 | 12.94 | 89 | 2.34 | 126 | 3.31 | 0 | 0.00 | 15 | 0.40 | 3,816 |
| **Clare** | 2,183 | 99.04 | 17 | 0.77 | 4 | 0.19 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 2,204 |
| **Cork** | 5,837 | 63.91 | 1,209 | 13.24 | 574 | 6.29 | 541 | 5.92 | 689 | 7.55 | 282 | 3.09 | 9,132 |
| **Donegal** | 36,788 | 75.00 | 6,145 | 12.53 | 2,762 | 5.63 | 2,459 | 5.01 | 625 | 1.27 | 271 | 0.55 | 49,049 |
| **Dublin** | 1,076 | 87.02 | 95 | 7.68 | 65 | 5.29 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1,236 |
| **Galway** | 24,329 | 53.48 | 8,796 | 19.34 | 4,530 | 9.96 | 3,811 | 8.38 | 1,874 | 4.12 | 2,149 | 4.72 | 45,488 |
| **Kerry** | 17,401 | 67.99 | 3,895 | 8.56 | 1,434 | 5.60 | 1,829 | 7.15 | 786 | 3.07 | 248 | 0.97 | 25,593 |
| **Leitrim** | 8,120 | 74.41 | 1,132 | 10.37 | 325 | 2.98 | 504 | 4.62 | 727 | 6.66 | 104 | 0.96 | 10,912 |
| **Limerick** | 264 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 264 |
| **Louth** | 397 | 86.11 | 64 | 13.89 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 461 |
| **Mayo** | 26,663 | 34.77 | 20,063 | 26.16 | 9,305 | 12.13 | 6,556 | 8.55 | 4,889 | 6.37 | 9,215 | 12.02 | 76,691 |
| **Roscommon** | 835 | 94.25 | 47 | 5.36 | 0 | 0.00 | 4 | 0.40 | 0 | 0.00 | 0 | 0.00 | 885 |
| **Sligo** | 6,930 | 77.50 | 398 | 4.45 | 780 | 8.72 | 248 | 2.78 | 531 | 5.94 | 55 | 0.62 | 8,943 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tipperary** | 502 | 96.41 | 10 | 1.86 | 0 | 0.00 | 0 | 0.00 | 9 | 1.73 | 0 | 0.00 | 521 |
| **Waterford** | 894 | 82.34 | 192 | 17.66 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 1,085 |
| **Wexford** | 5 | 34.07 | 9 | 65.93 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 14 |
| **Wicklow** | 12,897 | 87.64 | 1,284 | 8.72 | 525 | 3.57 | 8 | 0.06 | 1 | 0.01 | 1 | 0.01 | 14,716 |
| | | | | | | | | | | | | | |
| **Totals** | **148,212** | | **43,879** | | **20,394** | | **16,085** | | **10,131** | | **12,342** | | **251,043** |

*This column illustrates the % of land mapped by CFP (both commonage and private) containing blanket bog (on its own or as a mosaic) according to the level of damage.

## APPENDIX IV

## DISTRIBUTION OF WIND FARMS IN RELATION TO BLANKET BOG

A distribution map (see Map II – Appendix V) of the current wind farms connected to the National Grid in the Republic of Ireland has been produced based on the list of wind energy suppliers provided by EirGrid (http://www.eirgrid.ie). EirGrid plc is the independent electricity Transmission System Operator (TSO) in Ireland and the market operator in the wholesale electricity trading system. The list includes a total of 62 connected wind farms until September 2006 (see table IV.1 below). The table includes the name of the wind farm that mostly corresponds with the townland where the wind farm was erected.

For those projects connected before 2000, the exact location of the wind farm was confirmed on the year 2000 aerial photographs. However those projects connected after 2000 were mapped based on townland. A more accurate location of the project was not available. Although the mapping of the location of some of the wind farms is rather coarse, the townland identification and following location on the map allowed us ascertain the location of these projects in relation to the distribution of blanket bog. Only 56 of the 62 wind farms were mapped. Five of the un-mapped wind farms are actual extensions of those mapped (e.g. Meenanilta (1) was mapped but not Meenamilta (2)). Arklow Banks wind farm, which was connected after 2000, is offshore and it was not possible to gauge the location, as it does not appear on the 2000 aerial photographs.

The mapping of the wind farms and comparison against the distribution of blanket bog and particularly blanket bog designated sites (i.e. NHAs or SACs) and 2000 aerial photographs gave the following results:

- 20 of the 56 wind farms mapped are located on relatively intact blanket bog; 9 on degraded blanket bog (i.e. mainly drained) and 3 on blanket bog cutaway. The occurrence of blanket bog is unknown at 7 of the wind farms but these areas are likely to contain a mosaic of blanket bog with other habitats. 17 wind farms were built in areas where blanket bog is absent. Thus, overall 39 wind of 56 farms are located in areas corresponding to blanket bog. The overwhelming majority of the windfarms are on uplands.

- Two wind farms, which were connected in 1997, are currently located within NHAs designated for blanket bog (Golagh within NHA 2375 (Co. Donegal) and Kilronan Mountain within NHA 617 (Co. Roscommon). 18 wind farms are located near (i.e. mostly <2km) NHAs or SACs. A further five wind farms are located near or within NHAs or SACs, the exact location could not be confirmed. The remaining 31 farms are far from a designated blanket bog but some are located on blanket bog.

- County Donegal is the county with the largest number of wind farms (11), followed by Cork (8), Tipperary (6), Kerry (5), Galway (4), Mayo (4), Leitrim (3) Roscommon (3), Sligo (3), Clare (2), Cavan (2), Wexford (2), Carlow, Louth and Wicklow with one wind farm each.

- NHAs Carrane Hill Bog (2415) and Corrie Mountain (2321) in the Leitrim –Sligo border are the two sites designated for blanket bog with the highest pressure from wind farms. Indeed, two wind farms (Black Banks (1) and Corrie Mountain on the plateau of the blanket bog) although excluded from the Corrie Mountain NHA are within this blanket bog.

- The following are some of the examples of specific wind farms that are likely to be threatening blanket bog: Two wind farms were erected on relative intact blanket bog, according to the 2000 aerial photographs, adjacent to SAC 2301 "River Finn" (Co. Donegal). Another wind farm was built on blanket bog adjacent to Fawnboy Bog (SAC 140) also in Donegal. A large wind farm was erected along the Monaghan-Cavan border along the site boundary of Slieve Rushen Bog (NHA 009) and other one to the south of the site (Corneen wind farm King's Mountain windfarm is located on blanket bog adjacent to Ox Mts. SAC, Co. Sligo). Derybrien wind farm is located within less than 600m from Slieve Aughty Bog (NHA 1229) in county Galway.

- Landslides and or peat slides have occurred during construction of several windfarms including Derrrybrien, Moneenatieve, Kilronan and Sonnagh Old. (As reporting of slides is not mandatory this is a not a comprehensive record of recent landslide occurrences). As a result of a major landslide on blanket bog and heath at Pollatomish (not windfarm related) and the major bog landslide that occurred at Derrybrien Windfarm in 2003 Geological Survey Ireland have established a landslides register and also published a report on Landslides in Ireland. (Irish Landslides Working Group, 2006) which collates information on the historic and reported recent landslide events and attempts to identify susceptibility factors or risk of landslides in the future.

- As table IV.1 below illustrates there has been a steady increase in the number of wind farms built in the last 4 years. Thus, whereas 6 were connected in 2003, 12 in 2004, 10 in 2005 and 10 until September 2006.

**Table IV.1. TSO and DSO connected Wind Farms in September 2006 (source EirGrid)**

| 110kV Node | Wind Farm Name | MEC (MW) | Year of Connection | Location in relation to blanket bog | Location in relation to designated sites (NHAs or SAC) within blanket bog |
|---|---|---|---|---|---|
| | | | | | |
| **TSO Connected:** | | | | | |
| Agannygal | Derrybrien (1) | 60.0 | 2005 | Degraded blanket bog | Near NHA 1221 |
| Booltiagh | Booltiagh (1) | 19.5 | 2005 | Degraded blanket bog | Near NHA 2367 |
| Coomagearlaghy | Coomagearlahy (1) | 42.5 | 2006 | No | Outside |
| Crane | Ballywater (1) | 31.5 | 2005 | No | Outside |
| Cunghill | Kingsmountain (1) | 23.8 | 2003 | On blanket bog | Near SAC 2006 |
| Drumkeen | Meentycat (1) | 71.0 | 2004 | On blanket bog | Near NHA 2301 |
| Golagh | Golagh (1) | 15.0 | 1997 | On blanket bog | Within NHA 2375 |
| **Total Installed TSO** | | **263.2** | | | |
| **DSO Connected:** | | | | | |
| Ardnacrusha | Curraghgraigue | 2.6 | 2004 | Unknown | Outside |
| Ardnacrusha | Mienvee | 0.7 | 2004 | No | Outside |
| Arigna | Corrie Mountain | 4.8 | 1997 | On blanket bog | Within or near NHA 2321 |
| Arigna | Kilronan (1) | 5.0 | 1997 | On blanket bog | Within NHA 617 |
| Arigna | Spion Kop (1) | 1.2 | 1997 | Degraded blanket bog | Near NHA 617 |
| Arklow | Arklow Banks (1) | 5.2 | 2003 | Offshore | Offshore |
| | Kealkil (Curraglass) | 8.5 | 2006 | Unknown | Near NHA 2386 |
| Bandon | Kilvinane (1) | 4.5 | 2006 | No | Outside |
| Bellacorick | Bellacorick (1) | 6.5 | 1992 | On blanket bog cutaway | Near SAC 1922 |
| Binbane | Burtonport Harbour (1) | 0.7 | 2003 | No | Outside |
| Carlow | Cronelea Upper (1) | 2.6 | 2005 | No | Outside |
| Castlebar | Burren [Mayo] - Lenanevea | 2.1 | | On blanket bog | Near NHA 2383 |
| Castlebar | Cuillalea West (1) | 3.4 | 2004 | On blanket bog | Outside |
| Castlebar | Raheen Barr (1) | 8.7 | 2003 | On blanket bog | Near NHA 2383 |
| Cath_Fall | Anarget (1) | 2.0 | 2001 | Unknown | Near SAC 165 |
| Cath_Fall | Anarget (2) | 1.1 | 2004 | Unknown | |
| Cath_Fall | Meenadreen (1) | 3.4 | 2003 | Blanket bog and heath | Near NHA 2375 |
| Corderry | Altagowlan (1) | 7.6 | 2005 | On blanket bog | Within or near NHA 2321 |
| Corderry | Black Banks (1) | 3.4 | 2001 | On blanket bog | Within or near NHA 2321 |
| Corderry | Black Banks (2) | 6.8 | 2005 | Unknown | |
| Corderry | Geevagh (1) | 5.0 | 2006 | Degraded blanket bog | Within or near NHA 2415 |
| Corderry | Moneenatieve (1) | 4.0 | 2005 | On blanket bog | Within or near NHA 2321 |
| Crane | Kilbranish (Greenoge) (1) | 5.0 | 2005 | Unknown | Outside |
| Dallow | Carrig (1) | 2.6 | 2006 | No | Outside |
| Dallow | Skehanagh (1) | 4.3 | 2006 | No | Outside |
| Drybridge | Dunmore (1) | 1.7 | | No | Outside |
| Dunmanway | Coomatallin (1) | 6.0 | 2005 | Degraded blanket bog | Outside |
| Dunmanway | Curabwee (1) | 4.6 | 1999 | No | Outside |
| Dunmanway | Lahanaght Hill (1) | 4.3 | 2006 | Degraded blanket bog | Outside |
| Dunmanway | Milane Hill (1) | 5.9 | 2000 | Unknown | Outside |
| Galway | Inis Mean (1) | 0.7 | 2002 | No | Outside |
| Galway | Inverin (Knock South) (1) | 3.3 | 1999 | On blanket bog | Near SAC 2034 |
| Glenlara | Taurbeg (1) | 5.3 | 2006 | On blanket bog cutaway | Outside |
| Ikerrin | Ballinlough (1) | 2.6 | 2006 | No | Outside |
| Ikerrin | Ballinveny (1) | 2.6 | 2006 | No | Outside |
| Knockeragh | Gneeves (1) | 9.4 | 2005 | On blanket bog | Outside |
| Letterkenny | Cark (1) | 5.0 | 1997 | On blanket bog | Near NHA 2301 |
| Letterkenny | Cronalaght (1) | 5.0 | 1997 | On blanket bog | Near SAC 140 |
| Letterkenny | Culliagh (1) | 1.9 | 2000 | On blanket bog | Near SAC 2301 |
| Letterkenny | Meenanilta (1) | 2.6 | 2004 | Degraded blanket bog | Outside |
| Letterkenny | Meenanilta (2) | 2.5 | 2004 | Unknown | |
| Meath Hill | Gartnaneane I & II | 5.0 | 2004 | No | Outside |
| Shankill | Corneen (1) | 3.0 | 2001 | On blanket bog | Near NHA 0009 |
| Somerset | Sonnagh Old (1) | 7.7 | 2004 | On blanket bog | Near SAC 1913 |
| Tonroe | Largan Hill (1) | 5.9 | 2000 | On blanket bog | Outside |
| Tralee | Beenageeha (1) | 4.0 | 2000 | On blanket bog | Outside |

| | | | | | |
|---|---|---|---|---|---|
| Tralee | Mount Eagle (1) | 5.1 | 2004 | Degraded blanket bog | Outside |
| Tralee | Tursillagh (1) | 15.2 | | Degraded blanket bog | Outside |
| Tralee | Tursillagh (2) | 6.8 | 2004 | Unknown | |
| Trien | Beale (1) | 1.7 | 2000 | No | Outside |
| Trien | Beale (2) | 2.6 | 2003 | Unknown | |
| Trillick | Crockahenny (1) | 5.0 | 1998 | On blanket bog | Near NHA 2405 |
| Trillick | Drumlough Hill (1) | 4.8 | 1997 | On blanket bog cutaway | Outside |
| Tullabrack | Moanmore (1) | 2.6 | 2004 | No | Outside |
| Wexford | Carnsore (1) | 1.9 | 2002 | No | Outside |
| **Total Installed DSO** | | **335.4** | | | |

TSO (Transmission System Operator); DSO (Distribution System Operator)

## APPENDIX V

## MAP OF THE DISTRIBUTION OF CONNECTED WIND FARMS (MAP IV)

## APPENDIX VI
## GRID SQUARES CONTAINING A SAC OR NHA DESIGNATED FOR *ACTIVE* BLANKET BOG (MAP V)

## APPENDIX VII

### ESTIMATION OF THE EXTENT OF FORESTRY PLANTED ON BLANKET BOG

An accurate assessment of the extent of forestry plantations on blanket bog cannot be carried out, mainly because of the absence of a comprehensive map of the ecosystem extent. However, an approximate assessment of the intensity of plantations on blanket bog can be based on the intersection of those FIPS (Forest Inventory and Planning System) 1997-98 parcels dominated by conifers forestry (also including areas where planting grants have been approved or clearing carried out) with Teagasc peat soils subtypes 63 & 65 (once these subtypes have been refined and those areas not corresponding to blanket bog ruled out – see Section C – Appendix II). As discussed in Section C, soils subtypes 41&43, which are characterised by peaty topsoil, also support blanket bog. However, the distinction between blanket bog and other ecosystems present on these soil sub-types was not possible and the extent of coniferous plantations on these soil subtypes has not been calculated. The intersection of FIPS conifer plantation with subtype 63 shows that 143,037ha of 755,916 allocated to this subtype are afforested. Furthermore, 2,707 of 26,226ha of soil subtype 65 are also afforested with conifers. **Hence, 145,744 (18.63%) of the total extent of soils subtypes 63&65 (782,142ha) are afforested with conifers. It should be highlighted that this estimation is based on 1997-98 FIPS data and more recent data was not available.**

A similar process was followed through comparing Corine "Coniferous forestry" and "Transitional woodland scrub" land covers with peat soil subtypes 63 and 65. The results illustrate that these land covers mainly correspond to afforested areas when they are located on these soil subtypes. The overall extent of these land covers on these soils is 146,934ha (on subtype 63) and 3,406ha (on subtype 65). Hence, the total extent of afforested areas on soil subtypes 63&65 is of 150,340ha, which is rather similar to the one previously calculated through FIPS maps. The former figure is likely to be more accurate as FIPS maps depict the exact boundaries of forestry parcels and Corine tends to have a coarser resolution.

According to Foss (1998) the estimated extent of plantations on blanket bog was 209,300ha. In addition, Conaghan et al. (2001) reported more than 150,000ha of blanket bog afforested by 1999 only on Coillte land. Therefore, the calculated figures are underestimating the actual extent of planted forestry on blanket bog. However, the GIS maps produced as part of the assessment can be used as guidance of the location of a large portion of blanket bog afforested.

## APPENDIX VIII

## GLOSSARY

*ACTIVE* or PEAT FORMING - According to the Interpretation Manual of the Habitats Directive, the term *Active* must be taken to mean still supporting a significant area of vegetation that is normally peat forming. Bogs where *Active* peat formation is temporarily at a standstill, such as after a fire or during a natural climatic cycle e.g., a period of drought, are also included.

ACROTELM - The living, *Active*ly growing upper layer of a raised bog, the surface of which is composed mainly of living Bog Mosses (Sphagnum spp.). The presence of the actrotelm is vital to a raised bog as this is the peat forming layer and water storing layer of the bog.

AFFORESTATION - The planting of trees (usually conifers) over an area of previously unplanted ground.

ALTITUDE - Vertical height above sea level.

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

BLANKET BOG - Bogs which carpet the landscape, following the underlying topography. They can cover extensive areas along the west coast and on uplands throughout the country.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CORINE - An information and mapping system, developed within the context of the Commission of the European Communities Biotope Project, which is used as a tool for the description of sites of importance for nature conservation in Europe. It catalogues recognisable communities of flora and fauna. The primary objective of this catalogue is to identify all major communities whose presence contributes to the conservation significance of a site. Included in this list of communities are interesting but rare natural or near-natural communities as well as the more widespread semi-natural ones.

CUTAWAY BOG - This term describes areas where peat has been removed systematically by industrial means. Any peat remaining can no longer be considered as economically removable (Irish Peatland Conservation Council).

CUTOVER BOG – An NPWS habitat classification that describes areas of bog which have been previously cut (by hand or by mechanical means), although not down to the underlying mineral soils or bedrock. Remaining peat can still be an economic reserve. Cut-over areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DoEHLG - Department of Environment, Heritage and Local Government

DESICCATION - Drying out.

DRAINAGE DITCHES - An NPWS habitat classification which refers to water channel systems with moving or stagnant water bodies, artificial in origin. Most ditches are cleared cyclically, although this category also includes ditches that are overgrown with wetland plants.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

FENS AND FLUSHES - An NPWS habitat classification. Fens are peatlands fed by calcium rich water, either from groundwater or from inflowing surface water. Flushes are wet areas maintained by the seepage of water down slopes of various gradient, and are usually local features. Both are characterised by an abundance of small sedge forming species-rich mosaics with other species. Orchid species are particularly noticeable in fens and butterworts are more typical of flushes. According to Cross (1990) flushes are areas where nutrient enrichment occurs, usually as a result of more concentrated horizontal water movement.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT. - Refers to traditional cutting of peat using a slean or spade.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

INTACT BOG: refers to uncut high bog still supporting typical high bog vegetation (*Active* or Degraded). No completely intact blanket bog remains in Ireland and all have been damaged to a certain degree by activities such as turf cutting, drainage, burning and afforestation.

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the “health” quantity or quality of a habitat or species.

MOSAIC - Used to describe habitats that occur together and cannot easily be mapped separately.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PEAT CUTTING BY HAND. - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

QUALIFYING INTERESTS – The habitat(s) and/or species for which an SAC or SPA is designated.

RECLAIMED LAND - this is applied to lands which have been modified from their natural state by intervention such as: a) drainage, b) bulldozing, c) clearance of scrub, d) infilling of wetland, e) ploughing and reseeding.

REPS - Rural Environment Protection Scheme. This is an Agri-Environmental programme which seeks to draw up agreements with farmers, according to the type of farming, landscape and features on the land. The overall objectives of REPS are to achieve: the use of farming practices which reduce the polluting effects of agriculture by minimising nutrient loss- an environmentally favourable extensification of crop farming, and sheep farming and cattle farming; - ways of using agricultural land which are compatible with protection and improvement of the environment, the countryside, the landscape, natural resources the soil and genetic diversity; - long-term set-aside of agricultural land for reasons connected with the environment; - land management for public access;- education and training for farmers in types of farming compatible with the requirements of environmental protection and upkeep of the countryside.

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SACs have also been known as cSACs, which stands for “candidate Special Areas of Conservation”, and pcSACs which stands for “proposed candidate Special Areas of Conservation.”

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

TURBARY – Turbary is the term used to describe the ancient right to cut turf on a particular area of bog. These rights came about with the resettlement of confiscated land or by prescription. Prescription is a legal term meaning that if a person is able to demonstrate that they cut turf without secrecy, without permission and without force continuously for a period of 30 years they have a turbary right. This implies that not all turbary rights will be formally registered.

## **7130** Blanket Bog (and Active* Blanket Bog)

| **National Level** | |
|---|---|
| **Habitat Code** | 7130 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| **Biogeographic level** | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| Published sources | ▪ Conaghan, J. et al. (2000). *Evaluation of Blanket bogs for Conservation in the Republic of Ireland:* A synthesis of the reports on surveys to identify blanket bog sites of scientific interest commissioned by Wildlife Service 1987, 1989 – 1991. Unpublished report to NPWS, Dept. Environment, Heritage and Local Government, Dublin, Ireland.<br>▪ Cross, J.R. (1990b). *Survey and Selection of Peatland Sites for Conservation in the Republic of Ireland.* In: G.J. Doyle (ed). Ecology and Conservation of Irish Peatlands, 175-88. Royal Irish Academy, Dublin, Ireland.<br>▪ Cross, J.R. (2006). *The Potential Natural Vegetation of Ireland*. In: Biology and Environment. Proceedings of the Royal Irish Academy. Vol.106b, N0. 2. August, RIA, Dublin, Ireland.<br>▪ Derwin, J., Dunnells, D., Dwyer, R., Wilson, F., Wann, J., Fanning, M., Mc Kee, A.M., Laszlo, N., (2004). *Survey and Evaluation of Blanket Bogs for proposal as Natural Heritage Areas in the Republic of Ireland*. Unpublished report to National Parks & Wildlife Service, Department of Environment, Heritage Local Government, Dublin, Ireland.<br>▪ Douglas, C. (1998). *Blanket Bog Conservation*. In: O' Leary, G. and Gormley, F. (eds.) Towards a Conservation Strategy for the Bogs of Ireland. Irish Peatland Conservation Council, Ireland.<br>▪ Doyle, G. J. and O Criodáin, C. (2003). *Peatland – fens and bogs*.(pp. 79 – 108), In: Marinus Otte (ed.): Wetlands of Ireland, Distribution, Ecology, Uses and Economic Value. UCD Press, Newman House, 86, St. Stephen's Green, Dublin 2, Ireland.<br>▪ Hammond, R.F. (1979). *The Peatlands of Ireland*. Soil and Survey Bulletin. No. 35. An Foras Talúntais, Dublin, Ireland.<br>▪ Hammond, R.F. 1984. *The Classification of Irish Peats as Surveyed by the National Soil Survey of Ireland*. 7th International Peat Congress, Dublin, Ireland.<br>▪ Irish Landslides Working Group (2006). *Landslides in Ireland*. Geological Survey of Ireland, Beggar's Bush, Haddington Rd., Dublin 4, Ireland.<br>▪ O'Connor, M. (2000). *Action Plan for Blanket Bog and Wet Heath*: Technical Aspects. Draft report to NPWS, Dept. Environment, Heritage and Local Government, Dublin, Ireland.<br>▪ Ryan, J. and Cross, J.R. (1984). *The Conservation of Peatlands In Ireland*. In: Proceedings of the 7th International Peat Congress (pp. 388 –406). Dublin, Ireland.<br>▪ Schouten, M.G.C. (1984). *Some Aspects of the Ecogeographical Gradient in the Irish Ombrotrophic Bogs*. In: Proceedings of the 7th International Peat Congress (pp. 414 – 432). Dublin, Ireland. |
| | ▪ Connolly, J., Holden, N. M., Ward, S., M. (2004). *A Rules-based GIS Methodology for Examining the Extent of Peatlands in Ireland from Multi-Source Data.* Proceedings of the 12th International Peat Congress Vol. 1, pp.26 – 31. International Peat Society Finland.<br>▪ Cross, J. R. (1989). Peatlands- Wastelands or Heritage? An Introduction to Bogs and Fens. Wildlife Service.Government Stationary Office, Dublin, Ireland. |
| **Range** | |
| Surface area | 49,500 km² |

| | |
|---|---|
| Date | 6/2007 |
| Quality of data | good |
| Trend | 0 |
| Trend-Period | 1994 – 2006 |
| Reasons for reported trend | Even in relatively modified areas there are still some areas supporting typical blanket bog vegetation and thus blanket bog habitat. |
| **Area covered by habitat** | |
| Surface area* | 390,000 ha. |
| Date | 6/2007 |
| Method used | 2 |
| Quality of data | 2 |
| Trend | - magnitude = 1.16% pa |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | 3 = direct human impact. |
| Justification of % thresholds for trends | This is an absolute minimum estimate as loss of habitat area due to irreversible erosion, roads, windfarms, reclamation, urbanisation and other activities are not quantified and the estimate for the annual rate of afforestation of blanket bog is likely to be too low. |
| Main pressures | 140 Grazing<br>160 General Forestry Management<br>161 Forestry planting<br>180 Burning<br>301 Quarries<br>310 Peat Extraction<br>311 Hand-cutting of peat<br>312 Mechanical removal of peat<br>421 Disposal of household waste<br>502 Roads, motorways<br>512 Wind Farm Development<br>530 Improved accesss to site<br>810 Drainage<br>900 Erosion<br>800 Land reclamation |
| Threats | 142 Grazing<br>160 General Forestry Management<br>180 Burning<br>310 Peat Extraction<br>311 Hand-cutting of peat<br>312 Mechanical removal of peat<br>403 Dispersed habitation<br>511 Electricity lines<br>512 Wind Farm Development<br>622 Walking, horse-riding, non-motorised vehicles<br>791 Climate change<br>810 Drainage<br>900 Erosion<br>954 Invasion by a species |
| ***Complementary information*** | |
| **Favourable reference range** | 49,500 km² |
| **Favourable reference area** | 444,000 ha. |

| | |
|---|---|
| **Typical species** | **Lowland Blanket Bog**<br><br>Vascular plants*: Schoenus nigricans, Molinia caerulea, Calluna vulgaris, Drosera anglica, D. intermedia, D. rotundifolia, Erica tetralix, Eriophorum angustifolium, E. vaginatum, Lobelia dortmanna, Menyanthes trifoliata, Myrica gale, Narthecium ossifragum, Pedicularis sylvatica, Polygala serpyllifolia, Pinguicula vulgaris, Dactylorhiza maculata, Potentilla erecta, Rhynchospora alba, Trichophorum caespitosum, Potamogeton polygonifolius. Eleocharis multicaulis, Eriocaulon aquaticum.* Mucilaginous algae.<br><br>Mosses, Liverworts and Lichens: *Campylopus atrovirens, Pleurozia purpurea, Sphagnum papillosum, S. capillifolium, S. auriculatum, S. cuspidatum, S. imbricatum, S. fuscum, S. magellanicum, S. subnitens, S. tenellum, S. pulchrum, (*Connemara*), Cladonia ciliata var tenuis, C. portentosa, C. uncialis* subsp*. biuncialis, Odontoschisma sphagnii, Racomitrium lanuginosum, Kurzia pauciflora, Hypnum jutlandicum.*<br><br>**Highland Blanket Bog**<br><br>Similar to Lowland Blanket Bog but *Eriocaulon aquaticum* and *Lobelia dortmanna* absent. *Schoenus* present in association with typical upland species such as *Empetrum nigrum*, *Vaccinium myrtillus* and *Diplophyllum albicans*.<br><br>**Mountain Blanket Bog**<br><br>Vascular plants*: Calluna vulgaris, Erica tetralix, Trichophorum caespitosum, Eriophorum angustifolium, E. vaginatum, Empetrum nigrum, Vaccinium myrtillus, Andromeda polifolia*<br><br>Mosses, Liverworts and Lichens: *Racomitrium lanuginosum. Diplophyllum albicans, Cladonia ciliata* var. *tenuis*, *C. uncialis* subsp*. biuncialis, Sphagnum capillifolium, S. papillosum, S. fuscum.* |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | This conservation assessment applies to Blanket Bog (as per Habitats Directive definition and thus excludes cutaways and/or bog that has been reclaimed to grassland or forest). *Active* Blanket Bog are scattered throughout the blanket bog range in coherent or fragmented states the most fragmented areas being in the midland, eastern and southern uplands and the most extensive expanses occurring in the lowlands of counties Mayo and Galway and in Co. Donegal. The area of *Active* Blanket Bog has not been quantified, however the impacts are relevant to both blanket bog and active blanket bog.<br><br>Blanket bog occurs along the Atlantic coast of Ireland on lowlands and uplands on slopes of up to c. 25 degrees and on mountains in the rest of the country. See Map II. Extensive areas have been removed or highly modified (chiefly through reclamation, peat extraction, afforestation but also via erosion/landslides triggered by anthropogenic factors). Relatively unmodified blanket bog containing areas of Blanket Bog includes degraded bog but excludes afforested bog and cutaway bog<br><br>FRA for Blanket Bog is required as a minimum to be that area considered unmodified when the Directive came into force in 1994. An estimate of maximum unmodified blanket bog of be 390, 727 ha (3907 km²) is calculable (based on the estimate of 517,231 ha ( 5,172 km²) for unmodified bog in 1982 (Ryan and Cross 1984) - less their estimate of annual loss due to afforestation and peat extraction of 5,271 ha/ pa ( 53 km²) - brought up to 1994. The FRA is therefore estimated at 450,000 ha.<br><br>FRA for *Active* Blanket Bog is Unknown as Active is not defined in sufficient detail and can cover a range of community types. In addition different parts of a blanket bog can be *Active* at different stages, even over very long periods of time, depending on topographic and climatic variables as well as anthropogenic factors. |

**Typical Species**

**Lowland Blanket Bog**

Vascular plants*: Schoenus nigricans, Molinia caerulea, Calluna vulgaris, Drosera anglica, D. intermedia, D. rotundifolia, Erica tetralix, Eriophorum angustifolium, E. vaginatum, Lobelia dortmanna, Menyanthes trifoliata, Myrica gale, Narthecium ossifragum, Pedicularis sylvatica, Polygala serpyllifolia, Pinguicula vulgaris, Dactylorhiza maculata, Potentilla erecta, Rhynchospora alba, Trichophorum caespitosum, Potamogeton polygonifolius. Eleocharis multicaulis, Eriocaulon aquaticum.* Mucilaginous algae.

Mosses, Liverworts and Lichens: *Campylopus atrovirens, Pleurozia purpurea, Sphagnum papillosum, S. capillifolium, S. auriculatum, S. cuspidatum, S. imbricatum, S. fuscum, S. magellanicum, S. subnitens, S. tenellum, S. pulchrum, (*Connemara*), Cladonia ciliata var tenuis, C. portentosa, C. uncialis* subsp*. biuncialis, Odontoschisma sphagnii, Racomitrium lanuginosum, Kurzia pauciflora, Hypnum jutlandicum.*

**Highland Blanket Bog**

Similar to Lowland Blanket Bog but *Eriocaulon aquaticum* and *Lobelia dortmanna* absent. *Schoenus* present in association with typical upland species such as *Empetrum nigrum*, *Vaccinium myrtillus* and *Diplophyllum albicans*.

**Mountain Blanket Bog**

Vascular plants*: Calluna vulgaris, Erica tetralix, Trichophorum caespitosum, Eriophorum angustifolium, E. vaginatum, Empetrum nigrum, Vaccinium myrtillus, Andromeda polifolia (*east*).*

Mosses, Liverworts and Lichens: *Racomitrium lanuginosum. Diplophyllum albicans, Cladonia ciliata* var. *tenuis*, *C. uncialis* subsp*. biuncialis, Sphagnum capillifolium, S. papillosum, S. fuscum.*

Indicator species: *Schoenus nigricans, Eriophorum angustifolium, Pedicularis sylvatica, Calluna vulgaris, Erica tetralix. Campyopus atrovirens, S. cuspidatum, S. auriculatum, S. magellanicum, S. imbricatum, S. fuscum, S. pulchrum, S. subnitens, Drosera anglica, D. intermedia, Untricularia intermedia, Menyanthes trifoliata, Cladonia ciliata var. tenuis, Pleurozia purpurea, Eriocaulon aquaticum, Lobelia dortmanna, Potamogeton polygonifolius*

Methods: all the species above are characteristic of[1] relatively unmodified blanket bog habitat in Ireland.

Drying out can cause changes in the relative proportions of species with those characteristic of wetter microhabitats decreasing and those of drier microhabitats increasing as the bog surface dries out. Many bog species can be deemed negative indicators if dominant especially: *Trichophorum caespitosum* or *Narthecium ossifragum* or *Carex panicea or Campylopus introflexus* or *Calluna vulgaris* or mucilaginous algae. Presence on ombrotrophic area of *Nardus stricta or Juncus squarrosus or Juncus effusus or Erica cinerea or Rhododendron ponticum* or grass species other than *Molinia* are negative indicators. Absence of *Sphagnum* species is a negative indicator. Colonisation of ombrotrophic areas of blanket bog by trees is an indicator of drying out of the bog surface.

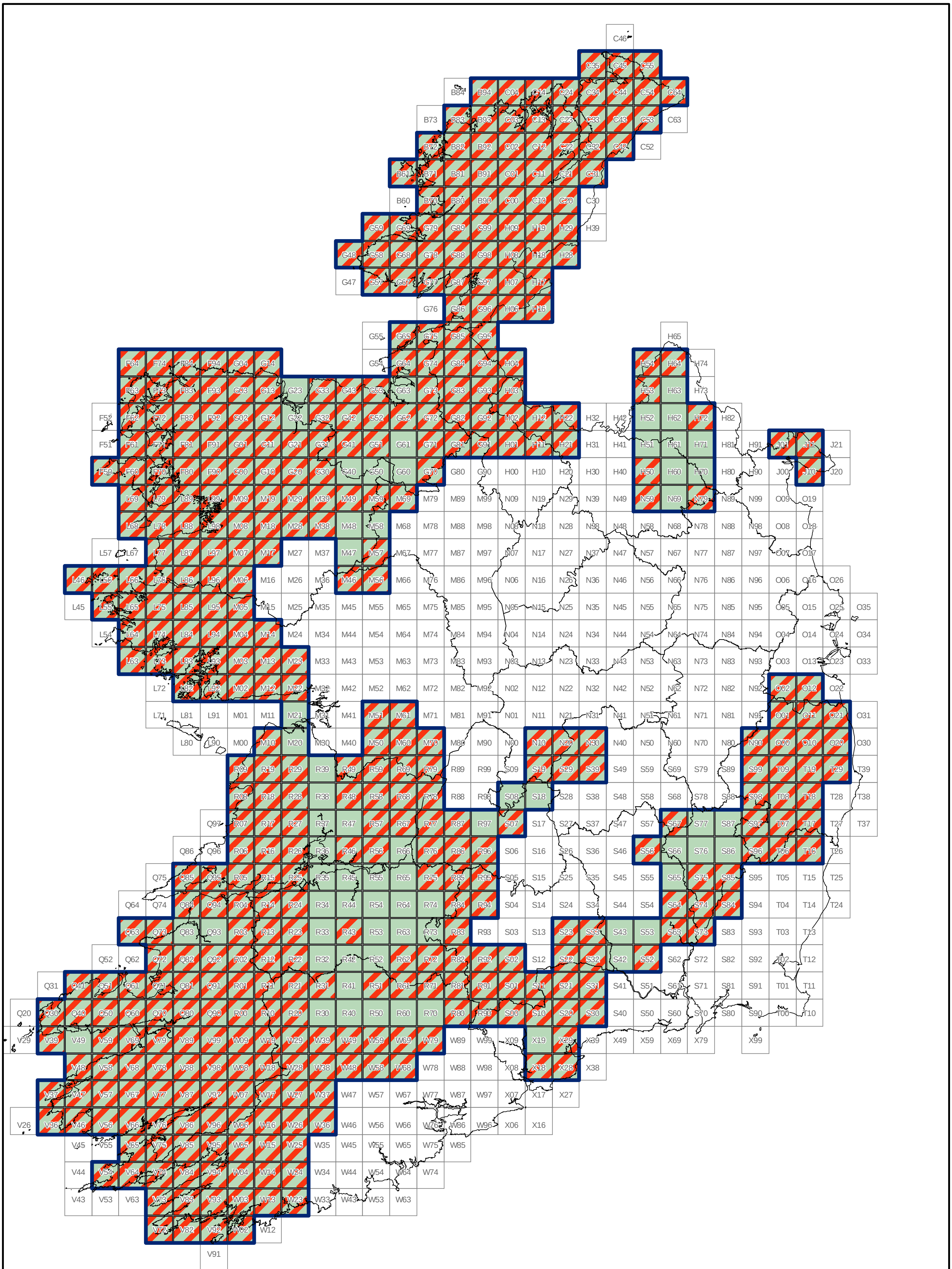
**Impacts**

Even though impacts have reduced substantially in recent years, agriculture, peat extraction, afforestation, wind farms and other infra-structural developments etc are still causing damage. Impacts from certain activities continue even after the damaging activity has ceased. Drought and extreme weather events predicted as a result of climate change are likely to increase erosion and blanket bog landslides, particularly on poorly vegetated areas.

[1] There is no completely intact blanket bog remaining in Ireland as all have to some extent been modified by man.

| | |
|---|---|
| | Restoration initiatives or land management schemes:<br>▪ Conservation of blanket bogs is targeted by a measure within the Rural Environment Protection Scheme (REPS) to promote recovery of vegetation on commonages and all designated sites. Percentage reductions in sheep stock levels proportional to vegetation damage is recommended in Commonage Framework Plans that are a basis for implementation of grazing management via REPS 3 and the NPWS Farm Plan Scheme. However full participation in these schemes would be required to promote recovery of depleted vegetation and sustainable management of these sites. Furthermore In badly degraded upland areas, e.g. where peat erosion is occurring, recovery of vegetation may not readily occur and erosion of significant areas of bog will continue. Climate changes are likely to significantly accelerate degradation via alternation of drought period with more extreme weather events that increase the rate of erosion and that can trigger peat slides.<br>▪ NPWS have designated blanket bog SACs and NHAs; blocked drains on blanket bog in Wicklow Mts National Park SAC; purchased and managed blanket bogs as Nature Reserves or National Parks; constructed paths to reduce peat erosion due to walkers in National Park SACs; jointly devised and co-ordinated commonage condition assessments for extensive areas including blanket bog habitat with Dept. Agriculture, Food and Forestry to inform stock management including significant stock reduction percentages. NPWS have also set up the National Farm Plan Scheme to grant-aid landowners to manage blanket bog and other habitats for nature conservation.<br>▪ NPWS are involved in BOGLAND an EPA-funded research project a major research project on sustainable peatland management in Ireland which is being led by University College Dublin and includes partners from many organisations around Ireland. This project is aiming, during its three year duration (2005 – '08), to address peatlands from four dimensions: Environmental, Social, Economic and Institutional and to bring this work together to develop a protocol for the sustainable management of peatlands in Ireland.<br>▪ Forest Service policy of refusing grant-aid for proposals for new afforestation on blanket bog SACs and NHAs has reduced pressure from afforestation on designated sites. However general forestry management and reforestation of felled plantation forestry on blanket bog will continue to degrade these areas and intact areas occurring along their extensive margins. Conifer trees may spread from plantations to colonise intact blanket bog and this may be accelerated if the bog surface dries out for any reason including as a result of longer dry periods resulting from climate change.<br>▪ "*Active* Blanket Bog Restoration" Project founded by an EU LIFE - Nature Programme. Initiated by Coillte Teo., in 2002 it aims to demonstrate restoration on c. 1, 900 ha of blanket bog via tree-felling, blocking of drains or protection from stock damage. NPWS have proposed several blanket bog areas in and adjacent to SACs for this approach.<br>▪ A COFORD Research Project "Re-designing Western Peatland Forests 2006" – on management options for plantations on peatland may have positive impacts on blanket bog condition once specific objectives are set and implemented.<br>▪ Bord na Mona (Turf Board) has carried out restoration work on selected areas within decommissioned industrial peatlands on former lowland blanket bog in north-west Mayo during 2001-2006. Early indications are positive as peat-forming conditions have been re-established on sections that were successfully re-wetted and poor fen vegetation including *Sphagna* are establishing. |

| ***Conclusions***<br>***(assessment of conservation status at end of reporting period)*** | |
|---|---|
| **Range** | Favourable (FV) |
| **Area** | Bad (U2). |
| **Specific structures and functions (incl. typical species)** | Unfavourable inadequate (U1) |
| **Future prospects** | Bad (U2) |
| **Overall assessment of CS** | Bad (U2) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Blanket bogs**

**7130**

Current Distribution (430 cells)
Current Range (495 cells)
Favourable Reference Range (495 cells)
W48 10km grid cells

Date: September 2007

## 7140 Transition mire

# CONSERVATION STATUS ASSESSMENT REPORT

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## 1. Habitat characteristics in Ireland

The term 'transition mire' relates to vegetation that in floristic composition and general ecological characteristics is transitional between acid bog and Alkaline fens, in which the surface conditions range from markedly acidic to slightly base-rich.

The vegetation normally has intimate mixtures of species considered to be acidophile and others thought of as calciphile or basophile.

In some cases the mire occupies a physically transitional location between bog and fen vegetation, as for example on the marginal lagg of raised bog or associated with certain valley and basin mires (JNCC 2007).

In other cases these intermediate properties may reflect the actual process of succession, as peat accumulates in groundwater-fed fen or open water to produce rainwater-fed bog isolated from groundwater influence. Many of these systems are very unstable underfoot and can therefore also be described as 'quaking bogs' or a floating scraw.

Transition mires and quaking bogs can occur in a variety of situations, related to different geomorphological processes: in flood plain mires, valley bogs, basin mires and the lagg zone of raised bogs, and as regeneration surfaces within mires that have been cut-over for peat or areas of mineral soil influence within Blanket bogs (e.g. ladder fens) (JNCC 2007).

The interpretation manual of the Habitats Directive defines the habitat as "Peat-forming communities developed at the surface of oligotrophic to mesotrophic waters, with characteristics intermediate between soligenous and ombrogenous types. They present a large and diverse range of plant communities. In large peaty systems, the most prominent communities are swaying swards, floating carpets or quaking mires formed by medium-sized or small sedges, associated with sphagnum or brown mosses. They are generally accompanied by aquatic and amphibious communities" (Rameo 1996).

While CORINE Biotopes manual defines Transition mires as wetlands mostly or largely occupied by peat-forming plant communities developed at the surface of oligotrophic or meso-oligotrophic water reaching a level above, sometimes well above, the substratum, providing little or no mineral nutrient supply. Their characteristics are thus intermediate between those of soligenous and topogenous mires and those of strictly ombrogenous bogs. In large systems, the most prominent communities are swaying swards, floating carpets or quaking mires formed by medium sized or small sedges, associated with *Sphagnum* or brown mosses. Transition mires form mostly as colonists of oligotrophic ponds and lakes, large bog pools or lagg zones.

Outside of transition mire systems, their communities can be found in bog hollows, blanket bogs, depressions of rich or poor acidic fens, spring systems and humid heaths *inter alia.*

The vegetation typically comprises species that are characteristic of bog, fen and open water habitats. Small to medium sedges, mainly Carex spp. (particularly *Carex diandra, C. lasiocarpa, C. limosa and C. viridula*), usually dominate and may occur together with White Beak-sedge (*Rhynchospora alba*), cotton grasses (*Eriophorum angustifolium*, and the much rarer *E. gracile*), Creeping Bent (*Agrostis stolonifera*), Purple Moor-grass (*Molinia caerulea*), and a range of broad-leaved wetland herbs such as Bogbean (*Menyanthes trifoliata*), Marsh Pennywort (*Hydrocotyle vulgaris*), Lesser Spearwort (*Ranunculus flammula*), Marsh Cinquefoil (*Potentilla palustris*) and Marsh Lousewort (*Pedicularis palustris*). Extensive moss cover is characteristic; *Sphagnum* spp., *Calliergon* spp. and *Scorpidium scorpioides* are usually abundant.

Transition mires in Ireland are classified in the alliance Sphagno Caricion lasiocarpae (small-sedge vegetation of quaking transition fens between poor and rich) (*sensu* Ó Críodáin & Doyle, 1994) within which 2 associations are recognised.

<u>Sphagneto-Caricetum lasiocarpae</u>
Floating quaking-bog vegetation, usually confined to the waterlogged marginal areas around areas of acid peat or fens (water pH range 3.8-5.8). *Carex lasiocarpa* prominent species, along with *Carex limosa, Hydrocotyle vulgaris, Menyanthes trifoliata, Molinia caerulea, Myrica gale, Potentilla palustris,* and *Ranunculus flammula.*

Calliergo gigantei-Caricetum diandrae

Floating or quaking mire vegetation, calcicole in character (water pH range 5.0-7.5), rich in pleurocarpus mosses, found in seepage areas around fens. Character species: *Carex diandra, Bryum pseudotriquetrum and Calliergon giganteum.*

In Ireland Transition mires and quaking bogs can occur in a variety of situations: in flood plain bogs, valley bogs, basin mires and the lagg zone of raised bogs, or areas of mineral soil influence within blanket bogs. Transition mires may also occur as secondary habitats on mined out raised or blanket bog sites (Doyle & Ó Críodáin 2003, Foss 2007, Curtis et al 2006 *inter alia*).

## 2. Habitat mapping

To-date no potential historic distribution or range map of the occurrence of this habitat has been available in Ireland (Foss 2007). A potential historic distribution and range map for Transition mire based on a series of data sets which would indicate the possible location of sites with the habitat in Ireland was produced as a part of the current assessment of the habitat in Ireland. Information on the historic habitat distribution and range provided by this map was compared with the present habitat distribution and range to ensure that an adequate network of sites has been selected to ensure favourable conservation of this habitat in Ireland. Such an exercise was felt to be justified in the absence of any systematic field survey of the habitat to date in Ireland.

The most recent mapping of the fen resource in Ireland was undertaken by Hammond in 1979. This study mapped only deep fen peat (>30cm in depth), and furthermore all fen peat areas were considered to be man modified and no attempt was made to distinguish between the various fen types.

A map of the **potential historic distribution and range** of Transition mire, based on a 10 km² grid basis was produced by selecting those grid squares in which Transition mire is known to be present (based on Foss 2007); or was believed to occur in the past (Hammond 1979; Corine 2000; Teagasc 2006) together with the total distribution of *Carex diandra* and *Carex lasiocarpa* in Ireland as recognised by the Botanical Society of Britain and Ireland (BSBI) (see Map 1). Further information on the specific data sets use to produce the map are listed in Appendix 1.

The mapping of the **current habitat distribution and range** of Transition mire (see Map 2) is based on National Parks and Wildlife Service (NPWS) study of the extent and conservation status of springs, fens and flushes undertaken in 2006 (NPWS Fen Study 2007, Foss 2007). In the absence of any detailed fen survey in Ireland to-date, this desk study compiled a list of all known Transition mires of conservation value in Ireland based on data held within NPWS and from external NGO and expert sources (see Appendix I & II). In addition to recognised sites for the habitat in Ireland, all 10 km² grid cells which contain a record for the Transition mire indicator species *Carex lasiocarpa* and *Carex diandra* were also mapped as part of the current habitat distribution, using records recorded between 1940 and the present. Extension of the range for this habitat, based on the distribution of these two *Carex* species was felt to be justified, in the absence of any National Fen Survey to-date in Ireland.

The NPWS Fen Study (Foss 2007) involved compilation of a list of all known fen sites in Ireland, classification of these according to fen type (using the fen habitats recognised in the EU Habitats Directive), and accurately assessing or estimating the area of fen vegetation present on sites where this was possible. Fen type and area data was obtained from a variety of related wetland studies previously undertaken within NPWS (see Appendix I). In the case of some of these surveys, accurate fen area data were available for the extent of fen vegetation on sites. In other cases only an estimated extent value could be assigned to fen sites.

The Transition mire **current habitat distribution and range map** (see Map 2) was produced by selecting the smallest polygon size containing all grid squares, where the habitat was recorded in the NPWS Fen Study database (Foss 2007), or species indicative of the habitat were located, using a minimum number of 90 degree angles. Gaps in the habitat distribution of at least two 10 km² square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range. The map produced should be taken as indicative of the distribution and range of Transition mire in Ireland, until such time as a national fen survey is completed. One exception to the mapping criteria used, involved the extensive river system SACs where only known sub sites containing Transition mire sites were mapped on the 10 km² square grids rather than the entire SAC river system.

The Transition mire **favourable reference range** (see Map 3) is considered to be the same as the current habitat range.

The FRR is defined as the range of 10 km² grid cells which contain a Transition mire site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km² grid cells which contain a record for the Transition mire indicator species *Carex lasiocarpa* and *Carex diandra*. Gaps in the habitat distribution of at least two 10 km² square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range.

## 3. Habitat Range

As fens are an early successional stage in the formation of raised and in some cases blanket bogs (eventually being buried under these more acid peatland types), or occurred naturally at the edges of such acid peatlands, they would have been widespread throughout the midlands and west of Ireland in post-glacial times.

The first attempt to map the range of general fen habitats in more recent times undertaken by Hammond (1979) indicates that the habitat type has the greatest concentration of sites occurring in the midlands and westwards into counties Galway, Mayo and Clare (see Table 4.1). Hammond (1979) records no fens in Counties Carlow, Cork, Donegal, Dublin, Monaghan or Wicklow. Subsequent reports show in fact that these counties also contain fen (see Crushell 2000, Foss *et al* 2001, Foss 2007). It is therefore likely that the total range of fen in Ireland recognised in Hammond (1979) is an under representation of the habitat in Ireland. In part, this shortcoming may be related to the fact that Hammond recorded only fen habitats occurring on a deep peat layer (greater than 30 cm).

Nonetheless, Hammond (1979) distribution map of man-modified fen still represents a minimum "best estimate" of the total extent of fen soils and fen habitats in Ireland. One further short coming of the report is that no subdivision is made in Hammond in terms of fen types (i.e. Alkaline fen, *Cladium* fen, Transition mires or Petrifying springs). The digitised version of this fen distribution data produces a **Hammond fen range map** which covers an area of 21,300 km$^2$ (213 grid squares x 100 km$^2$) containing fen, with a significant concentration of grid squares in the midlands and mid-west of Ireland (see Map 4).

A map of the **potential historic distribution and range** of Transition Mire, based on a 10 km² grid basis and undertaken as part of this assessment project (see section 2 above) indicates that in the potential historical distribution and range map, Transition mire has a range cover of 55,000 km$^2$ (550 grid squares x 100 km$^2$, see Map 1). The range polygon (area polygon derived from grid squares) derived for this habitat cover 69,500 km$^2$ (695 total grid squares x 100 km$^2$).

The potential historical distribution and range has therefore been found to be more than two and a half times that predicted by Hammond. The historical range as defined by this assessment (see Map 1) shows extensions to the range of the habitat in particular along the western seaboard and in the north east and south east of Ireland over that plotted using the Hammond data (see Map 4).

A distribution map of this habitat produced by Crushell (2000) based on the location of 206 sites identified for this habitat in the IPCC fen survey reveals a distribution of sites throughout most of Ireland with the largest concentration in mid and Western part of the country centred on Counties Mayo, Galway, Sligo, Roscommon, Offaly, Westmeath, Longford, Monaghan and Louth. The sites mapped, although defined by Crushell as "Open water Transition fen" may not accord well with the definition of the habitat as defined in the Habitats Directive, which is based more on floristic grounds than purely topographical location (see section 1 above). The map of Crushell (2000) should therefore be taken as indicative of the possible habitat distribution in Ireland only.

The most recent NPWS Fen Study (Foss 2007) undertaken to obtain a information on the distribution and extent of Alkaline fen, *Cladium* fen, Transition mires or Petrifying springs in Ireland, found that Transition mire occurs in every county throughout Ireland, with the exception of County Carlow and Dublin, with increased frequency in Counties Clare, Donegal, Galway, Monaghan, Mayo and Westmeath (see Table 4.3 below; and Map 2).

The **current distribution and range map** for Transition mire indicates that the habitat has a range of 39,800 km$^2$ (398 grid squares x 100 km$^2$, see Map 2). The current range polygon (area polygon derived from grid squares) derived for this habitat covers 59,5000 km² (595 grid squares x 100 km²).

The current range based on grid cells shows a decline of 28% over the total predicted historical range of the habitat. While an examination of the current range area polygon indicates that the habitat has declined 14% over the historical range area polygon. Until a detailed field survey of this habitat is completed in Ireland it remains unclear whether this observed decline in the range is the in fact due to loss of sites, or lack of knowledge of the occurrence of sites within these grid squares.

Expert opinion would indicate that the current range of the habitat, based on the known sites listed within the NPWS Fen Study database (Foss 2007), when taken together with the likely sites for the habitat indicated by the presence of *Carex lasiocarpa* and *Carex diandra* records, is sufficient to represent the ecological variation of the habitat across its distribution and range in Ireland when compared to the potential historic distribution and range, mapped as part of this conservation status assessment.

It is, however, likely that following a future detailed field based fen survey of Ireland, additional sites may be discovered (as indicated by species distribution data) within the area formerly believed to contain the habitat, which would increase the number of 10 km² grid cells which contain Transition mire, most likely within the current range polygon. Such new sites may add somewhat to the range of the habitat in Ireland above that proposed in this assessment.

Based on available data the **Favourable Reference Range** (FRR) (see Map 3) is therefore considered to be the same as the current range for the habitat in Ireland as mapped in this assessment, which should be regarded as a minimum until detailed habitat surveys are completed.

### 3.1. Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relationship between current habitat range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

No specific studies have been undertaken on conservation status of the habitat range in Ireland during the reporting period making any assessment of the annual decline in the habitat extent or range problematic. Thus, although the actual trend cannot be quantified it is considered to be negative based on expert opinion.

An assessment based on current and favourable reference range indicates that the **current range polygon of the habitat** in Ireland (see Map 2), as defined by the list of sites for this habitat held in the NPWS Fen Study database (Foss 2007) and related species range, covers 59,500 km$^2$ (595 total grid squares x 100 km$^2$).

The **Favourable Reference Range** (FRR) (see Map 3) is considered to be the same as the current range.

- **Current Habitat Range:** Can be considered as the area of the polygon which contains all of the grid cells with the habitat which is 59,500 km² (595 grid cells x 100km²).
- **Favourable Reference Range** 59,500 km² (595 grid cells x 100km²) the area of the polygon which contains all of the grid cells with the habitat.

The difference between the current Transition Mire habitat range and the FRR for this habitat reveals that the current habitat range is the same as the FRR which is considered to be **Favourable** according to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive).

## 4. Habitat Extent

The first attempt to estimate the original extent of fen habitats in the Republic of Ireland (Hammond 1979) indicated that 92,508 ha of fen occurred. Although Hammond did not differentiate between the different fen types recognised today, it is probable that a significant proportion of this original area of fen was Alkaline fen, with associated areas of Calcareous fen with *Cladium mariscus*, Transition mire and Petrifying springs. Many of these fens were associated with or occurred adjacent to midland raised bogs and in more western blanket bog habitats.

**Table 4.1: The original area (ha) of fen by County in Ireland after Hammond 1979**

| County | Area (ha) |
|---|---|
| Carlow | 7,883 |
| Cavan | 81 |
| Clare | 0 |
| Cork | 0 |
| Donegal | 0 |
| Dublin | 0 |
| Galway | 10,012 |
| Kerry | 5,844 |
| Kildare | 316 |
| Kilkenny | 4,654 |
| Laois | 1,232 |
| Leitrim | 81 |
| Limerick | 16,030 |
| Longford | 5,140 |
| Louth | 352 |
| Mayo | 3,901 |
| Meath | 0 |
| Monaghan | 469 |
| Offaly | 13,901 |
| Roscommon | 4,828 |
| Sligo | 1,279 |
| Tipperary | 4,298 |
| Waterford | 11,026 |
| Westmeath | 0 |
| Wexford | 566 |
| Wicklow | 615 |
| **Total** | **92,508** |

Significant decline in this habitat, due to the activities of human influences, have occurred in Ireland over the last 400 years, a feature noted by Hammond (1979) who included only a "man modified" fen category in his report. In his word "Undisturbed fens are rare and can only be found in a few counties in Ireland. Owing to their small size their representation on the map is not possible, even their continued existence as natural entities is under threat from agriculture and urban pressures".

The two activities which are most important for the decline of this habitat are drainage activities associated with the related activities of land reclamation and the development of turf extraction schemes on bogs, in particular midland raised bogs (Crushell 2000).

Traditional cutting of bogs for turbary over the last 400 years, and the associated drainage of marginal areas, has had a serious impact on the extent of the raised bogs and their associated fens. Raised bog has declined by an estimated 68% as a result of turbary activity (Hammond 1979, Ryan & Cross 1984, Cross 1989). The mechanisation of peat cutting combined with a grant aid scheme under the Turf Development Act (1981) enabled many small scale extraction programmes to get underway which has resulted in further loss of the raised bog and the associated Transition mire resource (Fernandez *et al*. 2006).

The most serious impact of mechanisation has been on midland raised bogs and the fens that were associated with these habitats. Mechanical extraction has accounted for a loss of 22% of the raised bog resource in less than 50 years (Cross, 1990), and the drainage works needed to make peat harvesting possible has also resulted in significant loss of Transition mire areas associated with the margins of raised bogs.

Subsequent studies undertaken by the Irish Peatland Conservation Council indicated that the intact resource of fen in Ireland had declined significantly since the Hammond study, with just 19,660 ha of intact conservation worthy fen remaining by the year 2000 (Crushell 2000; Foss *et al*. 2001).

Crushell (2000) recognised a possible 206 sites for this habitat in the IPCC survey with a total area of 13,764ha. The sites identified, although defined by Crushell as “Open water Transition fen” may not accord well with the definition of the habitat as defined in the Habitats Directive, which is based more on floristic grounds than purely topographical location (see section 1 above). Furthermore no detailed data on fen habitat extent within many of the sites recognised was available during this survey suggesting the area data is a crude “estimate”. The “Open water Transition fen” site list and area data estimated by Crushell (2000) should therefore be taken as indicative of the possible habitat extent in Ireland only.

**Table 4.2: Conservation worthy fen area (ha) and number of sites recognised by IPCC in 2000 in each Irish County**

| County | Conservation Area (ha) | Number of Sites |
|---|---|---|
| Carlow | 806 | 16 |
| Cavan | 340 | 9 |
| Clare | 90 | 3 |
| Cork | 893 | 13 |
| Donegal | 1,318 | 14 |
| Dublin | 96 | 3 |
| Galway | 2,419 | 34 |
| Kerry | 339 | 8 |
| Kildare | 554 | 11 |
| Kilkenny | 386 | 11 |
| Laois | 843 | 8 |
| Leitrim | 160 | 8 |
| Limerick | 399 | 13 |
| Longford | 572 | 5 |
| Louth | 437 | 19 |
| Mayo | 223 | 10 |
| Meath | 214 | 13 |
| Monaghan | 2,460 | 38 |
| Offaly | 954 | 14 |
| Roscommon | 1,650 | 21 |
| Sligo | 475 | 26 |
| Tipperary | 1,571 | 16 |
| Waterford | 1,161 | 20 |
| Westmeath | 543 | 12 |
| Wexford | 406 | 6 |
| Wicklow | 351 | 16 |
| **Total** | **19,660** | **367** |

An estimate of the extent of Transition mire undertaken by Ó Críodáin in 1995, as part of the SAC designation process, indicated that the Transition mire resource remaining in Ireland was just 6,000 ha.

The most recent analysis of conservation worthy sites recognised in Ireland, the NPWS Fen Study (Foss 2007) found that the total area of estimated fen vegetation recorded in the NPWS Fen Study amounted to 22,180 ha within 681 discrete sites (site complex sub-units omitted i.e. sub-sites that occur within existing SAC or NHA). In total the NPWS Fen Study database holds information on 808 sites (which includes 127 sub-site records), where fen habitats are known or believed to occur. This list of sites includes two fen types, poor fen and non-calcareous springs, which were not recorded as part of many of the earlier studies (i.e. Hammond 1979; Foss 2001 inter alia).

The extent of Annex 1 fens (i.e. Alkaline fen, *Cladium* fen, Transition mire, and Petrifying spring) which most closely relate to the fen types identified in previous studies, was estimated to cover just 10,298 ha (in a total of 702 sites) or 46% of the total fen area estimated in the NPWS Fen Study (Foss 2007). This is an indication that Annex 1 fens are less widespread in Ireland than estimated by previous workers (Crushell 2000; Foss *et al*. 2001).

In relation specifically to Transition mire, a total of 176 sites with this habitat were identified in Ireland. Area estimates indicate that 1,954 ha of this habitat occur within the conservation worthy sites recognized by the NPWS Fen Study (Foss 2000), making it the second most widespread Annex 1 fen habitat in Ireland after Alkaline fen.

The data for the known extent of the habitat, indicate that Transition mire (1,954 ha) is in fact less abundant than previously thought (Ó Críodáin 1995), and represent just 2% of the resource originally recognized by Hammond (1979).

**Table 4.3: The extent of Annex 1 fen habitats recognised in Ireland within each county in the NPWS Fen Study (Foss 2007). Area in ha with the number of sites in brackets [#].**

| **County** | * Cladium fen 7210 | Alkaline fen 7230 | **Transition Mire 7140** | * Tufa springs 7220 |
|---|---|---|---|---|
| Clare | 303 (15) | 856 (25) | 149 (13) | 7.92 (10) |
| Cavan | 0 (1) | 120 (7) | 0 (1) | 0.1 (3) |
| Carlow | 4 (2) | 4 (1) | | 0.01 (1) |
| Cork | 24 (3) | 501 (17) | 43 (8) | 5.6 (3) |
| Donegal | 21 (5) | 365 (25) | 375 (16) | 1.01 (2) |
| Dublin | | 61 (3) | | 0.1 (2) |
| Galway | 356 (29) | 1,282 (50) | 426 (23) | 7.6 (17) |
| Kildare | 84 (4) | 147 (11) | 2 (3) | 1.3 (8) |
| Kilkenny | 6 (4) | 118 (7) | 3 (2) | 1.9 (7) |
| Kerry | 10 (2) | 183 (9) | 1 (4) | 5.6 (4) |
| Longford | 0 (2) | 156 (7) | 13 (2) | |
| Louth | 3 (2) | 61 (6) | 1 (3) | 0 (1) |
| Leitrim | | 164 (6) | 59 (11) | 0.3 (2) |
| Laois | 10 (2) | 158 (10) | 0.1 (2) | 1.12 (5) |
| Limerick | 127 (13) | 436 (14) | 19 (3) | 0.16 (2) |
| Meath | 36 (4) | 81 (16) | 13 (3) | 0.12 (5) |
| Monaghan | 6 (3) | 9 (4) | 126 (14) | 0.1 (1) |
| Mayo | 249 (16) | 566 (34) | 548 (22) | 1.91 (10) |
| Offaly | 14 (5) | 1,955 (38) | 25 (7) | 2.67 (10) |
| Roscommon | 41 (5) | 386 (23) | 2 (3) | 1.01 (4) |
| Sligo | 0 (1) | 261 (20) | 13 (11) | 2.54 (11) |
| Tipperary | 163 (7) | 1,080 (19) | 16 (6) | 6.13 (7) |
| Westmeath | 11 (11) | 316 (56) | 95 (14) | 1.31 (8) |
| Wicklow | 60 (3) | 110 (8) | 30 (2) | 6.52 (9) |
| Wexford | 0 (2) | 63 (9) | 6 (1) | 0.11 (2) |
| Waterford | 0 (1) | 207 (11) | 4 (6) | 0.01 (1) |

# The data presented in this table includes a limited number of sites which cross one or more county boundaries. In such cases the area data and site is duplicated for the occurrence of the site in each of the respective counties in which it occurs.

Of the 176 sites listed for this habitat in the NPWS Fen Study database (Foss 2007) 50 sites have no habitat area data. Assuming an average size of 15.5 ha per site it is possible that the cover of this habitat may increase by an estimated 775 ha.

In addition to the sites listed in the NPWS Fen Study database (Foss 2007) for this habitat, an additional 137 potential sites identified for this habitat, based on the occurrence of *Carex lasiocarpa* and *Carex diandra* species distribution records, may add further to the overall habitat area. Assuming an average size of 15.5 ha per site (based on site extent data from the NPWS Fen Study, Foss 2007) it is possible that the cover of this habitat may increase by an estimated 2,124 ha in Ireland.

It is therefore possible, that when outstanding site surveys and habitat extent data are completed on these sites that the habitat area in Ireland may increase to as much as 4,850 ha. Confirmation of this increase in extent will only be possible following detailed site surveys undertaken as part of a National Fen Survey.

In the light of the missing data on extent referred to above, expert opinion would indicate that the current area of the habitat (1,945 ha), based on the extent of known sites listed within the NPWS Fen Study database (Foss 2007), is insufficient to represent the ecological variation of the habitat across its distribution and range in Ireland.

Additional habitat areas will be discovered as part a future detailed field based fen survey of Ireland, which would increase the known extent of Transition mire. The present extent of 1,954 ha of the habitat in Ireland should therefore be regarded as a minimum area until detailed surveys are completed. This qualification concerning extent of the habitat should also be applied to the **Favourable Reference Area** (FRA).

Based on available data the **Favourable Reference Area** (FRA) (see Map 3) is therefore considered to be the same as the current known area of the habitat in Ireland, which should be regarded as a minimum until detailed habitat surveys are completed.

## 4.1. Conservation Status of Habitat Extent

No specific studies have been undertaken on the conservation status of the habitat extent in Ireland. The IPCC fen study of Crushell (2000) lists 10 fen sites with a total site area of 190 ha that had "undergone complete habitat loss since their conservation value was recognised" during the 1990's. A further 47 fen sites with a total site area of 2,463 ha, out of a total of 342 sites recognised in the IPCC study, were reported to have been "damaged since their conservation value was recognised". This represents some 14% of the sites listed in this study. A further 86 sites are listed by Crushell as being threatened by a variety of activities including drainage, agricultural reclamation, afforestation, infilling, turbary *inter alia* (25% of the sites listed by the IPCC).

It is unclear, from the Crushell study, whether the annual incremental decline in habitat area exceeds the 1% per annum threshold set as unfavourably bad by the assessment criteria for this specific habitat.

Analysis of the sites held in the NPWS Fen Study database (Foss 2007), showed that of the 808 sites listed 448 sites (55% of the total) had been affected by damaging operations or were threatened by such activities. In total 377 sites had experienced serious or very serious damage as defined by the NHA standard data forms (data mainly compiled in the 1993-1995 period), representing 47 % of all fen sites in the NPWS Fen Study database (Foss 2007). A further 311 sites were threatened by such activities which represents 39% of the listed sites. Of the sites assessed for damaging activities and threats within the NPWS Fen Study database, only 86 sites (11% of the total) showed no damaging activity, while 83 sites (10% of the total) were considered to have no threats.

Specifically for Transition mire, the results of the NPWS Fen Study (Foss 2007) showed that, 82 sites with a habitat area of 1,045 ha (53%) have been damaged by human activities, while 68 sites with a habitat area of 616 ha (32%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 1,092 ha or 56% of the presently recognised Transition mire resource in Ireland. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum estimate for the area likely to be affected.

Again it is unclear, from this study, whether the annual incremental decline in habitat area exceeds the 1% per annum threshold set as unfavourably bad by the assessment criteria for this specific habitat.

The NPWS Fen Study found that the best estimate of the **current habitat area** in Ireland (based on known and predicted area information), as defined by the list of sites for this habitat listed in the NPWS Fen Study database (Foss 2007) covers an area of 19.54 $km^2$ (1,954 ha) in a total of 176 sites.

The **Favourable Reference Area (FRA)** is considered to be the area of this habitat in all sites listed in the NPWS Fen Study (Foss 2007) database, and is the same as the current area.

According to the to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive) the area covered by the habitat type within the range is therefore **Favourable**.

- **Known area covered by the habitat:** 19.54 km$^2$. **Should be regarded as a minimum until detailed surveys completed.**
- **Favourable Reference Area:** 19.54 km$^2$. **All known site with the habitat. Should be regarded as a minimum until detailed surveys completed.**

## 5. Structures and Functions

### 5.1. Habitat Structures and Functions

Satisfactory data on habitat quality, and habitat change trends are lacking for this habitat in Ireland.

The IPCC fen study of Crushell (2000) referred to in section 4.1 above, showed that 10 fen sites with a total site area of 190 ha that had "undergone complete habitat loss since their conservation value was recognised " during the 1990's. A further 47 fen sites with a total site area of 2,463 ha, out of a total of 342 sites recognised in the IPCC study, were reported to have been "damaged since their conservation value was recognised". This represents some 14% of the sites listed in this study. A further 86 sites are listed by Crushell as being threatened by a variety of activities including drainage, agricultural reclamation, afforestation, infilling, turbary *inter alia.* (25% of the sites listed by the IPCC).

Specifically for Transition mire, the results of the NPWS Fen Study (Foss 2007) showed that, 82 sites with a habitat area of 1,045 ha (53%) have been damaged by human activities, while 68 sites with a habitat area of 616 ha (32%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 1,092 ha or 56% of the presently recorded Transition mire resource. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum area estimate.

The damage caused to fen habitats and reported by Crushell (2000) and noted during the NPWS Fen Study (Foss 2007) has presumably been coupled with a decline in habitat quality (i.e. structure and functions).

It is likely that the number of sites for the habitat which have experienced damage in the past from a variety of negative factors (i.e. burning, peat extraction, dumping, infilling, over grazing) or suffered alteration in hydrological conditions (i.e. local drainage, arterial drainage, water abstraction etc.) or are threatened by these and other activities, is in fact much higher than indicated by these two studies. However, without a national survey to record such damage and threats no more specific assessment of conservation status can be undertaken at present.

Although, the overall extent of the habitat may remain unchanged in some cases, adverse changes in some of the above attributes would indicate deterioration in overall habitat structure and function.

#### 5.1.1. Conservation Status of Habitat Structures and Functions

Satisfactory data on habitat quality, and habitat change or species trends are lacking. Based on available information and expert opinion it is likely that more than 53% of the area of the habitat in Ireland is unfavourable conserved as regards its specific structures and functions (including typical species). Conservation status of habitat structures and functions is therefore regarded as unknown but likely to be **Unfavourable Bad**.

### 5.2. Typical Species

Transition mire typically contain a suite of vascular plants, that include those found on both acid bogs and Alkaline fens, formed by medium-sized or small sedges, associated with *Sphagnum* or brown mosses.

According to the 2003 version of the Interpretation Manual the characteristic plant communities and species of Transition mire (7140) are as follows: *Eriophorum gracile*, *Carex chordorrhiza*, *Carex lasiocarpa*, *Carex diandra*, *Carex rostrata*, *Carex limosa*, *Scheuchzeria palustris*, *Hammarbya* *paludosa*, *Liparis loeselii*, *Rhynchospora alba, R. fusca*, *Menyanthes trifoliata*, *Epilobium palustre*, *Pedicularis palustris, Sphagnum* sp. (*S. papillosum*, *S. angustifolium*, *S. subsecundum*, *S. fimbriatum*, *S. riparium*, *S. cuspidatum*, *Calliergon giganteum*, *Drepanocladus revolvens*, *Scorpidium scorpioides*, *Campylium stellatum*, *Aneura pinguis*.

While CORINE defines characteristic species to include *Eriophorum gracile, Carex lasiocarpa, C. chordorrhiza, C. limosa, Hammarbya paludosa*.

Table 3.1 shows characteristic species for the habitat as defined by the Habitats Directive; phytosociological association character and prominent species; characteristic species for the habitat in general in Ireland as well species considered to be indicators of good site quality or typical species as defined by the Directive (Ó Críodáin, C. *pers. comm.*).

**Table 3.1 List of typical species of Transition mire habitat in Ireland**

| Species | Characteristic species in the Habitats Directive Interpretation Manual (2003) | Association Character & prominent (PR) species on Transition mire (Ó Críodáin, C. & Doyle, G.J., 1994; Doyle, G.J. & Ó Críodáin, C., 2003) | Typical or good site quality indicator species (Ó Críodáin, C. *pers. comm.*) | Characteristic Irish Transition mire species |
|---|---|---|---|---|
| *Agrostis stolonifera* | | | | Yes |
| *Aneura pinguis* | Yes | | | Yes |
| *Bryum pseudotriquetrum* | | Character | Yes | Yes |
| *Calliergon giganteum* | Yes | Character | Yes | Yes |
| *Calliergonella cuspidata* | | PR | | Yes |
| *Campylium stellatum* | Yes | | | Yes |
| *Carex diandra* | Yes | Character | Yes | Yes |
| *Carex lasiocarpa* | Yes | Character | Yes | Yes |
| *Carex limosa* | Yes | PR | Yes | Yes |
| *Carex nigra* | | PR | | Yes |
| *Carex rostrata* | Yes | PR | | Yes |
| *Carex viridula* | | | | Yes |
| *Cladopodiella fluitans* | | | | Yes |
| *Drepanocladus revolvens* | Yes | | | Yes |
| *Epilobium palustre* | Yes | | | Yes |
| *Eriophorum angustifolium* | | | | Yes |
| *Eriophorum gracile* | Yes | | Yes | Yes |
| *Galium palustre* | | PR | | Yes |
| *Hammarbya paludosa* | Yes | | | Yes |
| *Hydrocotyle vulgaris* | | PR | | Yes |
| *Menyanthes trifoliata* | Yes | PR | Yes | Yes |
| *Molinia caerulea* | | PR | | Yes |
| *Myrica gale* | | PR | | Yes |
| *Pedicularis palustris* | Yes | | Yes | Yes |
| *Potentilla palustris* | | PR | Yes | Yes |
| *Ranunculus flammula* | | PR | | Yes |
| *Rhynchospora alba* | Yes | | | Yes |
| *Rhynchospora fusca* | Yes | | | Yes |
| *Scorpidium scorpioides* | Yes | PR | | Yes |
| *Sphagnum angustifolium* | Yes | | | Yes |
| *Sphagnum cuspidatum* | Yes | | | Yes |
| *Sphagnum denticulatum* | | PR | Yes | Yes |
| *Sphagnum fallax* | | | | Yes |
| *Sphagnum fimbriatum* | Yes | | | Yes |
| *Sphagnum papillosum* | Yes | | | Yes |
| *Sphagnum riparium* | Yes | | | Yes |
| *Sphagnum subsecundum* | Yes | | | Yes |

The final list includes species that are characteristic of the habitat expanded to include those species indicative of good habitat quality which might be included in future surveys of the habitat. An over representation of a single species does always indicate good habitat quality.

This list is slightly different from that in the Interpretation Manual of the Habitats Directive, as certain species are included in the Interpretation Manual as characteristic of the habitat but do not occur on Irish site. The list also reflects recent changes in species nomenclature.

### 5.2.1. Conservation Status of Habitat Typical Species

No specific studies have been undertaken on conservation status of habitat typical species in Ireland.

Nonetheless, the assessment of the habitat quality (i.e. Structure and Functions, see above) is partially based on changes in habitat extent and can be used to assess the conservation status of Typical Species. The definition of a habitat is based on the presence and dominance of certain typical species, with particular emphasis on sedges and brown mosses. Thus, a decline in habitat quality (estimated at 56% of the area of this habitat damaged and threatened in Ireland) is likely to have resulted in a decline in the presence of Typical Species. The conservation status of habitat structures and functions is regarded as **Unknown** for this habitat.

As habitat quality and typical species are so interdependent, it can be suggested that an unknown but likely to be **Unfavourable Bad** conservation status can also be inferred for Typical Species.

## 6. Impacts and Threats

A variety of impacts and threats are recognised which have resulted in the historic decline and loss in quality and functions of the habitat in Ireland to the levels we see today, and continue to threaten the habitat. Peat or turf cutting, arterial drainage, local drainage and agricultural reclamation are reported as being the most significant activities affecting the conservation status of Transition mire (Foss *et al*. 2001, Hammond 1979, Crushell 2000, Curtis *et al* 2006).

In more recent times a series of additional factors have also damaged sites of conservation value (Foss *et al*. 2001, Crushell 2000). These impacting activities include drainage associated with reclamation for agriculture or general land “improvement”, infilling of sites with building waste, dumping of household refuse, afforestation, water pollution and urban expansion (Foss *et al*. 2001, Crushell 2000, Curtis & McGough 1981, Curtis *et al* 2006). Crushell (2000) list some 46 fen sites with a total site area of 2,463 ha that have been damaged by these activities, while 86 fen sites are listed as being threatened by these activities.

These activities were found to seriously disrupt the hydrological conditions needed to maintain these habitats, leading to desiccation of the fen and loss of the characteristic micro-topographical features and eventually change in flora and fauna (Foss *et al*. 2001). These activities have resulted in at least a 79% decline in the extent of fens (Foss *et al*. 2001) with only 21% remaining in a conservation worthy condition.

Of the remaining sites, 80% are reported to be small in size (less than 100ha) making their future management particularly susceptible to external environmental changes (Foss *et al*. 2001). While in the most recent NPWS Fen Study (Foss 2007) of the 176 Transition mires identified in Ireland, almost 58% (103 sites) had a total site area smaller than 50 ha.

A review of damaging activities and threats reported on sites from 1993 to-date was also undertaken as part of this conservation assessment. Data on activities affecting or likely to affect sites were collated against individual sites from various sources.

These included:

- Recent site surveys undertaken by NPWS where damage to fens was reported
- Damage reported to fen sites in the IPCC Fen Study (Crushell 2000)
- Damage assessment section of the NHA standard data forms held by NPWS created as part of the NHA surveys of the mid to late 1990’s. Only serious or very serious damage, as reported on the NHA data forms, and likely to affect the fen habitats on sites was recorded

- Site Inspection Reporting (SIR) programme. Reporting under SIR is carried out on a three yearly cycle that began in 1998 (i.e. 1998-2000; 2001-2003; 2004-2006). The Research Branch Monitoring Section (NPWS) developed the SIR programme to be used as a monitoring tool. Local NPWS staff log the following info: activities occurring on the site and their effects on the site's integrity, follow-up actions including all outcomes such as prosecutions, notifiable actions and positive management undertaken and site patrolling frequency and purpose.

Analysis showed that of the 808 sites listed in the NPWS Fen Study database 448 sites (55% of the total) had been affected by damaging operations or were threatened by such activities. In total 377 sites had experienced serious or very serious damage as defined by the NHA standard data forms, representing 47 % of all fen sites in the NPWS Fen Study database (Foss 2007). A further 311 sites were threatened by such activities which represents 39% of the listed sites.

For Transition mire fen, 82 listed sites with a habitat area of 1,045 ha (53% of the national resource) have been damaged by human activities, while 68 sites with a habitat area of 616 ha (32%) are threatened by human activities. The total area affected by various threats and pressures has been estimated at 1,092 ha which represents 56% of the known Transition mire resource.

## 6.1. Agriculture & Land Reclamation

Crushell (2000) reported that the most serious impact on fens has been for their reclamation for agricultural land. The process involves drainage, fertilisation, reclamation and the removal of peat. The fact that alkaline fens (and associated areas of calcareous species rich Cladium fen, Petrifying springs and Transition mires) are most commonly found over limestone and are indicative of fertile land has resulted in many areas with such communities being drained and utilised for agriculture (O'Criodain & Doyle 1997). Drainage is undertaken to dry out the actual fen habitat surface, or the agricultural land or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural.

From the mid 1800's to the present day the total area of and drained under the various Acts and Schemes amounted to more than 2 million hectares, or some 30% of the total land area in Ireland (Anonymous 1999). Much of this work was carried out under the following: the 1945 Arterial Drainage Act, the Land Project of 1949, the Farm Modernisation Scheme 1974-1985, and the Western Drainage Package 1979-1988. These schemes are likely to have had a serious impact on many fen systems, a fact that is supported by evidence from the Arterial drainage act which resulted in drainage works being carried out on 38 catchments in Ireland, affecting some 262,800 ha of land. Since the mid 1980's there has been a substantial decline in grant aided drainage schemes.

Land reclamation has also been grant aided under the now suspended Farm Improvement Programme and the Programme for Western Development. Between 1981 and 1990 more than 25,000 approvals for intensive lowland reclamation works were made and provided with Euro 25 million in grant aid.

## Agriculture & Land Reclamation Trend

No specific studies have been undertaken on agriculture and land reclamation trends of the habitat in Ireland.

Although larger grant aided schemes have now ceased, small scale drainage and improvements works often carried out on agricultural land surrounding the fen habitat continue to damage these sensitive wetland systems.

## 6.2. Drainage

Drainage is conducted to interference with the aquifer, dry out the actual fen habitat surface, or the agricultural or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural purposes and the cutting of turf.

These drainage activities seriously disrupt the hydrological conditions needed to maintain these water dependent habitats, where water levels are at or close to surface all year round, with fluctuations being limited to just a little below the surface. Where a floating matt or scraw is present, a certain resilience to reduced water levels can occur due to the ability of the matt to move upwards or downwards with changing water levels (Curtis et al. 2006, Foss *et al*. 2001). However long term reduction in water level is likely to affect species composition of the scraw.

The blocking of drains is considered as an essential tool for the recovery and improvement of the habitat which has been affected by this activity, together with suitably nutrient poor water supply.

### Drainage Trend

No specific studies have been undertaken on drainage trends of the habitat in Ireland.

Although, according to the findings of numerous surveys conducted on sites with this habitat, drainage operations are a recurring feature that continues to threaten the integrity of sites or to lead to their degradation. The ban on the insertion of new drains on protected high bog areas (i.e. raised bogs) should have positive implications for associated fens in such locations.

## 6.3. Turf cutting

Although turf cutting has its most significant affect on the acid bogs from which the turf is cut, drainage works associated with this activity also adversely affects many low lying areas, where fen communities occur, and the lagg zone of bogs where Transition mire in particular would have been common in the past.

In addition, with more modern forms of mechanised peat extraction (see below), the peat must be spread over dry marginal land beside the bog to allow it to dry, a feature which necessitates improved drainage on these marginal areas.

Turf cutting, which in the past mainly consisted of hand cutting, became mechanised since the 1980's and was stimulated by the introduction of the Turf Development Act in 1981. The mechanisation of peat extraction by private producers allowed the exploitation of small bogs by small commercial companies and co-operatives. This has been accompanied by intensive drainage of the high bog, which was practically non-existent on the smaller bogs up to 1981.

Therefore, in the last two decades, medium and small size bogs have been increasingly severely impacted by mechanised turf cutting. In the view of the IPCC (Foss *et al*. 2001), the widespread use of machinery has in recent years greatly accelerated the process of decline in peatland resource, particularly Lowland Raised Bogs. They consider that, more peat is now being harvested over a wider area of bog and on a semi-commercial basis since the decline of hand cutting. This has in many cases altered the scale of cutting from the traditional domestic small scale level to much more intensive semi-industrial scale extraction.

### Turf Cutting Trend

The mechanisation of peat extraction has increased the amount of peat extracted from active turf plots and thus the negative effects of this activity. Mechanisation has correlated with a reduction in manual extraction.

Following the publication of the list of SAC raised bog sites in 1997, there was prolonged and strenuous objection from turf cutters. The objectors especially concerned about loss of property rights, loss of future fuel supplies and loss of a way of life in the summer months. The then Minister, Síle de Valera T.D., addressed the objections of bog owners by allowing them cut for domestic use for 10 years, up to and including 2008, at which stage all cutting would have to cease. When the NHAs were designated in 2004, a similar 10-year derogation was put in place, allowing cutting until 2014.

The Department of Environment, Heritage and Local Government (DEHLG) has introduced two voluntary turf cutting cessation schemes since 1999 to buy out turbary rights in NHAs and SACs. The schemes, which were relatively successful in dealing with obvious commercial activity (i.e. moss peat developments), were less successful in dealing with small scale, semi-commercial to commercial fuel peat operations and have had almost negligible impact on domestic cutting. The schemes do not appear to have significantly reduced the numbers of cutters and thus the negative effects of cutting on raised bog priority habitats (Fernandez *et al*. 2006). Thus, unless a more restrictive approach (i.e. mandatory cessation of cutting coupled by compensation packages) is taken, turf cutting is likely to continue at current levels or even increase with increasing fuel prices.

### 6.4. Afforestation

Forestry, which mainly consists of coniferous plantations, is found either on the raised or blanket bog or on the cutover area adjacent to these bog types bog. Surface drainage is always associated with forestry plantations and has similar negative effects to that carried out to facilitate peat cutting and land reclamation. However, other impacts such as shading of vegetation and compression of the peat caused by heavy machinery are related to afforestation.

Egan (1999) mentioned that in 1987, Coillte initiated a major afforestation programme on cutaway bogland and up to 1998 over 4,000 ha were planted.

### Afforestation Trend

EU grant aid for private forestry, which is administered by the Forest Service of the Department of Agriculture and Food, is now withheld for designated peatlands. Indeed, according to the Forestry Service biodiversity strategy, areas designated as SAC or SPA are not considered for afforestation grants. NHAs may also be excluded if the proposed development is incompatible with their protection (McAree, 2002). On the other hand, all grant-aided development in Ireland must also conform to the Forest Service Forest biodiversity guidelines which set out measures to protect existing habitats and wildlife and to maximise the biodiversity of forest.

Coillte Teoranta, one of the major owners of peatland in the country, has ceased planting conifers on intact peatlands on its ownership, principally on economic grounds. It has also made strong commitments to the implementation of the Helsinki Process on Sustainable Forest Management and as part of their Nature Conservation Program. Coillte has initiated *Blanket Bog & Raised Bog Restoration Projects* that will result in the felling of coniferous plantations and drain blocking on some of their peatland sites.

The threat from afforestation on SAC & NHA designated sites therefore appears to be declining. The current trend for un-designated sites is unknown.

### 6.5. Other Impacting Activities

Impacting activities such as over grazing by cattle and sheep, associated poaching by grazing animals, reduction in grazing leading to scrub invasion, burning, dumping of domestic waste, landfill dumping, fertilisation, water pollution, communication routes, cultivation, mowing/cutting, modification of inland water structures, sand and gravel extraction are among the impacting activities that have been reported on sites with the habitat (Foss 2007; see Table 6.1).

Specifically they may occur within and around locations for this habitat. These activities are considered to have negative impact on the habitat where they occur or where they affect the aquifer.

With the exception of damage caused by grazing, landfill and the possible effects of water pollution which are widely reported from fen sites, the activities listed above are in general less widespread than the impacting activities of land reclamation, drainage, peat cutting, and afforestation discussed earlier.

Although significant changes in water chemistry, caused by water pollution has been cited (Curtis *et al* 2006) as a factor affecting site vulnerability, studies are lacking on the physio-chemical requirements of the habitat in Ireland. However as the habitat is characteristic of more nutrient poor and less alkaline conditions, it may be assumed that changes in either of these water parameters will result in unfavourable conditions for long term survival of the habitat.

Buffering capacity is considered to be high for the habitat (due to nature of the organic peat substrate), but not accurately known. Phosphorus is the limiting nutrient to growth in most fen habitats (Doyle & Ó Críodáin 2003) and elevated levels lead to the vigorous growth of grasses over other species, resulting in the loss of fen species. The role of increased nitrogen levels in the species composition of the habitat is unclear.

**Table 6.1: Severity of impacting activities recorded on Transition mire sites recognised in the NPWS Fen Study (Foss 2007)**

| Main Pressure - Past and present | Level of Impact |
|---|---|
| 143 Overgrazing by cattle | Moderate/Significant |
| 150 Restructuring of agricultural land holding | Significant |
| 152 Removal of scrub | Minor |
| 160 General Forestry management | Moderate |
| 161 Forestry planting | Significant |
| 180 Burning | Moderate |
| 230 Hunting | Minor |
| 300 Sand gravel extraction | Minor |
| 301 Quarries | Minor |
| 310 Peat Extraction | Significant |
| 311 Hand-cutting of peat | Significant |
| 312 Mechanical removal of peat | Significant |
| 400 Urbanised areas, human habitation | Moderate |
| 421 Disposal of household waste | Moderate |
| 502 Communication networks routes, auto routes | Minor |
| 700 Pollution | Moderate |
| 701 Water Pollution | Moderate/ Significant |
| 790 Other pollution or human impacts | Moderate |
| 800 Landfill, land reclamation and drying out, general | Significant |
| 803 Infilling ditches, dykes, ponds, marshes and pits | Significant |
| 810 Drainage | Significant |
| 890 Other human induced changes in hydraulic conditions | Significant |
| 950 Biocenotic evolution | Minor |
| 951 Accumulation of organic material | Minor |
| 954 Invasion by a species | Moderate |

## 7. Future Prospects

### 7.1. Negative Future Prospects

Deterioration of the Transition mire hydrology at current rates caused by the main threats of peat cutting, drainage, forestry, land reclamation and possibly water pollution will continue to affect the viability of the habitat. Other negatively influenecing activities (see Table 6.1 above) may also result in further habitat decline at less significant levels than that caused by the main threats.

No accurate survey data on damage occurring on the known habitat national resource exists. However, the majority of anecdotal information from recent site specific surveys indicate that the Future Prospects for the habitat is Poor or Bad.

Furthermore, climate change predictions of increases in temperatures accompanied by a decrease in summer rainfall would increase the summer moisture deficit of Transition mire and potentially affect species composition on sites and might possibly result in a reduction or cessation of peat formation. This would result in further habitat losses, reduction in habitat quality and possible reduction in habitat viability.

## 7.2. Positive Future Prospects

No specific national management programme designed to ensure the favourable conservation status of sites with this habitat have been undertaken in Ireland (Ó Críodáin pers comm.).

Transition mire habitats may, however, benefit indirectly from a number of individual management and restoration programmes being carried out in Ireland, though these benefits are likely to be relatively restricted in terms of the overall extent of the habitat resource benefiting from these initiatives. In addition a variety of national measures under various schemes, Directives and survey and research programmes may also benefit sites with this habitat. The various initiatives occurring are outlined below:

**NPWS National Fen Survey of Ireland**

Due to limitations in the current knowledge of the Irish fen resource, in terms of both the fen types identified on many sites to date, and the extent of the habitat type(s) within sites (Foss 2007), the NPWS initiated the National Fen Survey of Ireland in 2007. The first detailed pilot survey is being undertaken in County Monaghan in conjunction with Monaghan County Council.

The aims of the County Monaghan and future fen surveys, will be to survey known and recently reported fen sites in each Irish County, locate further sites of conservation value, characterise the fen habitats present (including EU Annex I fen habitat types) in terms of their floristics, hydrology and water chemistry parameters, estimate the extent of fen habitat(s) present on each site, rate site and habitat quality, record threats and damaging operations and make management priorities and needs recommendations to ensure long term conservation and viability of the key sites identified, and their associated fen habitats.

Results of the National Fen Survey will feed into the respective County Development Plans and the NPWS conservation designation process.

**NPWS Site Research & Restoration Work**

Curtis *et al*. 2006 indicate that the potential for restoring stands of Transition mire is largely untested, and is dependent on the nature and extent of the damage. Restoration of the vegetation fabric, following damage, would be a very long term process unless there were still some areas of floating scraw present. Restoration would also be dependent on the provision of an appropraite nutrient-poor water regime. To date these options remain largely untested.

**NPWS Raised Bog Restoration Project**

On Irish raised bogs NPWS commenced a *Raised Bog Restoration Project* in 1994, which ran up to the end of 1999 and included 10 sites. This project was assisted by the EU Cohesion Fund (Ryan and Streefkerk, 1998). Objectives of the project were the restoration of the bogs hydrology, acquisition of raised bog land, survey of high bog and lagg systems and establishment of a monitoring program. These restoration works consisted of the blocking of drains, mainly on the high bog, and the construction of dams. NPWS again carried out restoration works (i.e. blocking of drains) on three new sites in 2003 and one in 2006. The results of these restoration works are considered positive overall, as there is some expansion and new Active Raised Bog habitat formation occurring (Fernandez *et al.* 2005). These restoration activities may also benefit other wetland habitat types.

**EU Life - Nature Programme**

Coillte Teoranta initiated a *Raised Bog Restoration Project* in 2004. This was funded by an EU Life - Nature Programme. This project will be completed in 2008 and forms part of Coillte's Nature Conservation Programme. The project will work towards restoring 571.2 hectares of raised bog habitat on its property in the midland counties. This project area will be managed with nature conservation as the primary management objective into the future. The project also involves the felling of 450ha of plantation forest, felling of naturally regenerated exotic trees on open bog, perimeter protection of vulnerable raised bog sites against fire, blocking of drains after felling and ongoing monitoring of vegetation and water levels on 14 sites (Coillte, 2005 - www.raisedbogrestoration.ie).

Coillte Teoranta initiated a *Blanket Bog Restoration Project* in 2002. This project, jointly funded by Coillte and DG-Environment under the EU LIFE-Nature Programme, is a four-year scheme, the primary aim of which is to achieve restoration of blanket bog habitat within 1212 hectares of land owned by Coillte. The main focus of the project, active blanket bog, is listed as a priority habitat for conservation under Annex 1 of the EU Habitats Directive, and the areas for restoration either lie within, or occur adjacent to, proposed Special Areas of Conservation. A total of 14 blanket bog sites, most of which are located along the western seaboard of Ireland, have been selected for restoration. At most sites, the main restoration measures to be employed are the removal of conifers and the blocking of any existing drains (http://www.irishbogrestorationproject.ie/).

**Cutaway Bog Restoration Projects**

A trend which may also facilitate the creation of new secondary Transition mire sites, over the long term, is the abandonment of former cutaway peat areas following the extraction of commercial peat reserves. On these sites, the cessation of drainage activities used to keep the areas dry enough to allow peat extraction, results in partial re flooding of areas, which may allow the regeneration of Transition mire communities (Egan 1999, Farrell 2006).

Bord na Móna (Irish Turf Development Bord) initiated a series of cutaway bog restoration projects in the 1990's in County Mayo (Anonymous 2003; Farrell & Doyle 1998; 2003) and in the midlands (Farrell 2006). Cutaway bog is the term used to describe peatland from which the economically recoverable layers of peat have been extracted for commercial or domestic purposes. There will be up to 70,000 ha of these lands emerging as a result of Bord na Móna's present peat production activities. The potential exists to create a future landscape of forestry and open grasslands interspersed with lakes, wetlands and natural corridors for wildlife; a landscape which is both economically productive for its communities and which respects and values areas of wilderness alongside commercial enterprise (http://www.bnm.ie).

**NPWS Site Conservation Designations**

One further positive prospect for the habitat in Ireland is that 46% (3,152 ha) of all sites recorded within the NPWS Fen study database (Foss 2007) are within a candidate SAC (cSAC) and an additional 28% (1,921 ha) of sites are within a candidate Natural Heritage Area (cNHA).

In the case of Transition mire sites 1,893 ha or 96% of the known habitat area falls within a candidate designated (SAC or NHA) area in Ireland, which should in the long term provide an additional degree of protection for these sites. This optimism must, however, be tempered by the fact that habitat loss in terms of extent and quality are still occurring within candidate SAC and NHA due to human interference (see above).

**NPWS SAC, SPA and NHA Conservation Management Plans**

The NPWS is planning to produce Conservation Management Plans for each SAC, SPA and NHA in Ireland. Each plan will list the wildlife resources of the area, the current human uses, any conflicts between the two, and strategies for retaining the conservation value of sites. The draft plans will be given to a liaison committee and other interested parties for discussion and consultation. The NPWS will then prepare a final version of the conservation plan. Consultation on draft consultation plans has begun. Conservation Plans, once complete, will be reviewed on a 5 year cycle.

Data provided by the Management Planning Services Unit (MPSU) section in NPWS (dated 21 February 2007) indicates that 382 conservation plans are presently planned for wildlife sites in Ireland. In total 274 plans are in preparation, 64 plans are completed an ready to go to consultation, while 44 are in consultation or have gone through this process. Within the NPWS Fen Study database (Foss 2007) of the 808 fen sites listed a total of 219 sites have management plans in preparation, 38 plans are completed an ready to go to consultation, while 40 are in consultation or have gone through this process. Implementation of the recommendations in these plans will provide additional conservation protection to fens within the listed sites.

To provide increased conservation protection under the Habitats Directive to SACs from damaging activities, a series of Notifiable Actions have been drawn up by the Department of the Environment (see Appendix IV) on these areas. A landowner must obtain a written consent before performing and such operations on, or affecting the land or waters within an SAC.

**Rural Environment Protection Scheme**

Rural Environment Protection Scheme (REPS), is a scheme designed to reward farmers for carrying our their farming activities in an environmentally friendly manner and to bring about environmental improvement on existing farms. The objectives of the Scheme are to:

- establish farming practices and production methods which reflect the increasing concern for conservation, landscape protection and wider environmental problems;
- protect wildlife habitats and endangered species of flora and fauna;
- produce quality food in an extensive and environmentally friendly manner.

When properly implemented the scheme can benefit sites with this habitat in Ireland, although the lack of sufficient scientific and management expertise needed at a local level, on sites with the habitat, may be a hindrance to achieving this goal.

**EU Water Framework Directive**

Under the Water Framework Directive (2000/60/E) all inland and coastal waters within defined river basin districts must reach at least good status by 2015 and the Directive further defines how this should be achieved through the establishment of environmental objectives and ecological targets for surface waters. Efforts to protect water dependent habitats, which include Alkaline Fen, Transition Mire, Petrifying Springs and Calcareous Fens with Cladium mariscus are being taken within each River Basin District. This is critical as far as protection of the water supplies for these groundwater dependant systems are concerned.

All SACs and, in future, NHAs in which these fen habitats as a qualifying interests will be listed in the Register of Protected Areas drawn up for each River Basin District.

The Water Framework Directive requires that an integrated monitoring programme be established within each river basin district. These monitoring programmes will in many cases be extensions or modifications of existing programmes and will enable collection of the physical, chemical and biological data necessary to assess the status of surface and groundwater bodies in each river basin district.

Where water quality or supply issues are, or have the potential to, impact adversely on sites, this will have to be dealt with through the Programme of Measures associated with each River Basin District Management Plan.

### 7.3. Overall Habitat Future Prospects

No specific management programmes designed to ensure the favourable conservation status of sites with this habitat have been undertaken in Ireland.

Negative actions such as land reclamation, turf cutting, and drainage continue impacting the habitat: decreasing its extent and degrading its structure and functions. Only limited measures have been introduced to address these damaging activities, which are likely to have increased in severity since the 1990’s.

To summarise, the habitat long-term viability is not assured and there are unfavourable prospects for its future. The Future Prospects are therefore deemed to be **Unfavourable Bad**.

## 8. Overall Assessment of the Habitat Conservation Status

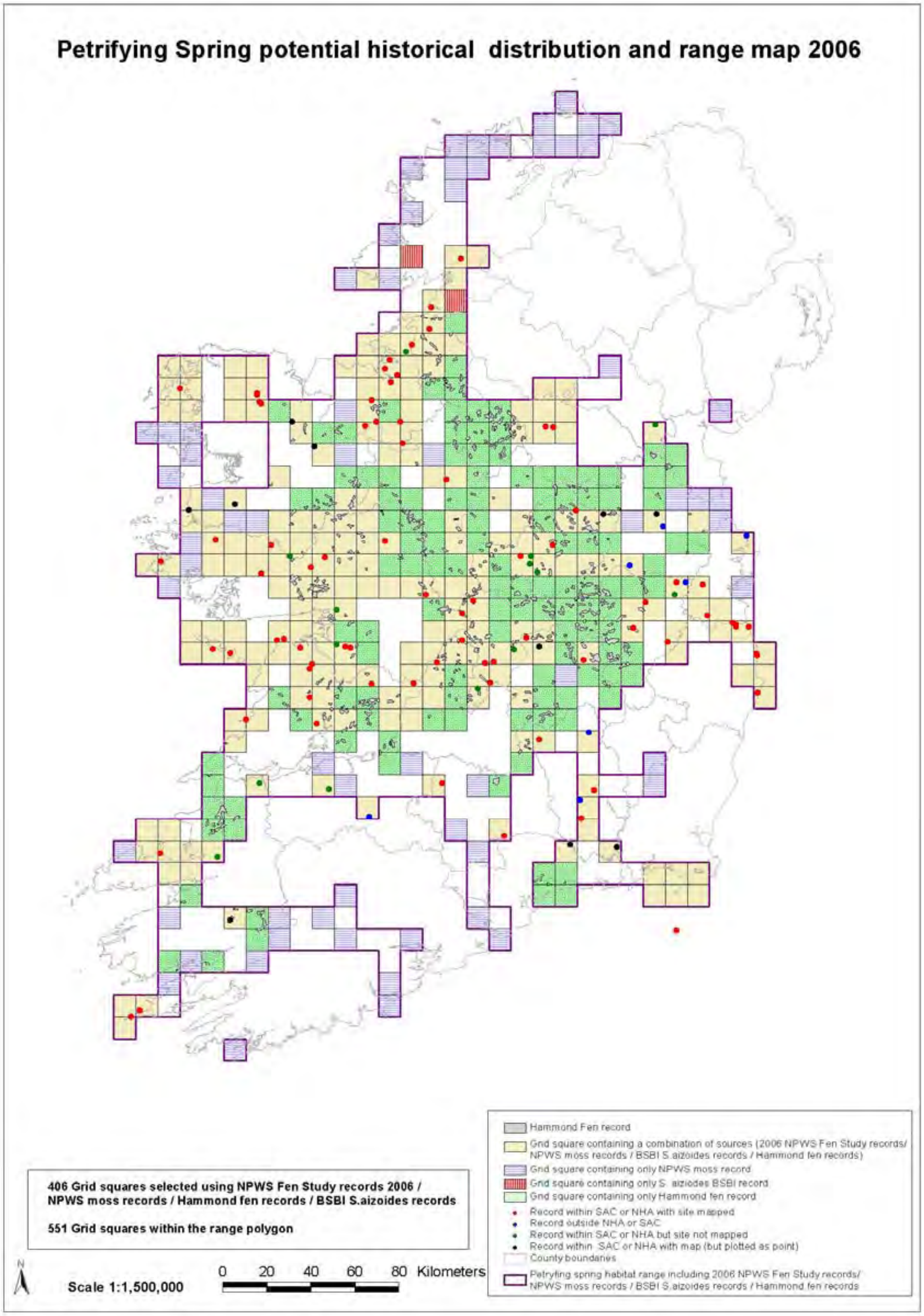
The habitat conservation status of the four main attributes has been assessed as follows:

- The **Favourable Reference Range (FRR)** is estimated to be 100% of the current habitat range and thus **Favourable**.

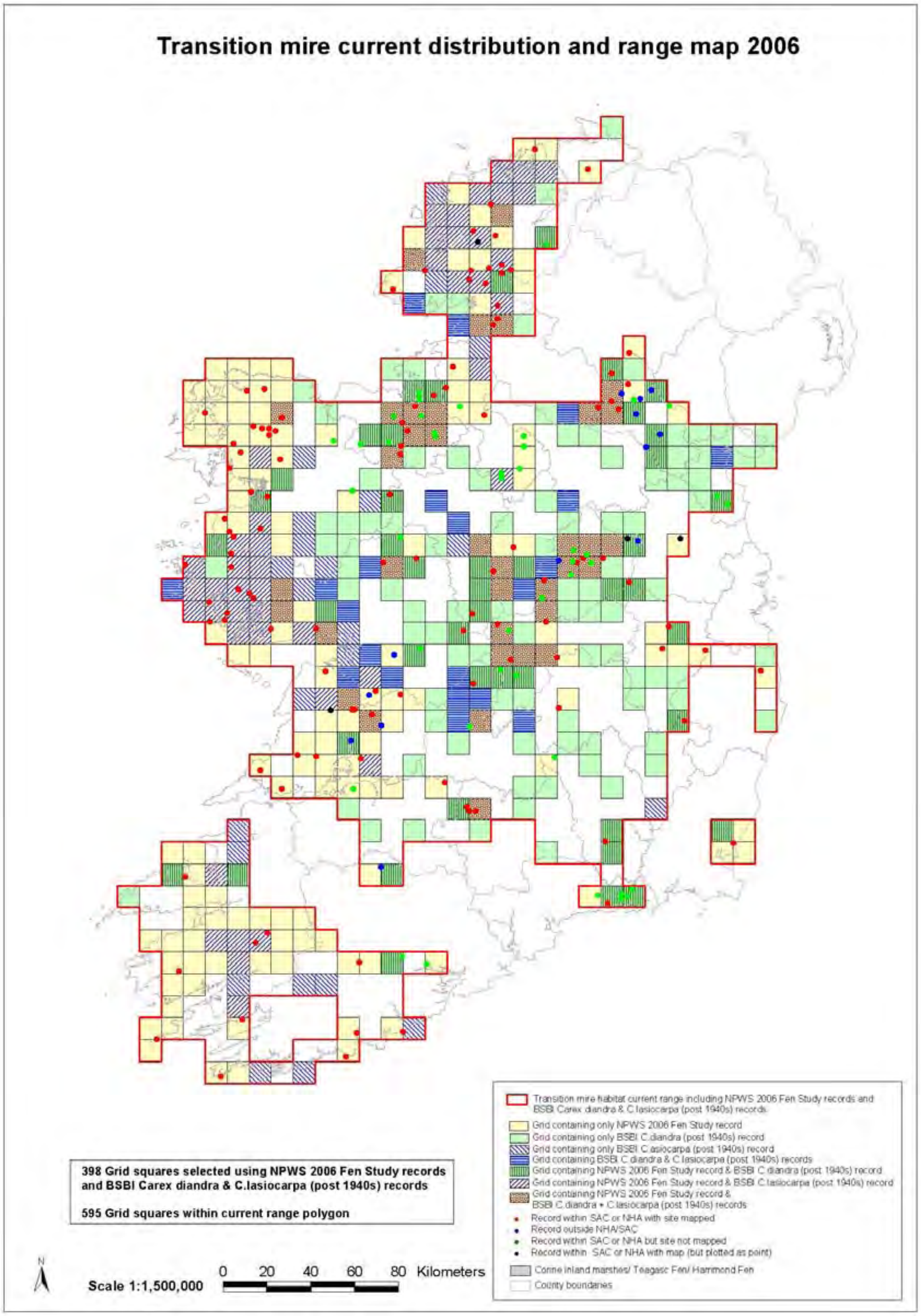
- The **extent of Transition Mire** habitat has decreased, though exact figures for the decline area not available. The extent of the FRA of the habitat is the same as the current extent and therefore deemed **Favourable**.
- An **Unfavourable Bad** assessment is given to the **habitat structures and functions** as the decline in habitat quality indicates.
- The **habitat's Future Prospects** are overall deemed to be **Unfavourable Bad**. Ongoing deterioration of the hydrological conditions of Transition Mire at current rates caused by drainage, reclamation, and infilling severely threatens the viability of the habitat. Major positive management actions: land purchase and restoration works are required.

Thus, considering the assessment of the four main habitat's attributes, the overall conservation status for **Transition Mire** habitat is **Unfavourable Bad**.

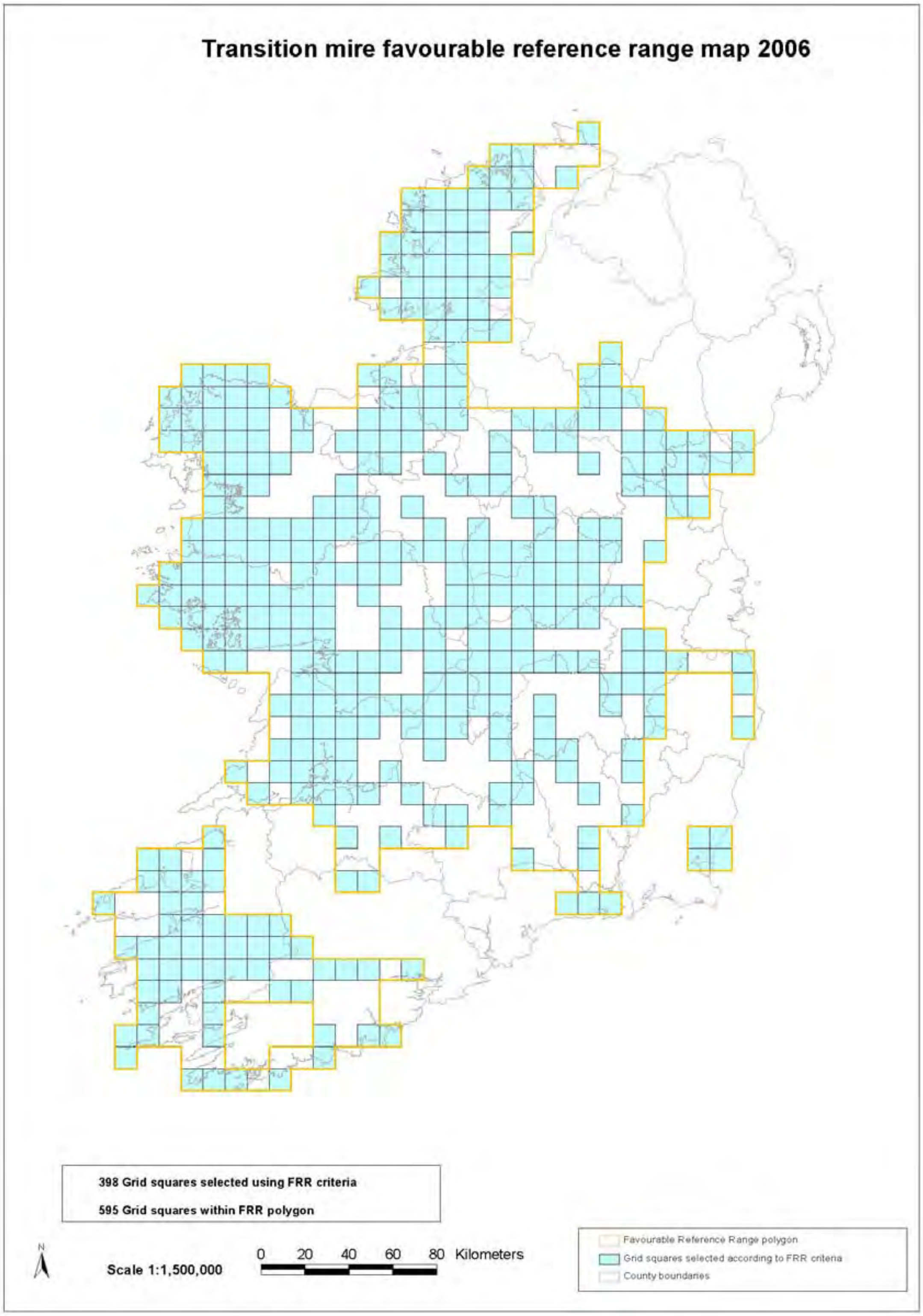
**Map 1: Transition mire potential historical habitat distribution and range map**



**Map 2: Transition mire current habitat distribution and range map**



**Map 3: Transition mire habitat favourable reference range map**




**9.**

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# APPENDICES

# APPENDIX I

# STUDY OF THE EXENT AND CONSERVATION STATUS OF SPRINGS, FENS AND FLUSHES IN IRELAND

The National Parks and Wildlife Service (NPWS) carried out a *Study of the Extent and Conservation status of Springs, Fens and Flushes in Ireland* (Foss, P.J. 2007) during 2006 with the aim of compiling a comprehensive list of all fen sites in Ireland, classifying these according the EU Habitats Directive fen categories recognised as occurring in Ireland, and assessing the extent of fen vegetation within the sites identified.

No systematic national survey of fens has yet been undertaken in Ireland, in contrast to the situation for raised and blanket bogs. The NPWS Fen study aimed to ascertain our baseline understanding of the fen resource in Ireland.

This study addressed the following research objectives:

- collect and amalgamate data on known fen sites of conservation importance in Ireland from within the NPWS and following consultation with external groups;
- produce a computerised inventory of all sites of known or possible conservation value to include key data on each site, including the specific fen vegetation type(s) present; the known or estimated area of each fen vegetation type; and compile available published and survey information on sites;
- collect data on fen sites without a current conservation designation (outside the NHA and SAC network) but which might be considered for NHA or SAC designation by NPWS following survey and evaluation;
- examine where other sites of conservation interest might be located based on local soil, geological and environmental factors;
- assess the past and present extent of fen habitats in Ireland;
- evaluate each site in terms of its conservation importance, known area information, known survey information, and assign a survey priority to each;
- make recommendations for a future national fen field survey.

The NPWS Fen study focused on 6 fen habitat types of conservation importance (four of which are listed in Annex 1 of the EU Habitats Directive, two of which - denoted with an asterisk - are priority habitats) in Ireland. The Annex 1 fen types investigated during the study include:

7230 Alkaline fens (Fossitt category PF1)

7140 Transition mires and quaking bogs (Fossitt category PF3)

7210 *Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (Fossitt category PF1)

7220 * Petrifying springs with tufa formation (*Cratoneurion*) (Fossitt category FP1)

A variety of data sources (reports, publications, databases and other habitat inventory lists), groups and individuals were consulted in the compilation of information for the NPWS Fen Study database, over an eight month period in 2006, from both within NPWS and from external sources. The main sources consulted in the compilation of the NPWS Fen Study database are listed below.

The past extent of fens in Ireland (based on Anonymous 1981; Hammond 1979; Foss, P.J., O'Connell C.A. & Crushell P. (eds.), 2001 *inter alia*) is presented in the report. The original area of fens in Ireland is estimated to have been at least 92,508 ha (Hammond 1979). An estimated 19,660 ha of conservation worthy intact fens, occurring in 367 discrete sites were recognised in Ireland by IPCC in 2001 (Foss *et al.* 2001).

The total area of estimated fen vegetation recorded in the NPWS Fen Study amounted to 22,180 ha within 681 discrete sites (site complex sub-units omitted i.e. sub-sites that occur within existing SAC or NHA). In total the NPWS Fen Study database holds information on 808 sites (which includes 127 sub-site records), where fen habitats are known or believed to occur. This list of sites includes those classified as poor fen and non-calcareous springs.

Annex 1 fens (i.e. Alkaline fen, *Cladium* fen, Transition mire, and Petrifying spring) which most closely relate to the fen types identified in previous studies, was estimated to cover 10,298 ha (in a total of 702 discrete sites) or 46% of the total fen area estimated in the present study. This data indicates that Annex 1 fens are less widespread than previously believed (IPCC 2001).

In relation to the fen habitat types classified within the present NPWS Fen Study, the following number of sites and estimated area (ha) of fen vegetation have been recorded:

- 7230 Alkaline fens: 348 discrete sites with a fen area of 6,840 ha
- 7210 *Calcareous fens with *Cladium mariscus:* 102 discrete sites with a fen area of 1,486 ha
- 7140 Transition mires and quaking bogs: 155 discrete sites with a fen area of 1,955 ha
- 7220 * Petrifying springs: 97 discrete sites with a fen area of 36 ha

These fens can be categorised, in terms of their current conservation designation, as follows:

- The number and area (ha) of fens which have been designated for Annex 1 fen habitats under the Habitats Directive: **68 discrete sites with an area of 2,191 ha of designated fen habitat; representing 21% of the total Annex 1 fen resource estimated for Ireland**

- The number and area (ha) of fen sites with Annex 1 habitats which are within designated Natural Heritage Areas (NHA) or proposed candidate Natural Heritage Areas (cNHA): **281 sites with an area of 2,747 ha; representing 27% of the total estimated Irish fen resource.**

- The number and area (ha) of fen sites with Annex 1 habitats which are located within designated Special Areas of Conservation (SAC) or proposed candidate Special Areas of Conservation (cSAC): **362 sites with an area of 5,681 ha; representing 55% of the total estimated Annex 1 Irish fen resource.**

- The number of Annex 1 fen habitat sites which were “newly” discovered or reported to the NPWS Fen Study and had no conservation designation: **72 sites with an area of 1,947 ha; representing 19% of the total estimated Annex 1 Irish fen resource.**

The NPWS Fen Study also found that it is very probable that sites with conservation worthy fen communities exist outside of the sites which have been identified in the present NPWS Fen Study. Based on the results of the study the following counties were identified as a priority as part of any future NPWS Fen Field Survey: Clare, Galway, Kildare, Leitrim, Limerick, Mayo, Offaly, Roscommon and Westmeath.

The NPWS Fen Study also found that existing knowledge of the fen resource in Ireland is markedly incomplete. Our knowledge in relation to the specific fen type(s) present, is considered wholly lacking or inadequate (confusion over one or more fen types) for 268 (33%) of sites identified in the present NPWS Fen Study database. While knowledge in relation to the extent of fen type(s) present on sites, is considered wholly lacking for 102 sites (13%), and inadequate for a some further 600 sites identified in the NPWS Fen Study database (i.e. 74%, where only estimated data on fen extent is presently available).

These findings make a systematic survey of existing and newly reported sites a high priority for Ireland, if conservation worthy sites are to be identified and the best examples put forward for conservation under the Natural Heritage Area or European Habitats Directive Natura 2000 (SAC) network and provided favourable conservation status.

Data sources used in the compilation of list of site in the NPWS Fen Study database 2007:

- **Habitat Assignment Project (NPWS 2006)**
  This desktop project was undertaken by NPWS and the main aim was classifying sites according to habitats listed in the Annex I of the Habitats Directive (92/43/EEC). Sites were obtained from a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, NGOs shadow lists inter alia.

- **NPWS Enquiries (Sites) Database**
  This is a comprehensive NPWS internal database, which includes data on habitat type and extent, and site designation.

- **CORINE Database – Fen sites**
  This is a NPWS internal database, which includes data on designated CORINE habitat types and extent present within sites listed in the NPWS Enquiries database.

- **IPCC Fen Sites Database**
  The Irish Peatland Conservation Council (IPCC) sites database holding a range of information on sites designated as fens.

- **Conaghan (2000) Blanket bog Database – Fen site list**
  An electronic list of blanket bog sites prepared by Conaghan (2000) for the NPWS which records the occurrence of fen habitats within the mire complexes identified, together with data on their extent.

- **Derwin (2003) Blanket bog Database – Fen site list**
  An electronic list of blanket bog sites prepared by Derwin (2003) for the NPWS which records the occurrence of fen habitats within the mire complexes identified, together with data on their extent.

- **External Expert fen site submissions**
  A number of external submissions were made by expert interests groups and individuals which provided additional sites to the NPWS Fen Study. These included submissions from Bord na Mona, Botanical Society of the British Isles County Recorders, and County Council Heritage/Biodiversity Officers.

# APPENDIX II

## SOURCES OF DATA USED IN THE PRODUCTION OF HABITAT DISTRIBUTION & RANGE MAPS

The following is a summary of the main sources of information employed to produce the habitat's potential historic distribution and range map, current habitat distribution and range map and the Favourable reference range (FRR) map. These maps and area extent were used to carry out the habitats conservation status assessment for this habitat:

**Potential Historic distribution and range map**:
To-date no map of the potential historical distribution and range of this habitat in Ireland has been available. It was decided to create a potential historical distribution and range map for Transition mire based on a series of data sets which would indicate the possible former location of sites with the habitat in Ireland. Information on the habitat range provided by this map could then be compared with the current distribution and range to ensure that an adequate network of sites has been recognised to ensure favourable conservation of this habitat in Ireland. Such an exercise was felt justified in the absence of a systematic field survey of the habitat to date in Ireland.

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site or species record occurred as a point source was included in the range map.

For the Hammond; Corine and Teagasc data sets, every grid square which contained a digitised boundary element was included within the range map.

The list of the data sets used in the compilation of the potential habitat distribution and range map (for details of the data sources employed see below) included:

- NPWS Fen Study Database - Foss (2007) - Transition mire site list (176 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- Corine Land Cover Map (2000) - Habitats classified in the following vegetation categories: Inland marshes
- Digitised Peatland Map of Ireland - Hammond (1979) – entire Fen data set
- National Soils and Parent Material Maps - Teagasc (2006)
- Botanical Society of the British Isles 10 km Flora distribution map for: *Carex diandra; Carex lasiocarpa* including all reported records
- British Bryological Society 10 km bryophyte distribution maps for: none

**Current habitat distribution and range map**:
The present habitat distribution and range is defined as the range of 10 km grid cells which contain a Transition mire site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km grid cells which contain a record for the Transition mire indicator species *Carex lasiocarpa* and *Carex diandra*. Extension of the range for this habitat, based on the distribution of these two *Carex* species was felt to be justified, in the absence of any National Fen Survey to-date in Ireland.

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site/ species record occurred as a point source was included in the range map.

The list of the data sets used in the compilation of the current habitat distribution and range map (for details of the data sources employed see this section, below) included:

- NPWS Fen Study Database - Foss (2007) - Transition mire sites listed within NPWS Fens Database (176 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- Botanical Society of the British Isles 10 km Flora distribution map for: *Carex diandra; Carex lasiocarpa* using species records between 1940 and the present.

**Favourable reference range map (FRR)**:
The favourable reference range for Transition mire habitat is considered to be the same as the current habitat range.

The FRR is defined as the range of 10 km grid cells which contain a Transition mire site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km grid cells which contain a record for the Transition mire indicator species *Carex lasiocarpa* and *Carex diandra*.

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site/ species record occurred as a point source was included in the range map.

The list of the data sets used to map the Favourable reference range (FRR) (for details of the data sources employed see this section, below) included:

- NPWS Fen Study Database - Foss (2007) - Transition mire sites listed within NPWS Fens Database (176 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- Botanical Society of the British Isles 10 km Flora distribution map for: *Carex diandra; Carex lasiocarpa* using species records between 1940 and the present.

## Further information on data sources:

### A. NPWS Fen Study Database (2007)

As part of the NPWS **Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007** (see project details in Appendix I above) a specific NPWS Fens Study database was created at the outset of this project to hold data on the fen sites recorded during the study.

In summary the main NPWS Fen Study database held information on site provenance or proposer, site names, county, SAC and NHA codes, national grid reference, site conservation designations, habitat information on the specific fen vegetation type(s) present and the area of each (or an estimate where no accurate area data was available), information on rare species of note, a summary of published reports holding information on the site, and a site evaluation section which ranked each site in terms of its conservation importance, area information, survey information, and survey priority (For a full list of data fields recorded in the NPWS Fen Study database see Foss 2007).

Two secondary relational databases (linked to one together by use of site record number and reference code number), hold a list of fen related reports and publications for Ireland, and a publications / report site records database.

The database was created using the Filemaker Pro 8 database package which runs on both PC and Mac platforms.

This database (NPWSFENSURVEY.fp7 Version 1.3) was used to produce distribution maps, habitat area estimates and site lists for the current and favourable habitat range and conservation assessment for alkaline fen in Ireland.

### B. Corine Land Cover Map (2000) – Map 5

Corine Land Cover (CLC) is a map of the European environmental landscape based on interpretation of satellite images. It provides comparable digital maps of land cover for each country for much of Europe. The CLC 2000 project in Ireland forms part of the update of land cover maps for the whole of Europe, which is being co-ordinated by the EEA (European Environmental Agency) with the co-operation of national competent authorities in contributing states. The Environmental Protection Agency (EPA) is the national competent authority for CLC 2000 data in Ireland. The CLC 2000 database was created by first assessing and correcting the existing CLC 1990 land cover database and images for geometric and thematic content, followed by mapping land cover changes using 2000 satellite imagery and ancillary data. The CORINE project provides a coarse quantification of land cover in Ireland (EPA, 2004).

CLC is based on a simple 3-level hierarchy classification system consisting of 44 land cover classes. The land cover inventory was conducted at a scale of 1:100,000 and the minimum area digitised in the updated version, CORINE 2000 is 25 ha.

Fen land cover from this data set is available for the following subtypes:

Wetlands 4/ Inland wetlands 4.1/ 4.1.1 Inland Marshes

Low-lying land usually flooded in winter and more or less saturated by water all year round.

**Extension :**
Non-forested areas of low-lying land flooded or floodable by fresh, stagnant or circulating water. Covered by a specific low ligneous, semi-ligneous or herbaceous vegetation.

**This heading includes :**
- Fens and transitional bogs without peat deposition or on peaty ground (peat layer is less than 30 cm thick) with specific vegetation composed of reeds, bulrushes, rushes, willows, sedges and tall herbs, sphagnum hummocks, often with alder or willows and other water plants,
- marsh vegetation located in margin zones of raised bogs,
- water-fringe vegetation of reed beds, sedge communities, fen-sedge beds, tall rush swamps, riparian cane formations,
- high floating vegetation,
- inland saline (alkali) marshes (prevailing arheic).

**This heading excludes :**
- humid meadows (water logging of between 10 and 30 cm depth) (class 231),
- rice fields (class 213),
- free water space in wetlands (class 512),
- salt marshes (class 421),
- salt meadows in intertidal zone (class 421),
- Garaat, (classified 211 or 411 according to land cover visible from the satellite image)
- polders with reticulated channels bordered by hydrophitic vegetation (class 2xx),
- humid forests with a crown cover more than 30 % (class 31x),
- Peat bogs (class 412)
- low floating aquatic vegetation (class 512).

(http://www.epa.ie/OurEnvironment/Land/CorineLandCover).

### C. Digitised Peatland Map of Ireland - Hammond (1979) – Map 4

Hammond's *Peatland Map of Ireland* (1979) is the most comprehensive over-view of the distribution of peatlands and fen in Ireland at the end of the 1970s. Hammond mapped the mire subtypes described by Moore (1972).

Hammond's map is based on data from several sources, principally the detailed soil map data from the National Soil Survey carried out by An Foras Talúntais since 1968, these maps covered 10 counties fully and 2 counties partially. Aerial photographs from 1973/74 together with site visits covered the rest of the country. No aerial cover existed however for county Donegal and parts of counties Sligo, Cork, Waterford and Louth. Hammond acknowledges that the these counties were not covered by the same detailed reconnaissance field sheets as the other counties and were mapped principally on the basis of the far cruder 1920 peat map for Ireland. However, Hammond's map is regarded as the only peatland map which has been methodically produced and which specifically targets peatlands and fens.

Although Hammond maps categorised mires (i.e. blanket bog, raised bog and fen) according to the level of disturbance (i.e. man modified, milled peat, moss peat) the current status of those sites considered unmodified is likely to have changed since 1979. Hammond's maps are therefore not reliable for identifying the current site status due to the impact of the Turf Development Act (1981-1995) supported projects and private afforestation grant aids. However, Hammond's map is considered to be the most accurate national map available for indicating the location of fen peat soils.

The Soils Division of Teagasc has now digitised the original Hammond's *Peatland Map of Ireland* (1979). This was used to refine the habitat distribution map produced from other sources by overlaying the Hammond's digital map on it. This provided further validations for those sites already mapped and most importantly identify fen areas in grid squares where they had not been identified by other sources.

### D. National Soils and Parent Material Maps Teagasc (2006) - Map 6

A digital data set of alkaline fen soils identified in Ireland, produced by Teagasc in 2006.

### E. BSBI Flora Atlas (2000)

10 km square distribution maps produced by the Botanical Society of the British Isles, as part of the New Atlas of the British & Irish Flora 2002. For access to the most up-to-date data sets see National Biological Network Gateway website at http://www.searchnbn.net/index_homepage

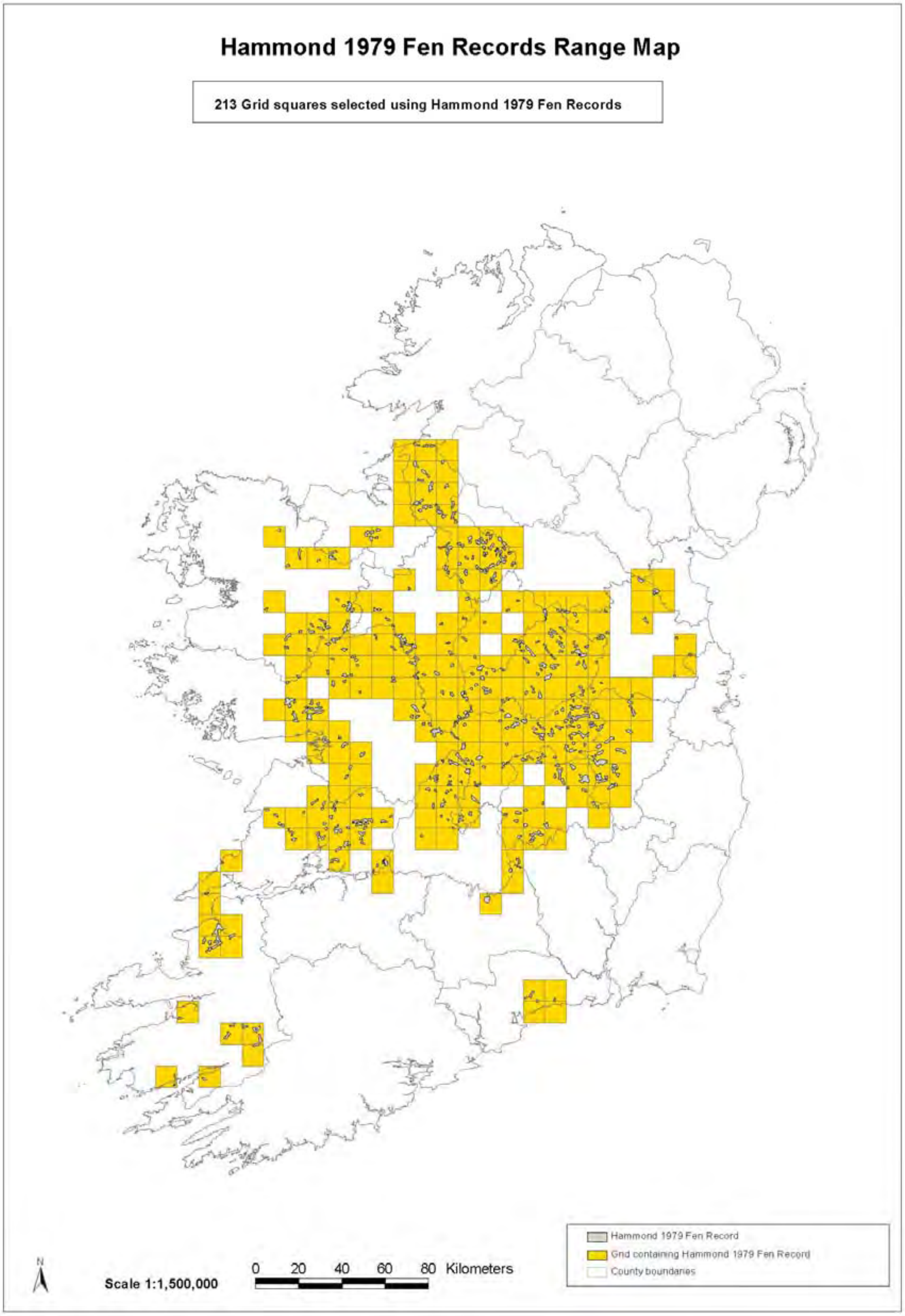
Data sets used in compilation of habitat distribution maps include those for the following species: **Carex diandra** and **Carex lasiocarpa**

### F. Bryophyte Distribution data (2007)

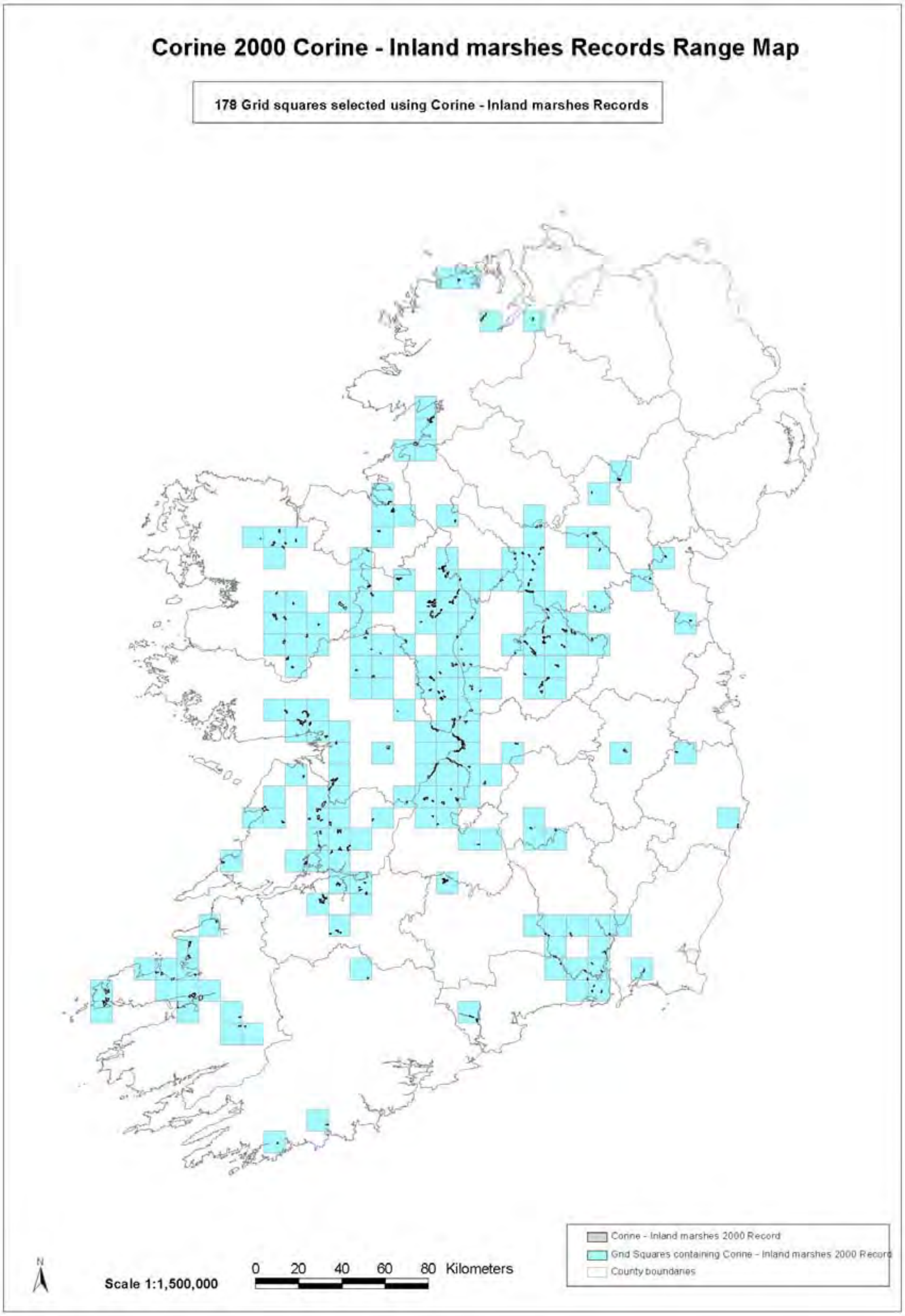
10 km square distribution maps obtained from THE DISTRIBUTION OF BRYOPHYTES IN IRELAND: an annotated review of the occurrence of liverworts and mosses in the Irish vice-counties, based mainly on the records of the British Bryological Society (Holyoak 2003) produced by the British Bryological Society, with additional recent additions provided by N. Lockhart, NPWS (pers. comm.).

Data sets used in compilation of habitat distribution maps include those for the following species: **None**

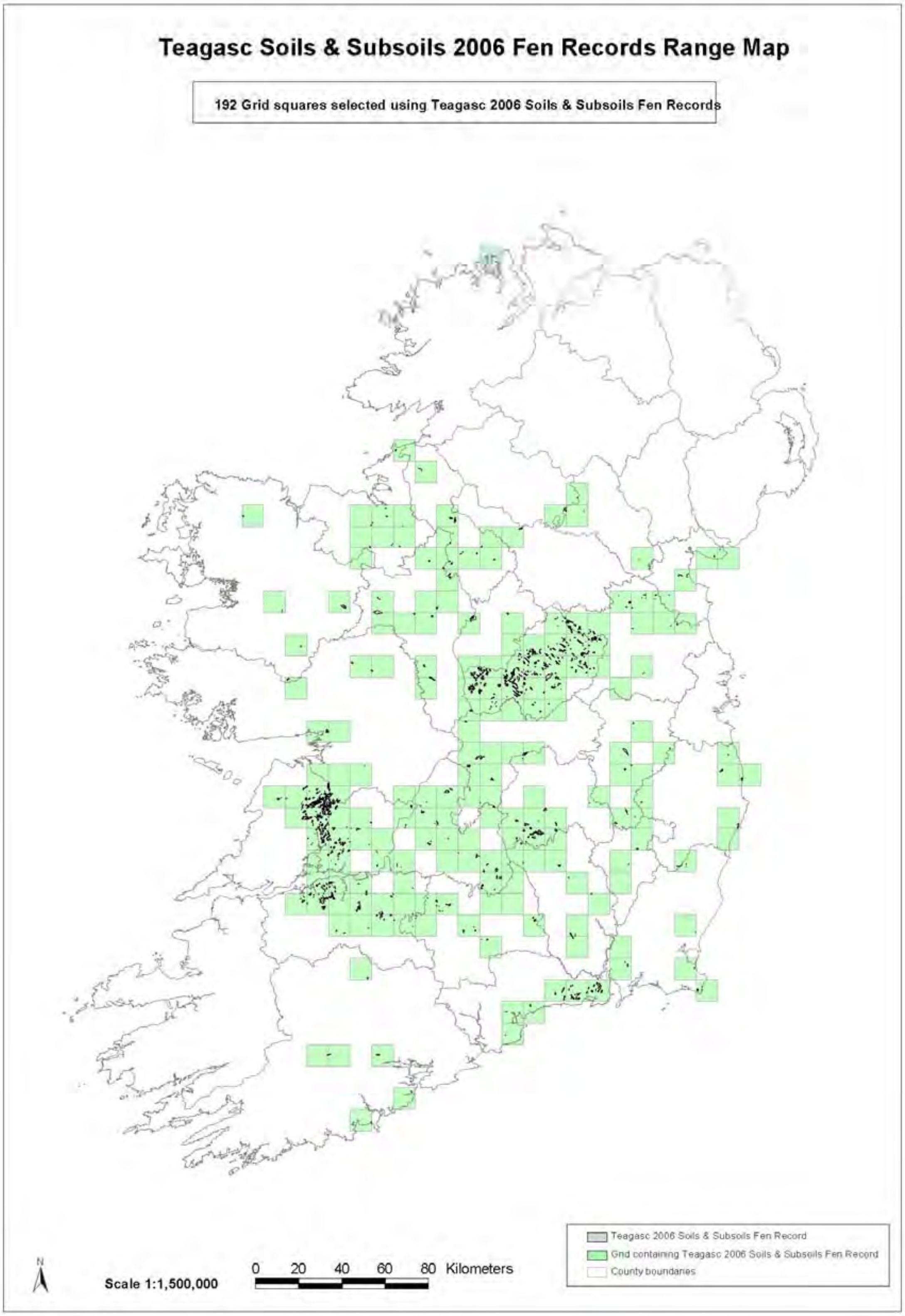
**Map 4: Digitised Peatland Map of Ireland - Hammond (1979)**



**Map 5: Corine Land Cover Map (2000)**



**Map 6: National Soils and Parent Material Maps Teagasc (2006)**



# APPENDIX III

## HABITAT SITE LIST

| Site Code | SAC/NHA Name | New/Subsite Name | Nat Grid E | Nat Grid N |
|---|---|---|---|---|
| F2692 | | BALLYNACARRIGY - DEER | 231000 | 258000 |
| F759 | | CLOONDANNAGH LOUGH | 150200 | 183000 |
| F2700 | | CLORAN LOUGHS | 267000 | 267000 |
| F750 | | COLMAN'S LOUGH | 144700 | 196700 |
| F2731 | | CORAVILLA - RAKEEN | 266000 | 324500 |
| F2728 | | GRAFFAGH AND CORINSHI | 259500 | 333800 |
| F756 | | KILBRECKAN LOUGH | 136500 | 176100 |
| F753 | | KILCREEST (RIVER MARG | 156000 | 215000 |
| F310 | | KILLYNEILL FEN | 273000 | 335400 |
| F708 | | LISINISKY MARSH | 270600 | 309600 |
| F754 | | LOUGHANAWARLA | 150000 | 118500 |
| F2722 | | SHEETRIM | 267900 | 331500 |
| F2725 | | TOSSY CROSS | 276900 | 315400 |
| 000015 | BALLYCAR LOUGH | | 141000 | 168000 |
| 000019 | BALLYOGAN LOUGH | | 137000 | 190000 |
| 000054 | MONEEN MOUNTAIN | | 124746 | 207500 |
| 000057 | MOYREE RIVER SYSTEM | | 138000 | 190000 |
| 000086 | DURSEY ISLAND | | 048000 | 040000 |
| 000122 | CASHELNAVEAN BOG NHA | | 205000 | 389000 |
| 000163 | LOUGH ESKE AND ARDNAM | | 197500 | 384000 |
| 000167 | LOUGH UNNA/LOUGH UNSH | | 155500 | 381500 |
| 000172 | MEENAGUSE/ARDBANE BOG | | 190000 | 386000 |
| 000173 | MEENTYGRANNAGH BOG | | 202000 | 405800 |
| 000197 | WEST OF ARDARA/MAAS R | | 170000 | 390000 |
| 000263 | DRUMBULCAUN BOG | | 151000 | 257000 |
| 000299 | LOUGH CUTRA | | 147496 | 198511 |
| 000301 | LOUGH LURGEEN BOG/GLE | | 166000 | 259000 |
| 000365 | KILLARNEY NATIONAL PA | | 093000 | 084000 |
| 000365 | KILLARNEY NATIONAL PA | CUMMERAGH RIVER BOG ( | 058000 | 071000 |
| 000382 | SHEHEREE (ARDAGH) BOG | | 098300 | 088400 |
| 000397 | RED BOG, KILDARE | | 297600 | 216994 |
| 000404 | HUGGINSTOWN FEN | | 252000 | 130000 |
| 000413 | ANNAGHMORE LOUGH FEN | | 230000 | 214000 |
| 000426 | KILGARRIFF MARSH | | 197000 | 324000 |
| 000440 | LOUGH REE | | 201000 | 253000 |
| 000470 | MULLET/BLACKSOD BAY C | | 070004 | 325002 |
| 000481 | COOLBARREEN LOUGH | | 098200 | 286900 |
| 000500 | GLENAMOY BOG COMPLEX | | 089000 | 335100 |
| 000500 | GLENAMOY BOG COMPLEX | RATHAVISTEEN (538) | 097000 | 336000 |
| 000522 | LOUGH GALL BOG | | 081000 | 300000 |
| 000534 | OWENDUFF/NEPHIN COMPL | | 086050 | 307000 |
| 000534 | OWENDUFF/NEPHIN COMPL | LETTERA (1525) | 083000 | 311000 |
| 000534 | OWENDUFF/NEPHIN COMPL | UGGOOL (1569) | 092000 | 319000 |
| 000548 | TAWNYMACKAN BOG | | 079000 | 277000 |
| 000572 | CLARA BOG | | 225000 | 230000 |
| 000576 | FIN LOUGH (OFFALY) | | 203000 | 229000 |
| 000604 | DERRINEA BOG | | 154000 | 288000 |
| 000636 | TEMPLEHOUSE AND CLOON | | 162000 | 317000 |
| 000639 | ANNACARTY WETLANDS | | 193000 | 144000 |
| 000647 | KILCARREN-FIRVILLE BO | | 192000 | 202000 |

| | | | | |
|---|---|---|---|---|
| 000672 | AGHALASTY FEN | | 251000 | 259000 |
| 000688 | LOUGH OWEL | | 239000 | 257000 |
| 000692 | SCRAGH BOG | | 242000 | 259000 |
| 000708 | SCREEN HILLS | | 310310 | 129332 |
| 000716 | CARRIGGOWER BOG | | 322831 | 207720 |
| 000909 | LOUGH COURA | | 209000 | 213000 |
| 001025 | ST.SENAN'S LOUGH | | 105000 | 154000 |
| 001040 | BARLEY COVE TO BALLYR | | 077000 | 023000 |
| 001052 | GALLANES LOUGH | | 139000 | 043000 |
| 001053 | GARRETTSTOWN MARSH | | 160000 | 043500 |
| 001061 | KILKERAN LAKE AND CAS | | 134000 | 032000 |
| 001067 | LOUGH GAL | | 140000 | 075000 |
| 001125 | DURNAGH LOUGHS/PETTIG | | 203000 | 374000 |
| 001127 | ILLIES HILL BOG | | 244100 | 435900 |
| 001241 | CARNA HEATH AND BOG | | 079000 | 231000 |
| 001247 | CLOONASCRAGH FEN AND | | 187400 | 226100 |
| 001251 | CREGDUFF LOUGH | | 071822 | 239114 |
| 001253 | DERNASLIGGAUN WOOD AN | | 082000 | 261000 |
| 001387 | BALLYNAFAGH LAKE | | 281000 | 228000 |
| 001482 | CLEW BAY COMPLEX | | 091000 | 289000 |
| 001603 | ESHBRACK BOG | | 255000 | 343000 |
| 001630 | CRANBERRY LOUGH | | 191400 | 233700 |
| 001697 | FENNOR BOG | | 253020 | 101979 |
| 001757 | HOLDENSTOWN BOG | | 288000 | 185000 |
| 001781 | LISARILLY BOG | | 258200 | 326800 |
| 001782 | KILLYHOMAN MARSH | | 263000 | 352300 |
| 001785 | MULLAGHMORE LAKE (SOU | | 262400 | 338100 |
| 001786 | KILROOSKY LOUGH CLUST | | 249000 | 327500 |
| 001819 | LOUGH BAWN | | 210300 | 264000 |
| 001840 | LISLANNAN BOG | | 254900 | 330300 |
| 001846 | BALLYNEILL MARSH | | 190000 | 144000 |
| 001847 | PHILIPSTON MARSH | | 189001 | 146002 |
| 001880 | MEENAGUSE SCRAGH | | 191000 | 390000 |
| 001899 | CLOONAKILLINA LOUGH | | 159000 | 306200 |
| 001901 | QUARRYFIELD WEST TURL | | 159100 | 310000 |
| 001902 | SLIEVEWARD BOG | | 165600 | 328000 |
| 001907 | FIN AND RISKEEN LOUGH | | 159800 | 320600 |
| 001919 | GLENADE LOUGH | | 182800 | 346100 |
| 001922 | BELLACORRICK BOG COMP | | 105000 | 323000 |
| 001922 | BELLACORRICK BOG COMP | BELLACORRICK (465) | 096000 | 318000 |
| 001922 | BELLACORRICK BOG COMP | DERRY LOWER (1493) | 099000 | 318000 |
| 001922 | BELLACORRICK BOG COMP | DERRY UPPER (544) | 099000 | 315000 |
| 001922 | BELLACORRICK BOG COMP | DOOLEEG BEG (515) | 102000 | 317000 |
| 001932 | MWEELREA/SHEEFFRY/ERR | | 083045 | 268737 |
| 001932 | MWEELREA/SHEEFFRY/ERR | DERRYAUN (488) | 095000 | 272500 |
| 001932 | MWEELREA/SHEEFFRY/ERR | SRAHROOSKY (545) | 081000 | 271000 |
| 001975 | BALLYHOORISKY POINT T | | 220000 | 445000 |
| 001976 | LOUGH GILL | | 174000 | 333000 |
| 001976 | LOUGH GILL | THE DOONS/DOON LOUGH | 179600 | 336400 |
| 001992 | TAMUR BOG | | 203000 | 368000 |
| 001992 | TAMUR BOG | BELALT SOUTH (117) | 201000 | 365000 |
| 002008 | MAUMTURK MOUNTAINS | TOOREENACOONA (329) | 082000 | 255000 |
| 002034 | CONNEMARA BOG COMPLEX | | 090000 | 243000 |
| 002034 | CONNEMARA BOG COMPLEX | DERROUGH SOUTH(259) | 100000 | 227000 |
| 002034 | CONNEMARA BOG COMPLEX | DOOLETTER (262) | 080000 | 234000 |
| 002034 | CONNEMARA BOG COMPLEX | KNOCKADAV (327) | 092000 | 241000 |
| 002034 | CONNEMARA BOG COMPLEX | LETTERSHINNA (294) | 085000 | 245000 |
| 002046 | OWENDOO AND CLOGHERAV | | 205000 | 392500 |
| 002046 | OWENDOO AND CLOGHERAV | OWENDOO | 199000 | 391000 |

| | | | | |
|---|---|---|---|---|
| 002047 | CLOGHERNAGORE BOG AN | | 200000 | 420000 |
| 002047 | CLOGHERNAGORE BOG AN | CLOGHERNAGORE (126) | 192000 | 408000 |
| 002070 | TRALEE BAY AND MAGHAR | | 061000 | 114000 |
| 002111 | KILKIERAN BAY AND ISL | | 072000 | 230000 |
| 002186 | GRAGEEN FEN AND BOG N | SLIEVE FELIM FLUSH | 179000 | 157000 |
| R002299 | RIVER BOYNE & RIVER B | | 286083 | 268000 |
| R002299 | RIVER BOYNE & RIVER B | LOUGH SHESK (556) | 262000 | 268000 |
| R002301 | RIVER FINN | | 194200 | 402800 |
| 002313 | BALLYMORE (DUNEEL) FE | | 224333 | 249135 |
| 002331 | MOUDS BOG | | 278000 | 218000 |
| 002333 | KNOCKACOLLER BOG | | 231000 | 191000 |
| 002342 | MOUNT HEVEY BOG | | 263000 | 248000 |
| 002343 | TULLAHER LOUGH & BOG | | 095000 | 162500 |
| 002364 | MOYCULLEN BOGS NHA | | 120500 | 227000 |
| 002374 | CLOON AND LAGHTANABBA | | 061000 | 256000 |
| 002377 | LOUGH ATORICK DISTRIC | | 159000 | 197000 |
| 002393 | NEPHIN BEG BOGS | | 104000 | 304000 |
| 002400 | CRAGNASHINGAUN BOGS N | | 112000 | 169500 |
| 002417 | LEAHILL BOG NHA | | 087000 | 049000 |
| 002421 | LOUGH ACROW BOGS NHA | | 120500 | 169000 |
| 002437 | MEENAGARRANROE BOG NH | | 209300 | 390200 |
| 002442 | MAGHERA MOUNTAIN BOG | | 146000 | 188000 |
| 002477 | KILRUANE WETLAND | | 190500 | 182500 |
| 002490 | CLONLYON GLEBE FEN | | 208100 | 226000 |
| 002527 | BELHAVEL LOUGH | | 186000 | 328000 |
| 002561 | LOUGHAPOLLBOY LAKE | | 159000 | 268400 |
| 002572 | BALLINAHISTLE (BALLYD | | 167600 | 217900 |
| 002576 | RATHESCAR WOOD | | 303000 | 287000 |
| 002586 | WATERLOO FEN | | 159700 | 077600 |
| 002587 | RAPHOE | | 225000 | 401700 |
| 002594 | TULLANVOOLY BOG | | 229100 | 168500 |
| 002597 | TINURE | | 307700 | 283500 |
| 002605 | MILLTOWN LAKES | | 137500 | 154000 |
| 002607 | ARDMEENAN LOUGH | | 215000 | 309800 |
| 002608 | CLOONFINNAN LOUGH | | 205000 | 295100 |
| 002609 | LOUGH ADORN | | 215000 | 314500 |
| 002610 | LOUGH ANNAGHMACONWAY | | 213200 | 299700 |
| 002611 | LOUGH ERRIL | | 204800 | 296500 |
| 002612 | LOUGH MACHUGH | | 204600 | 297800 |
| 002614 | PRIESTFIELD LOUGH | | 265000 | 331000 |
| 002615 | BALLYMORE LOUGHS | | 128500 | 312300 |
| 002616 | CARRICK LOUGH | | 136800 | 289600 |
| 002621 | CLONDALLOW FEN | | 204500 | 208500 |
| 002622 | KILLAUN BOG | | 211500 | 205600 |
| 002625 | CARROWMORE LOUGH | | 167300 | 334000 |
| 002626 | CARROWNABANNY LOUGH | | 155700 | 323400 |
| 002627 | CARROWREAGH BRIDGE (R | | 140600 | 310900 |
| 002628 | CLEAVRY LOUGH | | 174700 | 314500 |
| 002629 | LOUGHMEENAGHAN | | 174300 | 316200 |
| 002631 | OGHAMBAUN TURLOUGH | | 153600 | 311500 |
| 002632 | PUNCHBOWL LOUGH | | 167400 | 331300 |
| 002633 | TOBERSCANAVAN LOUGH | | 168400 | 323800 |
| 002635 | BALLYGUNNER BOG | | 264200 | 108400 |
| 002636 | CASTLETOWN FEN | | 262000 | 104900 |
| 002637 | COOLRATTIN FEN | | 248600 | 105400 |
| 002638 | DUAGH FEN | | 259200 | 106200 |
| 002640 | PICKARDSTOWN FEN | | 259100 | 103800 |
| 002642 | MONROE FEN | | 237300 | 257600 |
| 002644 | BALLAGH BOG | | 223100 | 240900 |

| | | | | |
|---|---|---|---|---|
| 002645 | LOUGH DRIN | | 245700 | 256700 |
| 002646 | LENY FEN | | 237500 | 262600 |
| 002647 | GARRYSALLAGH FEN | | 243600 | 260400 |
| 002659 | TUITESTOWN FEN | | 236400 | 251500 |
| 002732 | DRUMGALLAN BOG | | 281300 | 328300 |
| 002737 | LOTA MORE WETLAND | | 170900 | 074100 |
| | | INCHIQUIN LAKE (00003 | 127000 | 189800 |
| 002048 | | Fergus Estuary NHA | | |

## *CAREX DIANDRA* BSBI 10 KM SQUARE RECORDS

| Dataset Key | 10km grid reference | First Year recorded | Last Year recorded | Comment |
|---|---|---|---|---|
| GA000091 | B80 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | B92 | 1939 | 1939 | Omitted from FRR and Current range map |
| GA000091 | C01 | 1987 | 1999 | |
| GA000091 | C03 | 0 | 1881 | Omitted from FRR and Current range map |
| GA000091 | C14 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | C20 | 1987 | 1999 | |
| GA000091 | C22 | 1987 | 1999 | |
| GA000091 | C23 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | C24 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | C55 | 1987 | 1999 | |
| GA000091 | C72 | 1989 | 1989 | |
| GA000079 | C80 | 1989 | 1989 | |
| GA000091 | C80 | 1500 | 1999 | |
| GA000091 | C91 | 1500 | 1969 | |
| GA000091 | D01 | 0 | 1986 | |
| GA000091 | D02 | 1936 | 1999 | |
| GA000091 | D04 | 1970 | 1986 | |
| GA000079 | D05 | 1980 | 1989 | |
| GA000091 | D05 | 1500 | 1999 | |
| GA000091 | D11 | 1987 | 1999 | |
| GA000079 | D14 | 1980 | 1989 | |
| GA000091 | D14 | 0 | 1999 | |
| GA000079 | D15 | 1988 | 1989 | |
| GA000091 | D15 | 1500 | 1999 | |
| GA000091 | D20 | 1987 | 1999 | |
| GA000091 | D30 | 1970 | 1986 | |
| GA000091 | G02 | 0 | 1969 | |
| GA000091 | G13 | 1950 | 1969 | |
| GA000091 | G22 | 1900 | 1969 | |
| GA000091 | G41 | 1999 | 1999 | |
| GA000091 | G50 | 1950 | 1988 | |
| GA000091 | G51 | 1950 | 1988 | |
| GA000091 | G52 | 1988 | 1999 | |
| GA000091 | G54 | 1999 | 1999 | |
| GA000091 | G60 | 1950 | 1999 | |
| GA000091 | G61 | 1960 | 1999 | |
| GA000091 | G62 | 0 | 1999 | |
| GA000091 | G63 | 1962 | 1962 | |
| GA000091 | G64 | 1962 | 1983 | |
| GA000091 | G67 | 1950 | 1969 | |
| GA000091 | G69 | 1946 | 1946 | |

| | | | | |
|---|---|---|---|---|
| GA000091 | G71 | 1500 | 1999 | |
| GA000091 | G72 | 1962 | 1962 | |
| GA000091 | G73 | 1962 | 1962 | |
| GA000091 | G77 | 1950 | 1969 | |
| GA000091 | G80 | 1960 | 1999 | |
| GA000091 | G86 | 1882 | 1999 | |
| GA000091 | G87 | 1987 | 1999 | |
| GA000091 | G95 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | G96 | 0 | 1999 | |
| GA000079 | H04 | 1995 | 1995 | |
| GA000091 | H04 | 1500 | 1999 | |
| GA000091 | H05 | 1970 | 1986 | |
| GA000079 | H06 | 1988 | 1990 | |
| GA000091 | H06 | 1987 | 1999 | |
| GA000079 | H08 | 1988 | 1988 | |
| GA000091 | H08 | 1987 | 1999 | |
| GA000091 | H16 | 0 | 1989 | |
| GA000091 | H17 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | H22 | 1968 | 1999 | |
| GA000079 | H23 | 1988 | 1990 | |
| GA000091 | H23 | 1500 | 1999 | |
| GA000079 | H24 | 1988 | 1991 | |
| GA000091 | H24 | 1500 | 1999 | |
| GA000091 | H25 | 1500 | 1999 | |
| GA000079 | H26 | 1981 | 1981 | |
| GA000091 | H26 | 1970 | 1999 | |
| GA000091 | H27 | 1987 | 1999 | |
| GA000091 | H31 | 1968 | 1968 | |
| GA000079 | H32 | 1988 | 1990 | |
| GA000091 | H32 | 1950 | 1999 | |
| GA000091 | H33 | 1950 | 1969 | |
| GA000079 | H34 | 1988 | 1990 | |
| GA000091 | H34 | 1987 | 1999 | |
| GA000091 | H35 | 1987 | 1999 | |
| GA000091 | H36 | 1987 | 1999 | |
| GA000079 | H36 | 1989 | 2001 | |
| GA000079 | H37 | 1988 | 1988 | |
| GA000091 | H37 | 1987 | 1999 | |
| GA000079 | H41 | 1988 | 1990 | |
| GA000091 | H41 | 1987 | 1999 | |
| GA000079 | H42 | 1980 | 1998 | |
| GA000091 | H42 | 0 | 1999 | |
| GA000079 | H43 | 1988 | 1990 | |
| GA000091 | H43 | 1500 | 1999 | |
| GA000079 | H44 | 1981 | 1990 | |
| GA000091 | H44 | 1970 | 1999 | |
| GA000091 | H45 | 1987 | 1999 | |
| GA000091 | H46 | 0 | 1969 | |
| GA000091 | H47 | 1896 | 1969 | |
| GA000091 | H50 | 1987 | 1999 | |
| GA000079 | H52 | 1980 | 1980 | |
| GA000091 | H52 | 0 | 1988 | |
| GA000079 | H53 | 1980 | 1994 | |
| GA000091 | H53 | 1500 | 1999 | |
| GA000091 | H54 | 1987 | 1999 | |

| | | | | |
|---|---|---|---|---|
| GA000079 | H55 | 1989 | 1989 | |
| GA000091 | H55 | 1970 | 1999 | |
| GA000091 | H62 | 1987 | 1999 | |
| GA000091 | H64 | 1987 | 1999 | |
| GA000091 | H70 | 1987 | 1999 | |
| GA000091 | H71 | 1987 | 1999 | |
| GA000079 | H73 | 1980 | 1997 | |
| GA000091 | H73 | 1500 | 1999 | |
| GA000091 | H75 | 1970 | 1999 | |
| GA000079 | H76 | 1988 | 1988 | |
| GA000091 | H76 | 1970 | 1999 | |
| GA000091 | H80 | 1970 | 1986 | |
| GA000079 | H81 | 1994 | 1994 | |
| GA000091 | H81 | 1500 | 1999 | |
| GA000079 | H83 | 1988 | 1994 | |
| GA000091 | H83 | 1987 | 1999 | |
| GA000079 | H84 | 1998 | 1998 | |
| GA000091 | H84 | 1970 | 1999 | |
| GA000091 | H85 | 1987 | 1999 | |
| GA000091 | H87 | 1987 | 1999 | |
| GA000091 | H88 | 1987 | 1999 | |
| GA000079 | H89 | 1985 | 1993 | |
| GA000091 | H89 | 1970 | 1999 | |
| GA000091 | H90 | 1987 | 1999 | |
| GA000079 | H91 | 1989 | 1997 | |
| GA000091 | H91 | 1987 | 1999 | |
| GA000079 | H94 | 1994 | 1994 | |
| GA000091 | H94 | 1987 | 1999 | |
| GA000079 | H96 | 1988 | 1988 | |
| GA000091 | H96 | 1987 | 1999 | |
| GA000091 | H97 | 1987 | 1999 | |
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| GA000091 | J05 | 1970 | 1999 | |
| GA000079 | J06 | 1991 | 1991 | |
| GA000091 | J06 | 1987 | 1999 | |
| GA000079 | J08 | 1988 | 1988 | |
| GA000091 | J08 | 1970 | 1999 | |
| GA000091 | J09 | 1933 | 1933 | Omitted from FRR and Current range map |
| GA000091 | J10 | 1987 | 1999 | |
| GA000079 | J12 | 1991 | 1994 | |
| GA000091 | J12 | 1987 | 1999 | |
| GA000079 | J14 | 1984 | 1984 | |
| GA000091 | J14 | 1970 | 1986 | |
| GA000091 | J18 | 1970 | 1999 | |
| GA000091 | J19 | 1500 | 1969 | |
| GA000091 | J20 | 1987 | 1999 | |
| GA000091 | J21 | 1987 | 1999 | |
| GA000079 | J23 | 1990 | 1994 | |
| GA000091 | J23 | 1935 | 1999 | |
| GA000079 | J24 | 1993 | 1993 | |

| | | | | |
|---|---|---|---|---|
| GA000091 | J24 | 1987 | 1999 | |
| GA000079 | J25 | 1992 | 1993 | |
| GA000091 | J25 | 1987 | 1999 | |
| GA000091 | J26 | 1901 | 1902 | Omitted from FRR and Current range map |
| GA000079 | J33 | 1993 | 1993 | |
| GA000091 | J33 | 1987 | 1999 | |
| GA000079 | J34 | 1984 | 1994 | |
| GA000091 | J34 | 1970 | 1999 | |
| GA000091 | J36 | 1500 | 1969 | |
| GA000091 | J37 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | J38 | 1950 | 1969 | |
| GA000079 | J43 | 1993 | 1996 | |
| GA000091 | J43 | 0 | 1999 | |
| GA000079 | J44 | 1980 | 1996 | |
| GA000091 | J44 | 1970 | 1999 | |
| GA000079 | J45 | 1986 | 1994 | |
| GA000091 | J45 | 1970 | 1999 | |
| GA000079 | J46 | 1993 | 1993 | |
| GA000091 | J46 | 1500 | 1999 | |
| GA000079 | J47 | 1996 | 1996 | |
| GA000091 | J47 | 1500 | 1999 | |
| GA000079 | J53 | 1993 | 1996 | |
| GA000091 | J53 | 1902 | 1999 | |
| GA000079 | J54 | 1981 | 1997 | |
| GA000091 | J54 | 1500 | 1999 | |
| GA000079 | J55 | 1982 | 1993 | |
| GA000091 | J55 | 1500 | 1999 | |
| GA000091 | J57 | 1945 | 1945 | |
| GA000079 | J65 | 1993 | 1993 | |
| GA000091 | J65 | 1950 | 1999 | |
| GA000091 | J66 | 1902 | 1902 | Omitted from FRR and Current range map |
| GA000091 | L54 | 1987 | 1999 | |
| GA000091 | L75 | 1987 | 1999 | |
| GA000091 | L76 | 1965 | 1965 | |
| GA000091 | L98 | 1965 | 1965 | |
| GA000091 | L99 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | M03 | 1987 | 1987 | |
| GA000091 | M04 | 1500 | 1969 | |
| GA000091 | M09 | 1965 | 1965 | |
| GA000091 | M19 | 1899 | 1931 | Omitted from FRR and Current range map |
| GA000091 | M22 | 1987 | 1999 | |
| GA000091 | M23 | 1500 | 1969 | |
| GA000091 | M24 | 1965 | 1965 | |
| GA000091 | M26 | 0 | 1999 | |
| GA000091 | M27 | 1950 | 1969 | |
| GA000091 | M30 | 1987 | 1987 | |
| GA000091 | M33 | 1987 | 1999 | |
| GA000091 | M34 | 1987 | 1999 | |
| GA000091 | M35 | 1899 | 1999 | |
| GA000091 | M36 | 1983 | 1983 | |
| GA000091 | M37 | 1896 | 1999 | |
| GA000091 | M41 | 1987 | 1999 | |
| GA000091 | M45 | 1962 | 1999 | |
| GA000091 | M47 | 1950 | 1969 | |
| GA000091 | M49 | 1950 | 1990 | |

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|---|---|---|---|---|
| GA000091 | M50 | 1987 | 1999 | |
| GA000091 | M54 | 1987 | 1999 | |
| GA000091 | M55 | 1984 | 1999 | |
| GA000091 | M56 | 1987 | 1999 | |
| GA000091 | M57 | 1950 | 1969 | |
| GA000091 | M58 | 1950 | 1969 | |
| GA000091 | M60 | 0 | 1897 | Omitted from FRR and Current range map |
| GA000091 | M61 | 1898 | 1999 | |
| GA000091 | M62 | 1987 | 1999 | |
| GA000091 | M63 | 1987 | 1987 | |
| GA000091 | M65 | 1987 | 1999 | |
| GA000091 | M69 | 0 | 1897 | Omitted from FRR and Current range map |
| GA000091 | M72 | 1987 | 1999 | |
| GA000091 | M73 | 1896 | 1896 | Omitted from FRR and Current range map |
| GA000091 | M74 | 1896 | 1896 | Omitted from FRR and Current range map |
| GA000091 | M76 | 1962 | 1962 | |
| GA000091 | M78 | 1950 | 1999 | |
| GA000091 | M80 | 1897 | 1999 | |
| GA000091 | M81 | 1950 | 1969 | |
| GA000091 | M82 | 1987 | 1999 | |
| GA000091 | M83 | 1950 | 1969 | |
| GA000091 | M87 | 1987 | 1999 | |
| GA000091 | M90 | 0 | 1999 | |
| GA000091 | M91 | 1970 | 1970 | |
| GA000091 | M93 | 0 | 1969 | |
| GA000091 | M94 | 1885 | 1958 | |
| GA000091 | M95 | 1987 | 1999 | |
| GA000091 | M96 | 0 | 1999 | |
| GA000091 | M99 | 1988 | 1988 | |
| GA000091 | N00 | 1987 | 1999 | |
| GA000091 | N01 | 1898 | 1968 | |
| GA000091 | N02 | 1987 | 1999 | |
| GA000091 | N03 | 1898 | 1986 | |
| GA000091 | N04 | 1898 | 1999 | |
| GA000091 | N05 | 1970 | 1986 | |
| GA000091 | N06 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | N07 | 1990 | 1990 | |
| GA000091 | N08 | 1899 | 1899 | Omitted from FRR and Current range map |
| GA000091 | N10 | 1950 | 1999 | |
| GA000091 | N11 | 1987 | 1999 | |
| GA000091 | N12 | 1950 | 1999 | |
| GA000091 | N13 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | N14 | 1898 | 1999 | |
| GA000091 | N15 | 1900 | 1969 | |
| GA000091 | N21 | 1500 | 1969 | |
| GA000091 | N23 | 1970 | 1986 | |
| GA000091 | N24 | 1950 | 1999 | |
| GA000091 | N25 | 1950 | 1999 | |
| GA000091 | N26 | 0 | 1988 | |
| GA000091 | N28 | 1950 | 1986 | |
| GA000091 | N33 | 1987 | 1999 | |
| GA000091 | N34 | 1987 | 1999 | |
| GA000091 | N35 | 1987 | 1999 | |
| GA000091 | N36 | 0 | 1999 | |
| GA000091 | N37 | 1987 | 1999 | |

| | | | | |
|---|---|---|---|---|
| GA000091 | N38 | 1950 | 1999 | |
| GA000091 | N41 | 1950 | 1969 | |
| GA000091 | N42 | 1896 | 1896 | Omitted from FRR and Current range map |
| GA000091 | N43 | 1987 | 1999 | |
| GA000091 | N44 | 1970 | 1986 | |
| GA000091 | N45 | 0 | 1999 | |
| GA000091 | N46 | 0 | 1986 | |
| GA000091 | N51 | 1897 | 1999 | |
| GA000091 | N53 | 0 | 1969 | |
| GA000091 | N54 | 1987 | 1999 | |
| GA000091 | N55 | 1950 | 1969 | |
| GA000091 | N56 | 1971 | 1999 | |
| GA000091 | N57 | 1950 | 1999 | |
| GA000091 | N60 | 1950 | 1999 | |
| GA000091 | N63 | 1896 | 1896 | Omitted from FRR and Current range map |
| GA000091 | N64 | 1987 | 1999 | |
| GA000091 | N66 | 0 | 1999 | |
| GA000091 | N67 | 1987 | 1999 | |
| GA000091 | N68 | 1903 | 1903 | Omitted from FRR and Current range map |
| GA000091 | N70 | 1887 | 1999 | |
| GA000091 | N71 | 1907 | 1907 | Omitted from FRR and Current range map |
| GA000091 | N74 | 1987 | 1999 | |
| GA000091 | N79 | 1987 | 1999 | |
| GA000091 | N80 | 0 | 1987 | |
| GA000091 | N82 | 1898 | 1999 | |
| GA000091 | N89 | 0 | 1988 | |
| GA000091 | N91 | 1924 | 1924 | Omitted from FRR and Current range map |
| GA000091 | N98 | 1897 | 1999 | |
| GA000091 | N99 | 1897 | 1999 | |
| GA000091 | O08 | 1987 | 1999 | |
| GA000091 | O21 | 1987 | 1999 | |
| GA000091 | Q30 | 1500 | 1969 | |
| GA000091 | Q51 | 1500 | 1969 | |
| GA000091 | Q81 | 1500 | 1969 | |
| GA000091 | R34 | 1987 | 1987 | |
| GA000091 | R37 | 0 | 1969 | |
| GA000091 | R39 | 1950 | 1999 | |
| GA000091 | R43 | 1987 | 1999 | |
| GA000091 | R48 | 1987 | 1999 | |
| GA000091 | R51 | 1970 | 1999 | |
| GA000091 | R63 | 1950 | 1999 | |
| GA000091 | R66 | 1987 | 1999 | |
| GA000091 | R78 | 1970 | 1970 | |
| GA000091 | R79 | 0 | 1969 | |
| GA000091 | R84 | 1999 | 1999 | |
| GA000091 | R87 | 1997 | 1997 | |
| GA000091 | R88 | 1899 | 1996 | |
| GA000091 | R89 | 1996 | 1996 | |
| GA000091 | R93 | 1987 | 1999 | |
| GA000091 | R94 | 1987 | 1999 | |
| GA000091 | R98 | 1900 | 1996 | |
| GA000091 | R99 | 1996 | 1996 | |
| GA000091 | S09 | 1987 | 1999 | |
| GA000091 | S14 | 1987 | 1999 | |
| GA000091 | S15 | 1987 | 1999 | |

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|---|---|---|---|---|
| GA000091 | S17 | 1990 | 1990 | |
| GA000091 | S18 | 1996 | 1996 | |
| GA000091 | S19 | 1987 | 1999 | |
| GA000091 | S22 | 1987 | 1999 | |
| GA000091 | S25 | 1987 | 1999 | |
| GA000091 | S26 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | S27 | 0 | 1898 | Omitted from FRR and Current range map |
| GA000091 | S28 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | S37 | 1991 | 1991 | |
| GA000091 | S38 | 1960 | 1969 | |
| GA000091 | S46 | 1987 | 1999 | |
| GA000091 | S47 | 1987 | 1999 | |
| GA000091 | S48 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | S50 | 1997 | 1999 | |
| GA000091 | S52 | 1987 | 1999 | |
| GA000091 | S53 | 1987 | 1999 | |
| GA000091 | S55 | 1987 | 1999 | |
| GA000091 | S60 | 1987 | 1999 | |
| GA000091 | S69 | 1950 | 1969 | |
| GA000091 | S76 | 1500 | 1969 | |
| GA000091 | S77 | 1500 | 1969 | |
| GA000091 | S88 | 1936 | 1969 | |
| GA000091 | S89 | 1926 | 1999 | |
| GA000091 | S99 | 1934 | 1934 | Omitted from FRR and Current range map |
| GA000091 | T02 | 1897 | 1897 | Omitted from FRR and Current range map |
| GA000091 | T03 | 1987 | 1999 | |
| GA000091 | T28 | 1938 | 1999 | |
| GA000091 | W57 | 1979 | 1999 | |

## *CAREX LASIOCARPA* BSBI 10 KM SQUARE RECORDS

| Dataset Key | 10km grid reference | First Year recorded | Last Year recorded | Comment |
|---|---|---|---|---|
| GA000091 | W64 | 1987 | 1999 | |
| GA000091 | W26 | 1964 | 1999 | |
| GA000091 | W16 | 1987 | 1999 | |
| GA000091 | W12 | 1987 | 1999 | |
| GA000091 | V98 | 1887 | 1999 | |
| GA000091 | V92 | 1987 | 1999 | |
| GA000091 | V88 | 1889 | 1999 | |
| GA000091 | V87 | 1987 | 1999 | |
| GA000091 | V86 | 1952 | 1986 | |
| GA000091 | V85 | 1949 | 1999 | |
| GA000091 | V78 | 1987 | 1999 | |
| GA000091 | S77 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | S74 | 1500 | 1969 | |
| GA000091 | S67 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | S49 | 1896 | 1896 | Omitted from FRR and Current range map |
| GA000091 | S18 | 1996 | 1996 | |
| GA000091 | R99 | 1996 | 1996 | |
| GA000091 | R98 | 1996 | 1996 | |
| GA000091 | R94 | 1987 | 1999 | |
| GA000091 | R89 | 1996 | 1996 | |
| GA000091 | R88 | 1969 | 1969 | |

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|---|---|---|---|---|
| GA000091 | R48 | 1987 | 1999 | |
| GA000091 | R46 | 1908 | 1974 | |
| GA000091 | R39 | 1950 | 1999 | |
| GA000091 | R37 | 1908 | 1908 | Omitted from FRR and Current range map |
| GA000091 | R29 | 1950 | 1969 | |
| GA000091 | R19 | 1950 | 1999 | |
| GA000091 | Q96 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | Q83 | 1500 | 1969 | |
| GA000091 | Q82 | 1500 | 1969 | |
| GA000091 | Q71 | 1987 | 1999 | |
| GA000091 | N97 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | N61 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | N56 | 1987 | 1999 | |
| GA000091 | N46 | 1950 | 1986 | |
| GA000091 | N45 | 1892 | 1999 | |
| GA000091 | N38 | 1987 | 1999 | |
| GA000091 | N36 | 1966 | 1999 | |
| GA000091 | N35 | 1987 | 1999 | |
| GA000091 | N25 | 1950 | 1999 | |
| GA000091 | N24 | 1958 | 1958 | |
| GA000091 | N23 | 1987 | 1999 | |
| GA000091 | N21 | 1991 | 1991 | |
| GA000091 | N15 | 1900 | 1900 | Omitted from FRR and Current range map |
| GA000091 | N14 | 1898 | 1999 | |
| GA000091 | N11 | 1987 | 1999 | |
| GA000091 | N09 | 1998 | 1998 | |
| GA000091 | N05 | 1972 | 1999 | |
| GA000091 | N04 | 1898 | 1999 | |
| GA000091 | N03 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | N02 | 1987 | 1999 | |
| GA000091 | N01 | 1968 | 1968 | |
| GA000091 | M98 | 1899 | 1899 | Omitted from FRR and Current range map |
| GA000091 | M96 | 0 | 1999 | |
| GA000091 | M94 | 1899 | 1899 | Omitted from FRR and Current range map |
| GA000091 | M87 | 1990 | 1990 | |
| GA000091 | M86 | 1990 | 1990 | |
| GA000091 | M80 | 1897 | 1999 | |
| GA000091 | M78 | 1950 | 1999 | |
| GA000091 | M60 | 0 | 1897 | Omitted from FRR and Current range map |
| GA000091 | M55 | 1984 | 1999 | |
| GA000091 | M50 | 1987 | 1999 | |
| GA000091 | M48 | 1992 | 1992 | |
| GA000091 | M45 | 1962 | 1984 | |
| GA000091 | M41 | 1899 | 1999 | |
| GA000091 | M40 | 1966 | 1990 | |
| GA000091 | M35 | 1899 | 1899 | Omitted from FRR and Current range map |
| GA000091 | M34 | 1899 | 1899 | Omitted from FRR and Current range map |
| GA000091 | M33 | 1987 | 1999 | |
| GA000091 | M32 | 1899 | 1988 | |
| GA000091 | M31 | 1952 | 1999 | |
| GA000091 | M30 | 1987 | 1987 | |
| GA000091 | M25 | 1990 | 1990 | |
| GA000091 | M24 | 1899 | 1999 | |
| GA000091 | M23 | 1899 | 1899 | Omitted from FRR and Current range map |
| GA000091 | M22 | 1895 | 1999 | |

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|---|---|---|---|---|
| GA000091 | M17 | 1965 | 1965 | |
| GA000091 | M16 | 1951 | 1981 | |
| GA000091 | M14 | 1952 | 1952 | |
| GA000091 | M12 | 1987 | 1999 | |
| GA000091 | M05 | 1966 | 1966 | |
| GA000091 | M04 | 1899 | 1999 | |
| GA000091 | M03 | 0 | 1969 | |
| GA000091 | L97 | 1965 | 1965 | |
| GA000091 | L96 | 1966 | 1966 | |
| GA000091 | L95 | 1937 | 1999 | |
| GA000091 | L94 | 1950 | 1999 | |
| GA000091 | L93 | 1987 | 1999 | |
| GA000091 | L92 | 1987 | 1999 | |
| GA000091 | L87 | 1882 | 1882 | Omitted from FRR and Current range map |
| GA000091 | L86 | 0 | 1999 | |
| GA000091 | L85 | 1966 | 1999 | |
| GA000091 | L84 | 0 | 1994 | |
| GA000091 | L83 | 1987 | 1999 | |
| GA000091 | L82 | 1987 | 1999 | |
| GA000091 | L74 | 1962 | 1999 | |
| GA000091 | L73 | 1977 | 1988 | |
| GA000091 | L65 | 1500 | 1969 | |
| GA000091 | L64 | 1950 | 1999 | |
| GA000091 | L63 | 1987 | 1999 | |
| GA000091 | L54 | 1987 | 1999 | |
| GA000079 | J54 | 1981 | 1997 | |
| GA000091 | J54 | 1500 | 1999 | |
| GA000091 | J53 | 1902 | 1902 | Omitted from FRR and Current range map |
| GA000079 | J43 | 1993 | 1996 | |
| GA000091 | J43 | 1987 | 1999 | |
| GA000091 | J22 | 1500 | 1969 | |
| GA000091 | J13 | 1500 | 1969 | |
| GA000079 | J06 | 1985 | 1985 | |
| GA000091 | J06 | 1500 | 1986 | |
| GA000079 | J05 | 0 | 1985 | |
| GA000091 | J05 | 1970 | 1986 | |
| GA000091 | J00 | 1930 | 1969 | |
| GA000091 | H87 | 0 | 1986 | |
| GA000079 | H79 | 1989 | 1989 | |
| GA000091 | H79 | 1987 | 1999 | |
| GA000091 | H53 | 1983 | 1983 | |
| GA000079 | H52 | 1980 | 1980 | |
| GA000091 | H52 | 1500 | 1988 | |
| GA000091 | H43 | 1500 | 1969 | |
| GA000079 | H42 | 1992 | 1992 | |
| GA000091 | H42 | 1987 | 1999 | |
| GA000091 | H32 | 1500 | 1969 | |
| GA000091 | H30 | 1905 | 1905 | Omitted from FRR and Current range map |
| GA000079 | H27 | 1996 | 1996 | |
| GA000091 | H27 | 1987 | 1999 | |
| GA000091 | H26 | 1987 | 1999 | |
| GA000091 | H17 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | H16 | 0 | 0 | Omitted from FRR and Current range map |
| GA000079 | H14 | 1997 | 1997 | |
| GA000091 | H14 | 1500 | 1999 | |

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|---|---|---|---|---|
| GA000091 | H09 | 1990 | 1990 | |
| GA000091 | H07 | 1990 | 1990 | |
| GA000079 | H06 | 1990 | 1990 | |
| GA000091 | H06 | 1500 | 1999 | |
| GA000079 | H05 | 1985 | 1997 | |
| GA000091 | H05 | 1500 | 1999 | |
| GA000079 | H04 | 1986 | 1997 | |
| GA000091 | H04 | 1500 | 1999 | |
| GA000091 | G98 | 0 | 1990 | |
| GA000079 | G96 | 1990 | 1990 | |
| GA000091 | G96 | 0 | 1999 | |
| GA000079 | G95 | 1996 | 1997 | |
| GA000091 | G95 | 1500 | 1999 | |
| GA000091 | G94 | 1500 | 1969 | |
| GA000091 | G88 | 1987 | 1999 | |
| GA000091 | G86 | 1990 | 1990 | |
| GA000091 | G80 | 1897 | 1897 | Omitted from FRR and Current range map |
| GA000091 | G79 | 1987 | 1999 | |
| GA000091 | G78 | 1990 | 1990 | |
| GA000091 | G72 | 1962 | 1962 | |
| GA000091 | G71 | 1987 | 1999 | |
| GA000091 | G69 | 0 | 1989 | |
| GA000091 | G67 | 0 | 1991 | |
| GA000091 | G62 | 1987 | 1999 | |
| GA000091 | G61 | 1987 | 1999 | |
| GA000091 | G52 | 1999 | 1999 | |
| GA000091 | G50 | 1988 | 1988 | |
| GA000091 | G10 | 1950 | 1969 | |
| GA000091 | G02 | 1987 | 1999 | |
| GA000091 | G00 | 1882 | 1882 | Omitted from FRR and Current range map |
| GA000091 | F90 | 1965 | 1965 | |
| GA000091 | F60 | 1904 | 1904 | Omitted from FRR and Current range map |
| GA000091 | D22 | 1500 | 1999 | |
| GA000091 | D21 | 1500 | 1969 | |
| GA000079 | D14 | 1988 | 1988 | |
| GA000091 | D14 | 1970 | 1999 | |
| GA000079 | D12 | 1991 | 1991 | |
| GA000091 | D12 | 1987 | 1999 | |
| GA000091 | D10 | 1920 | 1920 | Omitted from FRR and Current range map |
| GA000091 | D01 | 0 | 1986 | |
| GA000091 | C24 | 0 | 0 | Omitted from FRR and Current range map |
| GA000091 | C23 | 1987 | 1999 | |
| GA000091 | C13 | 1990 | 1990 | |
| GA000091 | C12 | 1955 | 1955 | |
| GA000091 | C03 | 1990 | 1990 | |
| GA000091 | C02 | 1950 | 1991 | |
| GA000091 | C01 | 0 | 1991 | |
| GA000091 | B92 | 1990 | 1990 | |
| GA000091 | B90 | 0 | 1990 | |
| GA000091 | B81 | 0 | 1990 | |
| GA000091 | B80 | 1990 | 1990 | |
| GA000091 | B72 | 1955 | 1955 | |
| GA000091 | B71 | 1950 | 1989 | |
| GA000091 | B70 | 1987 | 1999 | |

# APPENDIX IV

**NOTICE OF NOTIFIABLE ACTIONS**
**HABITAT TYPE 4.2**

Under STATUTORY INSTRUMENT 94 of 1997, made under the EUROPEAN COMMUNITIES ACT 1972 and in accordance with the obligations inherent in the COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 (the Habitats Directive) on the conservation of the natural habitats and species of wild fauna and flora, all persons must obtain the written consent, (in circumstances prescribed at section A and B below) of the Minister for The Environment and Local Government before performing any of the operations on, or affecting, the following habitats where they occur on lands / waters within the candidate Special Area of Conservation.

Please note that where a landowner has a current approved plan under the Rural Environmental Protection Scheme or any scheme which the Minister considers to be equivalent s/he need only notify the Minister of activities not covered in the plan.

**HABITAT TYPE**
**FENS, TRANSITION MIRES, PETRIFYING SPRINGS**

**SECTION A**
Please note that the activities listed in *Section A below* are required to be notified to the Minister for The Environment and Local Government and should not be undertaken before consent.

Section A
THE MINISTER FOR THE ENVIRONMENT AND LOCAL GOVERNMENT IS REQUIRED TO BE NOTIFIED IN RELATION TO THE FOLLOWING ACTIVITIES AND SUCH ACTIVITIES SHOULD NOT PROCEED WITHOUT PRIOR CONSENT**:**

grazing of livestock above a sustainable density (as defined in approved farm plans)

grazing by livestock treated within the previous week with a pesticide which leaves persistent residues in the dung

changing of traditional use from hay meadow (to either grazing or silage making), or from grazing to silage cutting

adding lime within 50m of the fen or a water course running into it

adding fertiliser of any sort within 50m or a water course running into it

extracting water for irrigation or other purposes

mowing grass before the 30th June (*Note; if you have been notified that your lands hold breeding corncrakes, or certain rare meadows, special provisions will apply)*

supplementary feeding of stock

operation of boat angling or shore angling business

restocking with fish

reclamation, infilling, ploughing or land drainage within 50m of the fen

reseeding, planting of trees or any other species within 50m of the fen

use of any pesticide or herbicide within 50m of fen

dumping, burning or storing any materials within 50m of the fen

alteration of the banks, bed or flow of watercourses within the fen or running into or out of it

harvesting reed or willow

operation of commercial recreation facilities (e.g. bird watching tours)

introduction (or re-introduction) into the wild of plants or animals of species not currently found in the area any other activity of which notice may be given by the Minister from time to time

**SECTION B**
Please note that the activities listed in *Section B below* may, and in most cases do, require a license or consent from another statutory authority (e.g. the local planning authority, the Minister for the Marine and Natural Resources, or the Minister for Agriculture and Food).

If so, these notifiable actions do not apply.

However, if such activities are not regulated by another statutory authority, the said activities are required to be notified to the Minister for The Environment and Local Government.

SECTION B

(NO REQUIREMENT TO NOTIFY IF ALREADY LICENSED BY ANOTHER MINISTER/BODY)

developing leisure facilities including golf courses, sports pitches, caravan or camping facilities

any activity which might cause pollution of the fen

removal of soil, mud, gravel, sand or minerals

developing roads or car parks

construction of fences, buildings or embankments

afforestation

# APPENDIX V

# GLOSSARY

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CUTAWAY BOG - This term describes areas where peat has been removed systematically by industrial means. Any peat remaining can no longer be considered as economically removable (Irish Peatland Conservation Council).

CUTOVER BOG – An NPWS habitat classification that describes areas of bog which have been previously cut (by hand or by mechanical means), although not down to the underlying mineral soils or bedrock. Remaining peat can still be an economic reserve. Cut-over areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DEHLG - Department of Environment, Heritage and Local Government

DESICCATION - Drying out.

DOMESTIC PURPOSES - Used in relation to the cutting of peat. Peat that is cut for domestic purposes is not for commercial sale and is cut at the rate of one year's supply for a household per year.

DRAINAGE DITCHES - An NPWS habitat classification which refers to water channel systems with moving or stagnant water bodies, artificial in origin. Most ditches are cleared cyclically, although this category also includes ditches that are overgrown with wetland plants.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ECOTOPE - The abiotic environment or habitat of a particular biotic system (Kulcher, 1967; Whittaker et al., 1973). According to work carried out by Kelly (1993) on Clara and Raheenmore raised bogs vegetation can be assigned to five different ecotopes. Sub-central and central ecotopes with Active peat formation (Active Raised Bog habitat) and marginal, sub-marginal and face bank ecotopes with little or no peat formation (Degraded Raised Bog habitat).

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

FENS AND FLUSHES - An NPWS habitat classification. Fens are peatlands fed by calcium rich water, either from groundwater or from inflowing surface water. Flushes are wet areas maintained by the seepage of water down slopes of various gradient, and are usually local features. Both are

characterised by an abundance of small sedge forming species-rich mosaics with other species. Orchid species are particularly noticeable in fens and butterworts are more typical of flushes. According to Cross (1990) flushes are areas where nutrient enrichment occurs, usually as a result of more concentrated horizontal water movement. They are particularly common near the bog margin and at the base of low mineral ridges and are characterised by the presence of *Molinia caerulea, Myrica gal*e and often *Sphagnum recurvum*.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT. - Refers to traditional cutting of peat using a slean or spade.

HIGH BOG – This is the area of bog which have not been previously cut and generally its vegetation is characterised by the presence of ericoid and *Cyperaceae* species and an abundant of *Sphagnum* species.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

LAGG - A term used to describe the transition from bog to mineral soil around a raised bog.

LIMESTONE - Sedimentary rock composed predominantly of calcium carbonate, often containing fossils.

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MICROTOPOGRAPHY – This is the small scale variation in surface level within a habitat.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NGO – Non governmental environmental conservation organisations.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PEAT CUTTING BY HAND. - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

RAISED BOG - An NPWS habitat classification characterised by an elevated dome of peat, the surface of which is isolated from the surrounding ground water table and receiving water solely from precipitation. The peat surface is wet, often with pools and hummock hollow systems and is usually dominated by *Sphagnum* mosses and bushy heather, with Deer-grass, Bog Cottons and other associated species. Raised bogs can be distinguished from blanket bogs by their paucity of grasses which typify blanket bog.

SENSITIVE MARGIN (or Margin with high sensitivity to cutting) - Section of high bog margin that is within 250m of priority habitat (i.e. Active Raised Bog or Bog Woodland).

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPWS is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

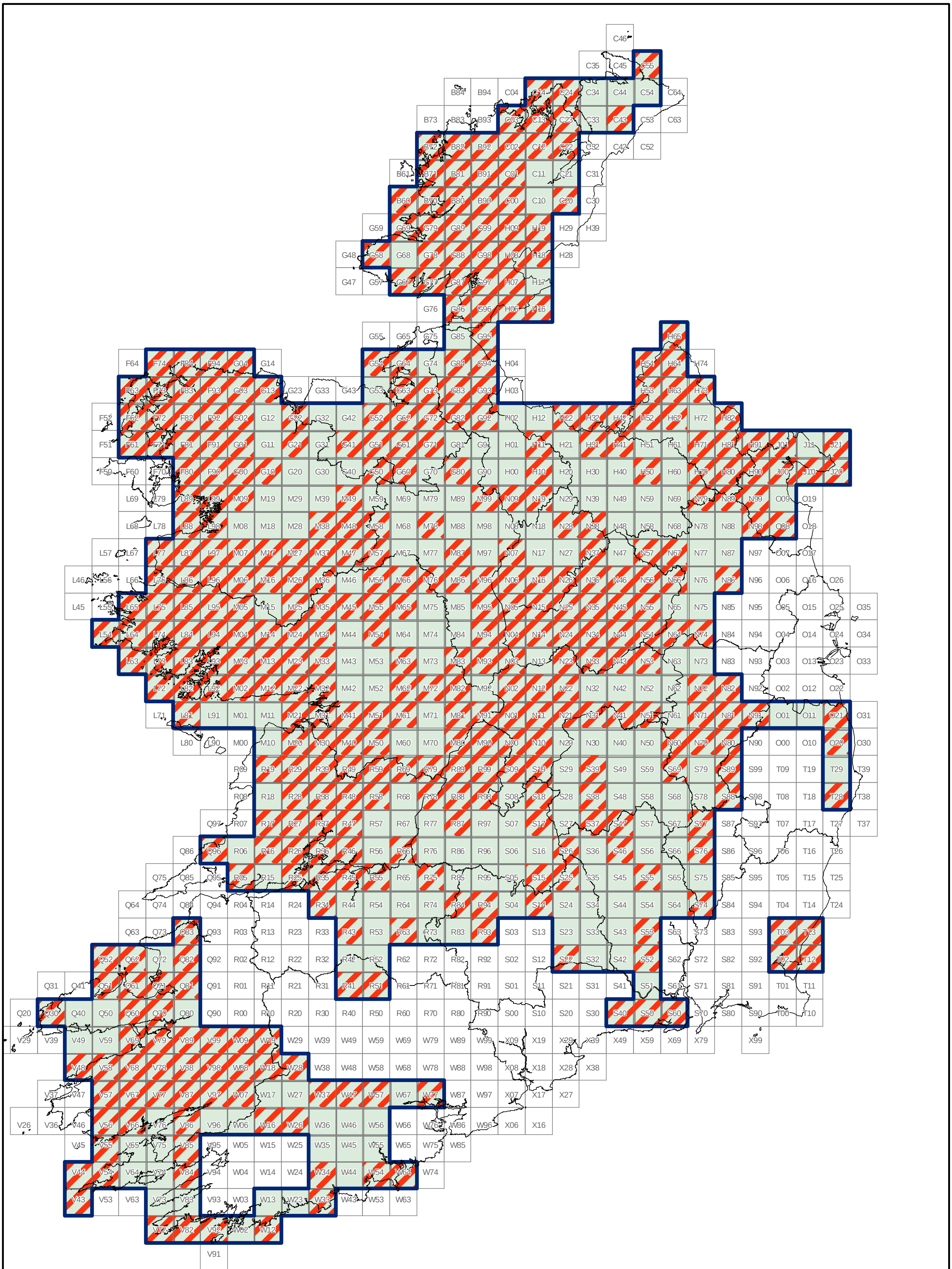
TURBARY – Turbary is the term used to describe the ancient right to cut turf on a particular area of bog. These rights came about with the resettlement of confiscated land or by prescription. Prescription is a legal term meaning that if a person is able to demonstrate that they cut turf without secrecy, without permission and without force continuously for a period of 30 years they have a turbary right. This implies that not all turbary rights will be formally registered.

## 7140 Transition mire and quaking bogs

| National Level | |
|---|---|
| **Habitat Code** | 7140 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | • Crushell P., 2000. *Irish Fen Inventory - A review of the status of fens in Ireland*, Irish Peatland Conservation Council, Dublin, pp. 100.<br>• Foss, P.J. 2007. National Parks & Wildlife Service Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007. Unpublished report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.<br>• Hammond R.F., 1979, The Peatlands of Ireland, Soil survey Bulletin No 35, An Foras Talúntais, Dublin. |
| **Range** | Throughout Ireland, most commonly in west and Midlands. |
| Surface area | 59,500 km² (595 grid cells selected x 100 km² - area polygon derived from grid cells) see Map 2 |
| Date | 02/2007 Data for habitat distribution and range covers data collection period from surveys of the early 1980's; the NHA surveys of the 1990's to NPWS Fen Study Project 2006. |
| Quality of data | 2 = moderate (based on partial data with some extrapolation) |
| Trend | Decreasing |
| Trend-Period | 1980-2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| **Area covered by habitat** | 19.54 km² |
| Distribution map | See map actual present distribution and range attached; NPWS Fen Study database 2007 |
| Surface area | 19.54 km² |
| Date | 02/2007 Data for habitat area covers data collection period from surveys of the early 1980's; the NHA surveys of the 1990's to NPWS Fen Study Project 2006. |
| Method used | 3 = ground based survey |
| Quality of data | 1 = poor (based on very incomplete data or on expert judgement) |
| Trend | - = decreasing |
| Trend-Period | 1980-2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| Justification of % thresholds for trends | There has been an unquantified decline in area since the beginning of the trend period, however this decline is not considered to be significant since the Directive came into force. |
| Main pressures | 140 Overgrazing<br>150 Restructuring agricultural land holding<br>161 Forestry planting<br>310 Peat Extraction<br>311 Hand-cutting of peat<br>312 Mechanical removal of peat<br>701 Water Pollution<br>800 Landfill, land reclamation and drying out, general<br>803 Infilling ditches, dykes, ponds, marshes and pits<br>810 Drainage<br>890 Other human induced changes in hydraulic conditions |

| | |
|---|---|
| Threats | 140 Overgrazing<br>150 Restructuring agricultural land holding<br>310 Peat Extraction<br>312 Mechanical removal of peat<br>701 Water Pollution<br>800 Landfill, land reclamation and drying out, general<br>803 Infilling ditches, dykes, ponds, marshes and pits<br>810 Drainage<br>890 Other human induced changes in hydraulic conditions |
| ***Complementary information*** | |
| **Favourable reference range** | 59,500 km² (595 grid cells selected x 100 km² - area polygon derived from grid cells) See Map 3 attached |
| **Favourable reference area** | 19.54 km² |
| **Typical species** | **Vascular plants***: Carex diandra, Carex lasiocarpa, Carex limosa, Eriophorum gracile, Menyanthes trifoliate, Pedicularis palustris, Potentilla palustris*<br><br>**Mosses, Liverworts and Lichens:** *Bryum pseudotriquetrum, Calliergon giganteum, Sphagnum denticulatum.*<br><br>Species information based on: Ó Críodáin, C. & Doyle, G.J., 1994; 1997; Doyle, G.J. & Ó Críodáin, C., 2003; White, J. & Doyle, G.J., 1982; Foss 2007.<br><br>Further characteristic vascular plants, mosses, lichens and liverworts see Table 5.1.<br><br>**Other species:**<br><br>**Dragonflies and Butterflies***: Euphydryas aurinia*<br><br>Methods: all the species above are characteristic of Transition Mire habitat in Ireland. |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Typical species were assessed as unfavourable/bad using best expert judgement. |
| **Other relevant information** | Restoration initiatives undertaken : Very limited; NPWS |
| ***Conclusions (assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Favourable (FV) |
| **Specific structures and functions (incl. typical species)** | Unfavourable Bad (U2) - ongoing deterioration of the condition of Transition mire habitats at current rates caused by drainage, land reclamation, peat cutting, forestry etc. threatens the structures and functions of the habitat as well as habitat quality indicator and typical species. |
| **Future prospects** | Unfavourable Bad (U2) - ongoing deterioration of Transition mire habitats at current rates caused by drainage, land reclamation, peat cutting, forestry etc. threatens the future prospects for the habitat. |
| **Overall assessment of CS** | Unfavourable Bad (U2) |



1:1,800,000

0 12.5 25 50 Kilometers

# Transition mires and quaking bogs

**7140**

- Current Distribution (397 cells)
- Current Range (595 cells)
- Favourable Reference Range (595 cells)
- W48 10km grid cells

Date: October 2007

AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

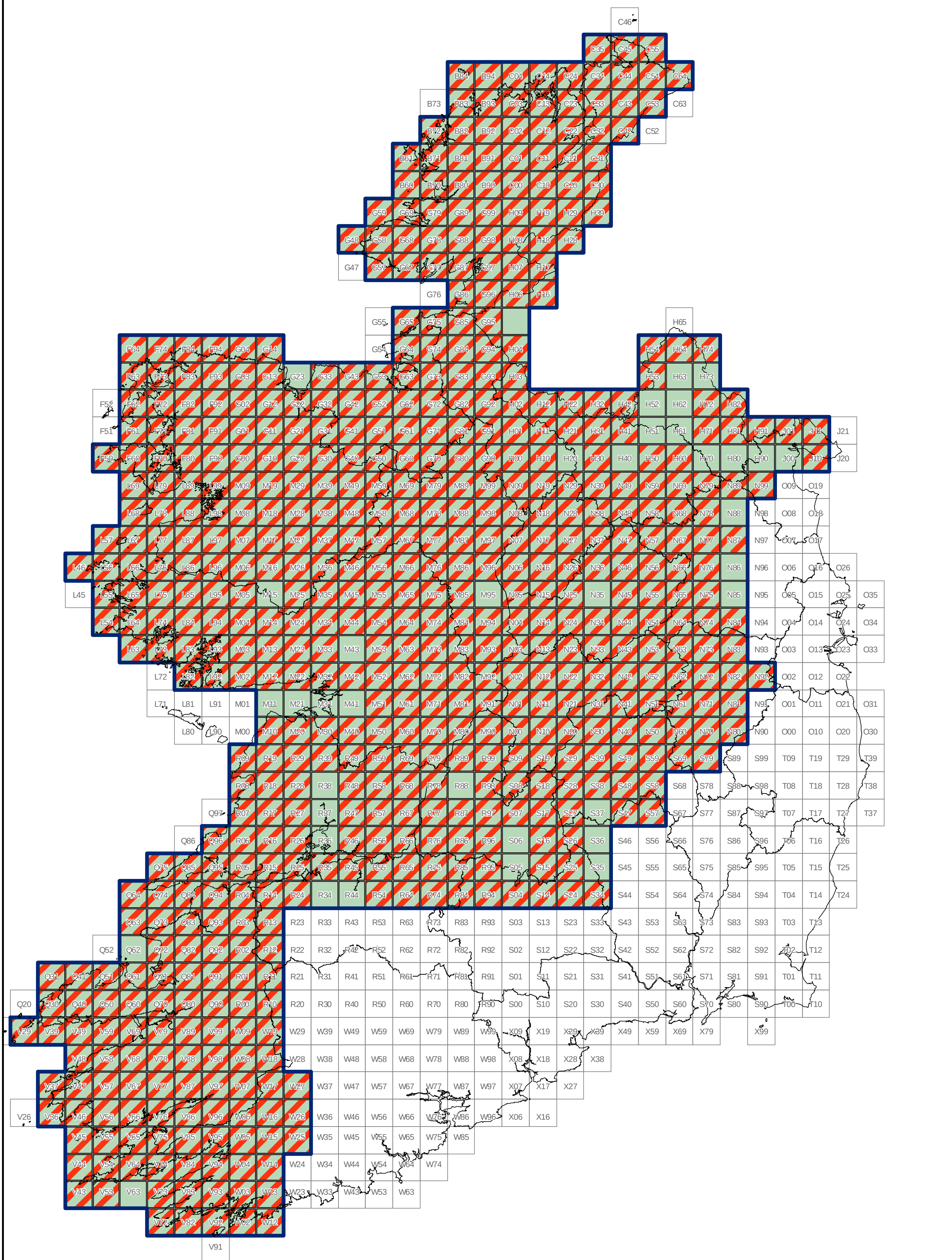
## 7150 Depressions on peat substrates of the *Rhynchosporion*

| National Level | |
|---|---|
| **Habitat Code** | 7150 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |

| | |
|---|---|
| **Published sources** | ▪ Conaghan, J. et al. (2001). *Evaluation of Blanket bogs for Conservation in the Republic of Ireland:* A synthesis of the reports on surveys to identify blanket bog sites of scientific interest commissioned by Wildlife Service 1987, 1989 – 1991. Unpublished report to NPWS, Dept. Environment, Heritage and Local Government, Dublin, Ireland.<br>▪ Derwin, J. & MacGowan, F. 2000. *Raised Bog Restoration Project: A Continuation of the Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland.* Unpublished report, Dúchas the Heritage Service, Dublin.<br>▪ Fernandez, F., Fanning, M., Mccorry, M. & Crowley, W. 2005. *Raised Bog Monitoring Project 2004-05*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.<br>▪ Fernandez, F., MacGowan F., Crowley, W., Farrell, M., Croal, Y., Fanning, M. & McKee, A. 2006. *Assessment of impacts of turf cutting on designated Raised Bogs 2003-06*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage Local Government, Dublin.<br>▪ O'Connor, M., 2000. *Action Plan for Blanket Bog and Wet Heath*: Technical Aspects. Unpublished report to Dúchas, The Heritage Service, Dublin. Internal Report.<br>▪ Hammond, R.F. 1979. *The Peatlands of Ireland*. Soil and Survey Bulletin. No. 35. An Foras Taluntais (Teagasc), Dublin.<br>▪ Hammond, R.F. 1984. *The Classification of Irish peats as surveyed by the National Soil Survey of Ireland*. 7th International Peat Congress, Dublin.<br>▪ Kelly, L., Doak, M. & Dromey, M. 1995. *Raised Bog Restoration Project: An Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland.* Unpublished report, National Parks & Wildlife Service, Department of Arts, Heritage, Gaeltacht and the Islands, Dublin. |
| **Range** | The habitat is associated with raised bog in the lowlands of central and midwest Ireland, and with lowland blanket bog and wet heath in western Ireland. The habitat becomes rare above 300m. It is absence from the southeast of the country due to the absence of suitable habitat. |
| Surface area | 60,900km² (609 grid cells x 100 km²) - area polygon derived from grid cells |
| Date | 07/2007 |
| Quality of data | 2 = moderate |
| Trend | Stable |
| Trend-Period | 1970's – 2006 |
| Reasons for reported trend | No known changes |

| | |
|---|---|
| **Area covered by habitat** | |
| Surface area | Unknown |
| Date | 07/2007 |
| Method used | 1 = expert opinion |
| Quality of data | poor |
| Trend | Stable |
| Trend-Period | 1994 -2006 |
| Reasons for reported trend | Habitat nature: pioneer, versatile, capacity to exploit degraded situations. |
| Justification of % thresholds for trends | NA |
| Main pressures | 810 Drainage<br>142 Overgrazing by sheep<br>161 Forestry planting<br>180 Burning<br>312 Mechanical removal of peat<br>900 Erosion |
| Threats | 810 Drainage<br>180 Burning<br>312 Mechanical removal of peat<br>142 Overgrazing by sheep<br>161 Forestry planting<br>800 Landfill, land reclamation and drying out, general<br>791 Climate change (via habitat desiccation and possibly 954)<br>900 Erosion<br>954 Invasion by a species |
| ***Complementary information*** | |
| **Favourable reference range** | 60,900km² (609 grid cells x 100 km²) area polygon derived from grid cells. Favourable range is considered to be similar to the habitat current range. |
| **Favourable reference area** | Unknown |
| **Typical species** | Vascular plants*: Rhynchospora alba, R. fusca, Drosera intermedia, D. rotundifolia, Drosera anglica, Eriophorum angustifolium, Narthecium ossifragum.*<br><br>Mosses, Liverworts and Lichens: *Sphagnum cuspidatum, S. auriculatum, S. magellanicum, S. papillosum, S. pulchrum (*local*), Lycopodium inundatum* (very rare*).*<br><br>The list of typical species submitted was derived using survey data combined with best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | The overall habitat conservation status assessment is favourable despite the Unfavourable assessment given to the associated habitats where it is found (e.g. raised bog, blanket bog and wet heath). This is mainly related to the pioneer and transitional nature of the habitat and capacity to exploit a more degraded situation. |
| ***Conclusions (assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Favourable (FV) |
| **Specific structures and functions (incl. typical species)** | Favourable (FV) |
| **Future prospects** | Favourable (FV) |
| **Overall assessment of CS** | Favourable (FV) |



**Depressions on peat substrates of the *Rhynchosporion* 7150**

1:1,800,000

0 12.5 25 50 Kilometers

AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

| | |
|---|---|
| | Current Distribution (571 cells) |
| | Current Range (609 cells) |
| | Favourable Reference Range (609 cells) |
| W48 | 10km grid cells |

Date: August 2007

# CONSERVATION STATUS ASSESSMENT REPORT

## TABLE OF CONTENTS

## 1. Habitat characteristics in Ireland

Fens, are usually peat-forming wetlands that receive mineral nutrients (magnesium, iron and in particular calcium) from sources other than precipitation: usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement, and are not generally so acidic as bogs. In general they are poor in nitrogen and phosphorus, the latter of which tends to be the limiting nutrient in fen systems. Studies of wetlands in Western Europe frequently show that nutrient enrichment (with nitrogen and phosphorus) leads to changes in species composition, decline in overall plant species diversity, and loss of rare and uncommon species (Doyle & O Críodáin 2003, Sheehy Skeffington & O'Connell 1998).

Ecologically, a fen is a mineral rich freshwater environment in which dead but undecayed plant matter has accumulated to the point where most or all of the remaining vegetation is emergent (Rieley & Page 1990).

Fens differ from bogs because they are less acidic and have relatively higher mineral levels. They are therefore able to support a much more diverse plant and animal community.

Some contain a rich selection of higher plants; up to and occasionally more than half Ireland's species of dragonflies, several thousand other insect species, as well as being an important habitat for a range of invertebrates and birds.

Fens, like bogs, provide important benefits in a watershed, including preventing or reducing the risk of floods, improving water quality, and providing habitat for unique plant and animal communities.

Fens often occur in mosaics with other wetland communities such as reed beds, bogs or open water in which case they may be of relatively limited extent. Although fens can be found as discrete habitats in their own right, they may also occur in association with (or within) a range of other habitats including blanket bog, raised bog, turlough, dune slack, machair, wet heathland, wet grassland, woodland, karst areas, lacustrine and riverine habitats and systems.

As fens are an early successional stage in the formation of raised and in some cases blanket bogs, or occurred at the edges of such acid peatlands, they have experienced a natural decline in area as these more acid peatlands developed and eventually buried them (Rieley & Page 1990).

More recently, like most peatland types in Ireland, fens have experienced a decline in range, area, and quality mostly as a result of such activities as peat mining activities, draining for cropland, infilling, and fertiliser pollution and eutrophication.

**Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae** (*Cladium* fens) are characteristic of flat ground and not on slopes. The broader view is that the habitat is wetter than Alkaline fen with the water table at or above the surface, though fluctuations in water table are less. The habitat is more calcareous and oligotrophic than Alkaline fen (Curtis *et al* 2006).

*Cladium* fens in Ireland are classified in the order Caricetalia davallianae (*sensu* Ó Críodáin & Doyle, 1994) within which 4 associations are recognised in Ireland.

If large areas are dominated by species-poor or mono dominant stands of *Cladium mariscus*, which may occur on the margins of hard water, oligotrophic lakes, these communities are regarded in the reed bed order or Phragmitalia and are not assignable to this habitat (i.e. Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae).

Caricetalia davallianae (*sensu* Ó Críodáin & Doyle, 1994) communities in Ireland:

Carici nigrae-Juncetum articulati
Waterlogged habitats in low lying areas in hollows along mesotrophic lake shores, deep drainage channels in blanket bog areas and neglected drainage channels in rough grassland. Also lakes in machair and wet dune hollows (water pH range 5.5-8.3).

Campylio-Caricetum dioicae
Vegetation typical of grazed calcareous flushes, sometimes surrounded by relatively calcifuge vegetation (water pH range 4.6-7.5).

Schoenetum nigricantis
*Schoenus nigricans* dominated base-rich fens and in well established flushes that are ungrazed, where tussock formation is typical (water pH range 5.5-8.1).

Juncetum subnodulosi
*Juncus subnodulosus* dominated calcium-rich fen vegetation (water pH range 5.6-8.5), typical of the contact zone between Cladietum marisci and the Schoenetum nigricantis.

In Ireland *Cladium* fens occur in a variety of situations including topogenous fens found in valleys or depressions, floodplains, over-grown-ditches, in flat and depressions, extensive wet meadows, within tall reed beds, on the landward side of lakeshore communities, calcium rich flush areas in blanket bogs, dune slack areas, fens adjacent to raised and blanket bogs, in turlough sites and wet hollows in machair often in association with Alkaline fen.

## 2. Habitat mapping

To-date no potential historic distribution or range map of the occurrence of this habitat has been available in Ireland (Foss 2007). A potential historic distribution and range map for *Cladium* fens based on a series of data sets which would indicate the possible location of sites with the habitat in Ireland was produced as a part of the current assessment of the habitat in Ireland. Information on the historic habitat distribution and range provided by this map was compared with the present habitat distribution and range to ensure that an adequate network of sites has been selected to ensure favourable conservation of this habitat in Ireland. Such an exercise was felt to be justified in the absence of any systematic field survey of the habitat to date in Ireland.

The most recent mapping of the fen habitat resource in Ireland is the work of Hammond in 1979. This study mapped only deep fen peat (>30cm in depth), and furthermore all fen peat areas were considered to be man modified with no attempt was made to distinguish between the various fen types.

A map of the **potential historic distribution and range** of *Cladium* fens, based on a 10 km² grid basis was produced by selecting those grid squares in which the habitat is known to be present (based on Foss 2007) or was believed to occur in the past (Hammond 1979); Corine 2000 and Teagasc 2000), together with the total distribution of *Cladium mariscus* in Ireland as recognised by the Botanical Society of Britain and Ireland (BSBI). The specific data sets use to produce the map are listed in Appendix I.

The mapping of the **current habitat distribution and range** of *Cladium* fens is based on National Parks and Wildlife Service (NPWS) study of the extent and conservation status of springs, fens and flushes undertaken in 2006 (Foss 2007). In the absence of any detailed fen survey in Ireland to-date, this desk study compiled a list of all known *Cladium* fens of conservation value in Ireland based on data held within NPWS and from external NGO and expert sources (see Appendix I & II). In addition to recognised sites for the habitat in Ireland, all 10 km² grid cells which contain a record for the habitat indicator species *Cladium mariscus* were also mapped as part of the current habitat distribution, using species records dated between 1940 and the present. Extension of the range for this habitat, based on the distribution of *Cladium mariscus* was felt to be justified, in the absence of any National Fen Survey to-date in Ireland.

The NPWS Fen Study (Foss 2007) involved compilation of a list of all known fen sites in Ireland, classification of these according to fen type (using the fen habitats recognised in the EU Habitats Directive), and accurately assessing or estimating the area of fen vegetation present on sites where this was possible. Fen type and area data was obtained from a variety of related wetland studies previously undertaken within NPWS (see Appendix I). In the case of some of these surveys, accurate fen area data were available for the extent of fen vegetation on sites. In other cases only an estimated area figure could be assigned to fen sites.

The Calcareous fens with *Cladium mariscus* **current habitat distribution and range map** (see Map 2) was produced by selecting the smallest polygon size containing all grid squares, where the habitat was recorded in the NPWS Fen Study database (Foss 2007), or species indicative of the habitat were located, using a minimum number of 90 degree angles. Gaps in the habitat distribution of at least two 10 km² square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range. The map produced should be taken as indicative of the distribution of Calcareous fens with *Cladium mariscus* until such time as a national fen survey is completed. One exception to the mapping criteria used, involved the extensive river system SACs where only known sub sites containing *Cladium* fen sites were mapped on the 10 km² square grids rather than the entire SAC river system.

The *Cladium* fen **favourable reference range** (see Map 3) is considered to be the same as the current habitat range.

The FRR is defined as the range of 10 km² grid cells which contain a *Cladium* fen site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km² grid cells which contain a record for the habitat indicator species *Cladium mariscus*. Gaps in the habitat distribution of at least two 10 km² square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range.

## 3. Habitat Range

As fens are an early successional stage in the formation of raised and in some cases blanket bogs (eventually being buried under these more acid peatland types), or occurred naturally at the edges of such acid peatlands, they would have been widespread throughout the midlands and west of Ireland in post-glacial times.

The first attempt to map the range of general fen habitats in more recent times undertaken by Hammond (1979) indicates that the habitat type is widespread in Ireland, with the greatest concentration of sites occurring in the midlands and westwards into counties Galway, Mayo and Clare (see Table 4.1). Hammond (1979) records no fens in Counties Carlow, Cork, Donegal, Dublin, Monaghan or Wicklow. Subsequent reports show in fact that these counties also contain fen (see Crushell 2000, Foss *et al* 2001, Foss 2007). It is therefore likely that the total range of fen in Ireland recognised in Hammond (1979) is an under representation of the habitat in Ireland. In part, this shortcoming may be related to the fact that Hammond recorded only fen habitats occurring on a deep peat layer (greater than 30 cm).

Nonetheless, Hammond (1979) distribution map of man-modified fen still represents a minimum "best estimate" of the total extent of fen soils and fen habitats in Ireland. One further short coming of the report is that no subdivision is made in Hammond in terms of fen type (i.e. Alkaline fen, *Cladium* fen, Transition mires or Petrifying springs). The digitised version of this fen distribution data produces a **Hammond fen range map** which covers an area of 21,300 km$^2$ (213 grid squares x 100 km$^2$) containing fen, with a significant concentration of grid squares in the midlands and mid-west of Ireland (see Map 4).

A map of the **potential historic distribution and range** of *Cladium* fen, based on a 10 km² grid basis and undertaken as part of this assessment project (see section 2 above) indicates that in the potential historical distribution and range map, *Cladium* fen has a range cover of 49,400 km$^2$ (494 grid squares x 100 km$^2$, see Map 1). The range polygon (area polygon derived from grid squares) derived for this habitat cover 62,900 km$^2$ (629 total grid squares x 100 km$^2$).

The **potential historic distribution and range** has therefore been found to be more than double the predicted "fen" range estimated by Hammond (1979). The historical range as defined by this assessment (see Map 1) shows extensions to the range of the habitat in particular in the Midlands, south west and south east of Ireland.

The most recent NPWS Fen Study (Foss 2007) undertaken to obtain information on the distribution and extent of Alkaline fen, *Cladium* fen, Transition mires or Petrifying springs in Ireland, found that *Cladium* fens occur in every county throughout Ireland with the exception of Counties Dublin and Leitrim, with increased frequency in the Midlands and West of the country (see Table 4.3 below; and Map 2).

The **current distribution and range map** for *Cladium* fen indicates that the habitat has a range of 29,100 km$^2$ (291 grid squares x 100 km$^2$, see Map 2). The current range polygon (area polygon derived from grid squares) derived for this habitat covers 42,9000 km² (429 grid squares x 100 km). The range polygon shows a significant decline (41%) over the total predicted historical range of the habitat.

Until a detailed field survey of this habitat is completed in Ireland it remains unclear whether this observed decline in the range is the in fact due to loss of sites, or lack of knowledge of the occurrence of sites with this habitat in these grid squares.

Expert opinion would indicate that the current range of the habitat, based on the known sites listed within the NPWS Fen Study database (Foss 2007), when taken together with the likely sites for the habitat indicated by the presence of *Cladium mariscus* records, is sufficient to represent the ecological variation of the habitat across its distribution and range in Ireland when compared to the potential historic distribution and range, mapped as part of this conservation status assessment.

It is, however, likely that following a future detailed field based fen survey of Ireland, some additional sites may be discovered (as indicated by species distribution data) within the area formerly believed to contain the habitat, which would increase the number of 10 km² grid cells which contain Calcareous fens with *Cladium mariscus,* most likely within the current range polygon. Such new sites may add somewhat to the range of the habitat in Ireland above that proposed in this assessment.

Based on available data the **Favourable Reference Range** (FRR) (see Map 3) is therefore considered to be the same as the current range for the habitat in Ireland as mapped in this assessment, which should be regarded as a minimum until detailed habitat surveys are completed.

### 3.1. Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relationship between current habitat range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

No specific studies have been undertaken on conservation status of the habitat range in Ireland during the reporting period making any assessment of the annual decline in the habitat extent or range impossible. Thus, although the actual trend can not be quantified it is considered to be negative based on anecdotal evidence and expert opinion.

An assessment based on current and favourable reference range indicates that the **current range polygon of the habitat** in Ireland (see Map 2), as defined by the list of sites for this habitat held in the NPWS Fen Study database (Foss 2007) and related species range, covers 42,900 km$^2$ (429 total grid squares x 100 km$^2$).

The **Favourable Reference Range** (FRR) (see Map 3) is considered to be the same as the current range.

- **Current Habitat Range:** Can be considered as the area of the polygon which contains all of the grid cells with the habitat which is 42,900 km² (429 grid cells x 100km²).
- **Favourable Reference Range** 42,900 km² (429 grid cells x 100km²) the area of the polygon which contains all of the grid cells with the habitat.

The difference between the current *Cladium* fen habitat range and the FRR for this habitat reveals that the current habitat range is the same as the FRR which is considered to be **Favourable** according to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive).

## 4. Habitat Extent

The first attempt to estimate the original extent of fen habitats in the Republic of Ireland (Hammond 1979) indicated that 92,508 ha of fen occurred. Although Hammond did not differentiate between the different fen types recognised today, it is probable that a proportion of this original area of fen was Calcareous fens with *Cladium mariscus*, which occurred in association with areas of Alkaline fen, Transition mire and Petrifying springs. Many of these fens were associated with or occurred adjacent to midland raised bogs and in more western blanket bog habitats.

**Table 4.1: The original area (ha) of fen by County in Ireland after Hammond 1979**

| County | Area (ha) |
|---|---|
| Carlow | 7,883 |
| Cavan | 81 |
| Clare | 0 |
| Cork | 0 |
| Donegal | 0 |
| Dublin | 0 |
| Galway | 10,012 |
| Kerry | 5,844 |
| Kildare | 316 |
| Kilkenny | 4,654 |
| Laois | 1,232 |
| Leitrim | 81 |
| Limerick | 16,030 |
| Longford | 5,140 |
| Louth | 352 |
| Mayo | 3,901 |
| Meath | 0 |
| Monaghan | 469 |
| Offaly | 13,901 |
| Roscommon | 4,828 |
| Sligo | 1,279 |
| Tipperary | 4,298 |
| Waterford | 11,026 |
| Westmeath | 0 |
| Wexford | 566 |
| Wicklow | 615 |
| **Total** | **92,508** |

Significant decline in this habitat, due to the activities of human influences, have occurred in Ireland over the last 400 years, a feature noted by Hammond (1979) who included only a "man modified" fen category in his report. In his word "Undisturbed fens are rare and can only be found in a few counties in Ireland. Owing to their small size their representation on the map is not possible, even their continued existence as natural entities is under threat from agriculture and urban pressures".

The two activities which are most important for the decline of this habitat are drainage activities associated with the related activities of land reclamation and the development of turf extraction schemes on bogs, in particular midland raised bogs (Crushell 2000).

Traditional cutting of bogs for turbary over the last 400 years, and the associated drainage of marginal areas, has had a serious impact on the extent of the raised bogs and their associated fens. Raised bog has declined by an estimated 68% as a result of turbary activity (Hammond 1979, Ryan & Cross 1984, Cross 1989). The mechanisation of peat cutting combined with a grant aid scheme under the Turf Development Act (1981) enabled many small scale extraction programmes to get underway has resulted in further loss of the raised bog and the associated fen resource (Fernandez *et al*. 2006).

The most serious impact of mechanisation has been on midland raised bogs and the fens that were associated with these habitats. Mechanical extraction has accounted for a loss of 22% of the raised bog resource in less than 50 years (Cross 1990), and the drainage works needed to make peat harvesting possible has also resulted in significant loss of fen areas associated with the margins of raised bogs.

Subsequent studies undertaken by the Irish Peatland Conservation Council indicated that the intact resource of fen in Ireland has declined significantly with just 19,660 ha remaining by the year 2000 (Crushell 2000, Foss *et al*. 2001).

Crushell (2000) did not recognise Cladium fen as a category in his report and provided no specific data relating to this fen habitat type.

**Table 4.2: Conservation worthy fen area (ha) and number of sites recognised by IPCC in 2000 in each Irish County**

| County | Conservation Area (ha) | Number of Sites |
|---|---|---|
| Carlow | 806 | 16 |
| Cavan | 340 | 9 |
| Clare | 90 | 3 |
| Cork | 893 | 13 |
| Donegal | 1,318 | 14 |
| Dublin | 96 | 3 |
| Galway | 2,419 | 34 |
| Kerry | 339 | 8 |
| Kildare | 554 | 11 |
| Kilkenny | 386 | 11 |
| Laois | 843 | 8 |
| Leitrim | 160 | 8 |
| Limerick | 399 | 13 |
| Longford | 572 | 5 |
| Louth | 437 | 19 |
| Mayo | 223 | 10 |
| Meath | 214 | 13 |
| Monaghan | 2,460 | 38 |
| Offaly | 954 | 14 |
| Roscommon | 1,650 | 21 |
| Sligo | 475 | 26 |
| Tipperary | 1,571 | 16 |
| Waterford | 1,161 | 20 |
| Westmeath | 543 | 12 |
| Wexford | 406 | 6 |
| Wicklow | 351 | 16 |
| **Total** | **19,660** | **367** |

The decline is the habitat was also acknowledged by Ó Críodáin in 1995, as part of the SAC designation process, when he estimated that national extent of the Cladium fen resource remaining in Ireland at just 2,500 ha.

The most recent analysis of conservation worthy sites recognised in Ireland, the NPWS Fen Study (Foss 2007) found that the total area of estimated fen vegetation recorded in the NPWS Fen Study amounted to 22,180 ha within 681 discrete sites (site complex sub-units omitted i.e. sub-sites that occur within existing SAC or NHA). In total the NPWS Fen Study database holds information on 808 sites (which includes 127 sub-site records), where fen habitats are known or believed to occur. This list of sites includes two fen types, poor fen and non-calcareous springs, which were not recorded as part of many of the earlier studies (i.e. Hammond 1979, Foss *et al* 2001 *inter alia*).

The extent of Annex 1 fens (i.e. Alkaline fen, *Cladium* fen, Transition mire, and Petrifying spring) which most closely relate to the fen types identified in previous studies, was estimated to cover just 10,298 ha (in a total of 702 sites) or 46% of the total fen area estimated in the NPWS Fen Study (Foss 2007). This is an indication that Annex 1 fens are less widespread in Ireland than estimated by previous workers (Crushell 2000; Foss *et al*. 2001; Hammond 1979).

Specifically in relation to Calcareous fens with *Cladium mariscus*, a total of 122 sites with this habitat were identified in the Republic of Ireland. Area estimates indicate that at least 1,468 ha of this habitat occur within the conservation worthy sites recognized by the NPWS Fen Study (Foss 2000), indicating that this habitat type is much less common than Alkaline fen (7230) which had an estimated cover of 6,830 ha in Ireland.

**Table 4.3: The extent of Annex 1 fen habitats recognised in Ireland within each county in the NPWS Fen Study (Foss 2007). Area in ha with the number of sites in brackets [#.]**

| **County** | *** Cladium fen 7210** | Alkaline fen 7230 | Transition Mire 7140 | * Tufa springs 7220 |
|---|---|---|---|---|
| Clare | 303 (15) | 856 (25) | 149 (13) | 7.92 (10) |
| Cavan | 0 (1) | 120 (7) | 0 (1) | 0.1 (3) |
| Carlow | 4 (2) | 4 (1) | | 0.01 (1) |
| Cork | 24 (3) | 501 (17) | 43 (8) | 5.6 (3) |
| Donegal | 21 (5) | 365 (25) | 375 (16) | 1.01 (2) |
| Dublin | | 61 (3) | | 0.1 (2) |
| Galway | 356 (29) | 1,282 (50) | 426 (23) | 7.6 (17) |
| Kildare | 84 (4) | 147 (11) | 2 (3) | 1.3 (8) |
| Kilkenny | 6 (4) | 118 (7) | 3 (2) | 1.9 (7) |
| Kerry | 10 (2) | 183 (9) | 1 (4) | 5.6 (4) |
| Longford | 0 (2) | 156 (7) | 13 (2) | |
| Louth | 3 (2) | 61 (6) | 1 (3) | 0 (1) |
| Leitrim | | 164 (6) | 59 (11) | 0.3 (2) |
| Laois | 10 (2) | 158 (10) | 0.1 (2) | 1.12 (5) |
| Limerick | 127 (13) | 436 (14) | 19 (3) | 0.16 (2) |
| Meath | 36 (4) | 81 (16) | 13 (3) | 0.12 (5) |
| Monaghan | 6 (3) | 9 (4) | 126 (14) | 0.1 (1) |
| Mayo | 249 (16) | 566 (34) | 548 (22) | 1.91 (10) |
| Offaly | 14 (5) | 1,955 (38) | 25 (7) | 2.67 (10) |
| Roscommon | 41 (5) | 386 (23) | 2 (3) | 1.01 (4) |
| Sligo | 0 (1) | 261 (20) | 13 (11) | 2.54 (11) |
| Tipperary | 163 (7) | 1,080 (19) | 16 (6) | 6.13 (7) |
| Westmeath | 11 (11) | 316 (56) | 95 (14) | 1.31 (8) |
| Wicklow | 60 (3) | 110 (8) | 30 (2) | 6.52 (9) |
| Wexford | 0 (2) | 63 (9) | 6 (1) | 0.11 (2) |
| Waterford | 0 (1) | 207 (11) | 4 (6) | 0.01 (1) |

[#] The data presented in this table includes a limited number of sites which cross one or more county boundaries. In such cases the area data and site is duplicated for the occurrence of the site in each of the respective counties in which it occurs.

Of the 122 sites listed for this habitat in the NPWS Fen Study database (Foss 2007) 41 sites have no habitat area data. Assuming an average size of 18 ha per site (based on site extent data from the NPWS Fen Study, Foss 2007) it is possible that the cover of this habitat may increase by an estimated 738.

In addition to the sites listed in the NPWS Fen Study database (Foss 2007) for this habitat, an additional 87 potential sites identified for this habitat, based on the occurrence of *Cladium mariscus* species distribution records, may add further to the overall habitat area. Assuming an average size of 18 ha per site it is possible that the cover of this habitat may increase by an estimated 1,566 ha.

It is therefore possible, that when outstanding site surveys and habitat extent data are completed on these sites that the habitat area in Ireland may increase to as much as 3,770 ha. Confirmation of this increase in extent will only be possible following detailed site surveys undertaken as part of a National Fen Survey.

In the light of the missing data on extent referred to above, expert opinion would indicate that the current area of the habitat (1,468 ha), based on the extent of known sites listed within the NPWS Fen Study database (Foss 2007), is insufficient to represent the ecological variation of the habitat across its distribution and range in Ireland.

Additional habitat areas will be discovered as part a future detailed field based fen survey of Ireland, which would increase the known extent of Calcareous fens with *Cladium mariscus*. The present extent of 1,486 ha of the habitat in Ireland should therefore be regarded as a minimum area until detailed surveys are completed. This qualification concerning extent of the habitat should also be applied to the **Favourable Reference Area** (FRA).

Based on available data the **Favourable Reference Area** (FRA) (see Map 3) is therefore considered to be the same as the current known area of the habitat in Ireland, which should be regarded as a minimum until detailed habitat surveys are completed.

### 4.1. Conservation Status of Habitat Extent

No specific studies have been undertaken on the conservation status of the habitat extent in Ireland.

The IPCC fen study of Crushell (2000) lists 10 fen sites with a total site area of 190 ha that had "undergone complete habitat loss since their conservation value was recognised" during the 1990's. A further 47 fen sites with a total site area of 2,463 ha, out of a total of 342 sites recognised in the IPCC study, were reported to have been "damaged since their conservation value was recognised". This represents some 14% of the sites listed in the IPCC study. A further 86 sites are listed by Crushell as being threatened by a variety of activities including drainage, agricultural reclamation, afforestation, infilling, turbary *inter alia.* (25% of the sites listed by the IPCC).

It is unclear, from the Crushell study, whether the annual incremental decline in habitat area exceeds the 1% per annum threshold set as unfavourably bad by the assessment criteria for this specific habitat.

Analysis of the sites held in the NPWS Fen Study database (Foss 2007), showed that of the 808 sites listed 448 sites (55% of the total) had been affected by damaging operations or were threatened by such activities. In total 377 sites had experienced serious or very serious damage as defined by the NHA standard data forms (data mainly compiled in the 1993-1995 period), representing 47 % of all fen sites in the NPWS Fen Study database (Foss 2007). A further 311 sites were threatened by such activities which represents 39% of the listed sites. Of the sites assessed for damaging activities and threats within the NPWS Fen Study database, only 86 sites (11% of the total) showed no damaging activity, while 83 sites (10% of the total) were considered to have no threats.

Specifically for Calcareous fens with *Cladium mariscus*, the results of the NPWS Fen Study (Foss 2007) showed that, 57 sites with a habitat area of 803 ha (55%) have been damaged by human activities, while 50 sites with a habitat area of 536 ha (37%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 882 ha or 60% of the presently recorded Calcareous fens with *Cladium mariscus* resource. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum area estimate.

Again it is unclear, from this study, whether the annual incremental decline in habitat area exceeds the 1% per annum threshold set as unfavourably bad by the assessment criteria for this specific habitat.

The NPWS Fen Study found that the best estimate of the **current habitat area** in Ireland (based on known and predicted area information), as defined by the list of sites for this habitat listed in the NPWS Fen Study database (Foss 2007) covers an area of 14.68 $km^2$ (1,468 ha) in a total of 122 sites.

The **Favourable Reference Area (FRA)** is considered to be the area of this habitat in all sites listed in the NPWS Fen Study (Foss 2007) database, and is the same as the current area.

According to the to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive) the area covered by the habitat type within the range is **Favourable**.

- **Known area covered by the habitat:** 14.68 $km^2$. **Should be regarded as a minimum value until detailed surveys completed.**
- **Favourable Reference Area:** 14.68 $km^2$. **All site with the habitat protected within the SAC network**

## 5. Structures and Functions

### 5.1. Habitat Structures and Functions

Satisfactory data on habitat quality, and habitat change trends are lacking for this habitat in Ireland.

The IPCC fen study of Crushell (2000) referred to in section 4.1 above, showed that 10 fen sites with a total site area of 190 ha that had "undergone complete habitat loss since their conservation value was recognised " during the 1990's. A further 47 fen sites with a total site area of 2,463 ha, out of a total of 342 sites recognised in the IPCC study, were reported to have been "damaged since their conservation value was recognised". This represents some 14% of the sites listed in this study. A further 86 sites are listed by Crushell as being threatened by a variety of activities including drainage, agricultural reclamation, afforestation, infilling, turbary *inter alia.* (25% of the sites listed by the IPCC).

Analysis of the sites held in the NPWS Fen Study database (Foss 2007) showed for Calcareous fen with *Cladium mariscus*, 57 sites with a habitat area of 803 ha (55%) have been damaged by human activities, while 50 sites with a habitat area of 536 ha (37%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 882 ha or 60% of the Calcareous fen with *Cladium mariscus* resource. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum area estimate.

The damage caused to fen habitats and reported by Crushell (2000) and noted during the NPWS Fen Study (Foss 2007) has presumably been coupled with a decline in habitat quality (i.e. structure and functions).

It is likely that the number of sites for the habitat which have experienced damage in the past from a variety of negative factors (i.e. burning, peat extraction, dumping, infilling, over grazing) or suffered alteration in hydrological conditions (i.e. local drainage, arterial drainage, water abstraction etc.) or are threatened by these and other activities, is in fact much higher than indicated by these two studies. However, without a recent national survey to record such damage and threats no more specific assessment of conservation status can be undertaken at present.

Although, the overall extent of the habitat may remain unchanged in some cases, adverse changes in some of the above attributes would indicate deterioration in overall habitat structure and function.

### 5.1.1. Conservation Status of Habitat Structures and Functions

Satisfactory data on habitat quality, and habitat change or species trends are lacking. Based on available information and expert opinion it is likely that more than 60% of the area of the habitat in Ireland is unfavourable conserved as regards its specific structures and functions (including typical species). Conservation status of habitat structures and functions is therefore regarded as unknown but likely to be **Unfavourable Bad**.

## 5.2. Typical Species

Calcareous fens with *Cladium mariscus* typically contain a suite of vascular plants, and are particularly characterised by the presence of small sedges, a rich herbaceous flora and usually a prominent "brown moss" carpet.

According to the 2003 version of the Interpretation Manual the characteristic plant communities and species of Calcareous fens with *Cladium mariscus* habitat (7230) are those of the Caricion davallianae which are defined as follows:

Calciphile small sedges and other Cyperaceae usually dominate the mire communities, which belong to the *Caricion davallianae*, characterised by a usually prominent "brown moss" carpet formed by *Campylium stellatum*, *Drepanocladus cossonii*, *D. revolvens*, *Palustriella commutata*, *Calliergonella cuspidata*, *Ctenidium molluscum*, *Fissidens adianthoides*, *Bryum pseudotriquetrum* and others, a grasslike growth of *Schoenus nigricans, S. ferrugineus, Eriophorum latifolium*, *Carex davalliana*, *C. flava*, *C. viridula ssp. brachyrrhyncha*, *C. hostiana*, *C. panicea*, *Juncus subnodulosus*, *Scirpus cespitosus*, *Eleocharis quinqueflora*, and a very rich herbaceous flora including *Tofieldia calyculata*, *Dactylorhiza incarnata*, *D. traunsteineri*, *D. traunsteinerioides*, *D. russowii*, *D. majalis* ssp. brevifolia, *D. cruenta*, *Liparis loeselii*, *Herminium monorchis*, *Epipactis palustris*, *Pinguicula vulgaris*, *Pedicularis sceptrum - carolinum*, *Primula farinosa*, *Swertia perennis*.

Wet grasslands (*Molinietalia caerulaea*, e.g. Juncetum subnodulosi & Cirsietum rivularis, 37), tall sedge beds (Magnocaricion, 53.2), reed formations (Phragmition, 53.1), fen sedge beds (Cladietum mariscae, 53.3), may form part of the fen system, with communities related to transition mires (54.5, 54.6) and amphibious or aquatic vegetation (22.3, 22.4) or spring communities (54.1) developing in depressions. The sub-units below, which can, alone or in combination, and together with codes selected from the categories just mentioned, describe the composition of the fen, are understood to include the mire communities sensu stricto (Caricion davallianae), their transition to the Molinion, and assemblages that, although they may be phytosociologically referable to alkaline Molinion associations, contain a large representation of the Caricion davallianae species listed, in addition to being integrated in the fen system; this somewhat parallels the definition of an integrated class Molinio - Caricetalia davallianae in Rameau et al., 1989. Outside of rich fen systems, fen communities can occur as small areas in dune slack systems (16.3), in transition mires (54.5), in wet grasslands (37), on tufa cones (54.121) and in a few other situations. The codes below can be used, in conjunction with the relevant principal code, to signal their presence. Rich fens are exceptionally endowed with spectacular, specialised, strictly restricted species. They are among the habitats that have undergone the most serious decline. They are essentially extinct in several regions and gravely endangered in most.

While CORINE defines the species present in Fen *Cladium* beds (53.31) and Fen sedge beds (53.3) as those species of the Rich fens Caricion davallianae (54.2) described as: Calciphile small sedges and other Cyperaceae usually dominate the mire communities, which belong to the Caricion davallianae, characterised by usually prominent “brown moss” carpet formed by *Campylium stellatum, Drepanocladus cossonii, D. revolvens, Palustriella commutata, Ctenidium molluscum, Fissidens adianthoides, Bryum pseudotriquetrum* and others. With a grasslike growth of *Schoenus nigricans, Eriophorum latifolium, Carex flava, C. viridula spp. brachyrrhyncha, C. hostiana, C. panicea, Juncus subnodulosus* inter alia. In addition Cladium beds may also occur in more acid quaking fens of the Caricion lasiocarpae.

Table 3.1 shows characteristic species for the habitat as defined by the Habitats Directive; phytosociological association character and prominent species; characteristic species for the habitat in general in Ireland as well species considered to be indicators of good site quality or typical species as defined by the Directive (Ó Críodáin, C. *pers. comm.*).

**Table 3.1 List of typical species of Calcareous fen with *Cladium mariscus* habitat in Ireland**

| Species | Characteristic species in the Habitats Directive Interpretation Manual (2003) | Association Character species on *Cladium* fen (Ó Críodáin, C. & Doyle, G.J., 1994 & 2003) | Typical or good site quality indicator species (Ó Críodáin, C. *pers. comm.*) | Characteristic Irish *Cladium* fen species |
|---|---|---|---|---|
| Cladium mariscus | Yes | Character | Yes | Yes |
| Anagallis tenella | | PR | | Yes |
| Aneura pinguis | | | | Yes |
| Bryum pseudotriquetrum | Yes | | Yes | Yes |
| Calliergonella cuspidata | | PR | | Yes |
| Campylium stellatum | Yes | PR | Yes | Yes |
| Carex dioica | | Character | Yes | Yes |
| Carex echinata | | PR | | Yes |
| Carex hostiana | Yes | Character | | Yes |
| Carex nigra | | Character | | Yes |
| Carex panicea | Yes | PR | | Yes |
| Carex pulicaris | | PR | Yes | Yes |
| Carex viridula ssp. brachyrrhyncha | Yes | PR | | Yes |
| Carex viridula ssp. oedocarpa | | Character | Yes | Yes |
| Carex viridula ssp. *brachyrrhyncha* | | Character | Yes | Yes |
| Cirsium dissectum | | PR | | Yes |
| Ctenidium molluscum | Yes | | Yes | Yes |
| Dactylorhiza incarnata | Yes | | | Yes |
| Dactylorhiza traunsteineri | Yes | | Yes | Yes |
| Drepanocladus cossonii | Yes | | | Yes |
| Drepanocladus revolvens | Yes | | Yes | Yes |
| Eleocharis multicaulis | | PR | | Yes |
| Eleocharis quinqueflora | Yes | Character | Yes | Yes |
| Epipactis palustris | Yes | | Yes | Yes |
| Eriophorum latifolium | Yes | | Yes | Yes |
| Fissidens adianthoides | Yes | | Yes | Yes |
| Galium palustre | | PR | | Yes |
| Hydrocotyle vulgaris | | Character | | Yes |
| Juncus articulatus | | Character | | Yes |
| Juncus bulbosus | | PR | | Yes |
| Juncus subnodulosus | Yes | Character | Yes | Yes |
| Mentha aquatica | | PR | | Yes |
| Molinia caerulea | | PR | | Yes |
| Palustriella commutata | Yes | | Yes | Yes |
| Parnassia palustris | | | Yes | Yes |
| Pinguicula vulgaris | Yes | | Yes | Yes |
| Ranunculus flammula | | Character | | Yes |
| Schoenus nigricans | Yes | Character | Yes | Yes |
| Scorpidium scorpioides | | PR | Yes | Yes |
| *Selaginella selaginoides* | | PR | Yes | Yes |
| Succisa pratensis | | PR | | Yes |

Table 3.1 list typical species for Calcareous fens with *Cladium mariscus* habitat in the Republic of Ireland. The final list includes species that are characteristic of the habitat expanded to include those species indicative of good habitat quality which might be included in future surveys of the habitat. An over representation of a single species does always indicate good habitat quality.

This list is slightly different from that in the Interpretation Manual of the Habitats Directive, as certain species are included in the Interpretation Manual as characteristic of the habitat but do not occur on Irish site. The list also reflects recent changes in species nomenclature.

### 5.2.1. Conservation Status of Habitat Typical Species

No specific studies have been undertaken on conservation status of habitat typical species in Ireland.

Nonetheless, the assessment of the habitat quality (i.e. Structure and Functions, see above) is partially based on changes in habitat extent and can be used to assess the conservation status of Typical Species. The definition of a habitat is based on the presence and dominance of certain typical species, with particular emphasis on sedges and brown mosses. Thus, a decline in habitat quality (estimated at 60% of the area of this habitat damaged and threatened in Ireland) is likely to have resulted in a decline in the presence of Typical Species. The conservation status of habitat structures and functions is regarded as **Unknown** for this habitat.

As habitat quality and typical species are so interdependent, it can be suggested that an **Unknown** but likely to be **Unfavourable Bad** conservation status can also be inferred for Typical Species.

## 6. Impacts and Threats

A variety of impacts and threats are recognised which have resulted in the historic decline and loss in quality and functions of the habitat in Ireland to the levels we see today, and continue to threaten the habitat. Peat or turf cutting, arterial drainage, local drainage and agricultural reclamation are reported as being the most significant activities affecting the conservation status of Calcareous fens with *Cladium mariscus* (Foss *et al*. 2001, Hammond 1979, Crushell 2000; Curtis *et al* 2006).

In more recent times a series of additional factors have also damaged sites of conservation value (Foss *et al*. 2001, Crushell 2000). These impacting activities include drainage associated with reclamation for agriculture or general land "improvement", infilling of sites with building waste, dumping of household refuse, afforestation, water pollution and urban expansion (Foss *et al*. 2001, Crushell 2000, Curtis & McGough 1981). Crushell (2000) list some 46 fen sites with a total site area of 2,463 ha that have been damaged by these activities, while 86 fen sites are listed as being threatened by these activities.

These activities were found to seriously disrupt the hydrological conditions needed to maintain these habitats, leading to desiccation of the fen and loss of the characteristic micro-topographical features and eventually change in flora and fauna (Foss *et al*. 2001). These activities have resulted in a 79% decline in the extent of fens (Foss *et al*. 2001) with only 21% remaining in a conservation worthy condition.

Of the remaining sites, 80% are reported to be small in size (less than 100ha) making their future management particularly susceptible to external environmental changes (Foss *et al*. 2001). While in the most recent NPWS Fen Study (Foss 2007) of the 122 Calcareous fens with *Cladium mariscus* sites identified in Ireland, almost 47% (57 sites) had a total site area smaller than 50 ha.

One trend which may facilitate the creation of new secondary Calcareous fens with *Cladium mariscus* sites, over the long term, is the abandonment of former cutaway peat areas following the extraction of commercial peat reserves. On these sites, the cessation of drainage activities used to keep the areas dry enough to allow peat extraction, results in partial re flooding of areas, which due to contact with the underlying mineral soils or fossil fen peat allows the regeneration of fen communities (Egan 1999, Farrell 2006, Farrell & Doyle 1998; 2000). Within the NPWS Fen Study database, 3 discrete sites, occurring in former Bord na Móna peat works are listed which contain 63 ha of regenerating secondary Calcareous fens with *Cladium mariscus* habitat (Anonymous 2003).

A review of damaging activities and threats reported on sites from 1993 to-date was also undertaken as part of this conservation assessment. Data on activities affecting or likely to affect sites were collated against individual sites from various sources.

These included:

- Recent site surveys undertaken by NPWS where damage to fens was reported
- Damage reported to fen sites in the IPCC Fen Study (Crushell 2000)
- Damage assessment section of the NHA standard data forms held by NPWS created as part of the NHA surveys of the mid to late 1990's. Only serious or very serious damage, as reported on the NHA data forms, and likely to affect the fen habitats on sites was recorded in the NPWS Fen Study database (Foss 2007)
- Site Inspection Reporting (SIR) programme. Reporting under SIR is carried out on a three yearly cycle that began in 1998 (i.e. 1998-2000; 2001-2003; 2004-2006). The Research Branch Monitoring Section (NPWS) developed the SIR programme to be used as a monitoring tool. Local NPWS staff log the following info: activities occurring on the site and their effects on the site's integrity, follow-up actions including all outcomes such as prosecutions, notifiable actions and positive management undertaken and site patrolling frequency and purpose.

Analysis showed that of the 808 sites listed in the NPWS Fen Study database 448 sites (55% of the total) had been affected by damaging operations or were threatened by such activities. In total 377 sites had experienced serious or very serious damage as defined by the NHA standard data forms, representing 47 % of all fen sites in the NPWS Fen Study database (Foss 2007). A further 311 sites were threatened by such activities which represents 39% of the listed sites.

For Calcareous fens with *Cladium mariscus*, 57 listed sites with a habitat area of 803 ha (55% of the national resource of this habitat) have been damaged by human activities, while 50 sites with a habitat area of 536 ha (37%) are threatened by human activities. The total area affected by various threats and pressures has been estimated at 882 ha which represents 60% of the known Calcareous fens with *Cladium mariscus* resource.

## 6.1. Agriculture & Land Reclamation

Crushell (2000) reported that the most serious impact on fens has been for their reclamation for agricultural land. The process involves drainage, fertilisation, reclamation and the removal of peat. The fact that Calcareous fens with *Cladium mariscus* (and associated areas of Alkaline fen, Petrifying springs and Transition mires) are most commonly found over limestone and are indicative of fertile land has resulted in many areas with such communities being drained and utilised for agriculture (O'Criodain & Doyle 1997). Drainage is undertaken to dry out the actual fen habitat surface, or the agricultural land or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural.

From the mid 1800's to the present day the total area of and drained under the various Acts and Schemes amounted to more than 2 million hectares, or some 30% of the total land area in Ireland (Anonymous 1999). Much of this work was carried out under the following: the 1945 Arterial Drainage Act, the Land Project of 1949, the Farm Modernisation Scheme 1974-1985, and the Western Drainage Package 1979-1988. These schemes are likely to have had a serious impact on many fen systems, a fact that is supported by evidence from the Arterial drainage act which resulted in drainage works being carried out on 38 catchments in Ireland, affecting some 262,800 ha of land. Since the mid 1980's there has been a substantial decline in grant aided drainage schemes.

Land reclamation has also been grant aided under the now suspended Farm Improvement Programme and the Programme for Western Development. Between 1981 and 1990 more than 25,000 approvals for intensive lowland reclamation works were made and provided with Euro 25 million in grant aid.

## Agriculture & Land Reclamation Trend

No specific studies have been undertaken on agriculture and land reclamation trends of the habitat in Ireland.

Although larger grant aided schemes have now ceased, small scale drainage and improvements works often carried out on agricultural land surrounding the fen habitat continue to damage these sensitive wetland systems.

### 6.2. Drainage

Drainage is conducted to dry out the actual fen habitat surface, or the agricultural or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural purposes and the cutting of turf.

These drainage activities seriously disrupt the hydrological conditions needed to maintain these water dependent habitats, leading to desiccation of the fen and loss of the characteristic micro-topographical features and eventually change in flora and fauna, through the loss of fen character species and/or the invasion of species that thrive in drier conditions (Foss *et al*. 2001).

The blocking of drains is considered as an essential tool for the recovery and improvement of the habitat which has been affected by this activity.

### Drainage Trend

No specific studies have been undertaken on drainage trends of the habitat in Ireland

Although, according to the findings of numerous surveys conducted on sites with this habitat, drainage operations are a recurring feature that continues to threaten the integrity of sites or to lead to their degradation. The ban on the insertion of new drains on protected high bog areas (i.e. raised bogs) should have positive implications for associated fens in such locations.

### 6.3. Turf cutting

Although turf cutting has its most significant affect on the acid bogs from which the turf is cut, drainage works associated with this activity may adversely affect many low lying areas, where fen communities occur. In addition, with more modern forms of mechanised peat extraction (see below), the peat must be spread over dry marginal land beside the bog to allow it to dry, a feature which necessitates improved drainage on these marginal areas.

Turf cutting, which in the past mainly consisted of hand cutting, became mechanised since the 1980’s and was stimulated by the introduction of the Turf Development Act in 1981. The mechanisation of peat extraction by private producers allowed the exploitation of small bogs by small commercial companies and co-operatives. This has been accompanied by intensive drainage of the high bog, which was practically non-existent on the smaller bogs up to 1981.

Therefore, in the last two decades, medium and small size bogs have been increasingly severely impacted by mechanised turf cutting. In the view of the IPCC (Foss *et al*. 2001), the widespread use of machinery has in recent years greatly accelerated the process of decline in peatland resource, particularly Lowland Raised Bogs. They consider that, more peat is now being harvested over a wider area of bog and on a semi-commercial basis since the decline of hand cutting. This has in many cases altered the scale of cutting from the traditional domestic small scale level to much more intensive semi-industrial scale extraction.

### Turf Cutting Trend

The mechanisation of peat extraction has increased the amount of peat extracted from active turf plots and thus the negative effects of this activity. Mechanisation has correlated with a reduction in manual extraction.

Following the publication of the list of SAC raised bog sites in 1997, there was prolonged and strenuous objection from turf cutters. The objectors especially concerned about loss of property rights, loss of future fuel supplies and loss of a way of life in the summer months. The then Minister, Síle de Valera T.D., addressed the objections of bog owners by allowing them cut for domestic use for 10 years, up to and including 2008, at which stage all cutting would have to cease. When the NHAs were designated in 2004, a similar 10-year derogation was put in place, allowing cutting until 2014.

The Department of Environment, Heritage and Local Government (DEHLG) has introduced two voluntary turf cutting cessation schemes since 1999 to buy out turbary rights in NHAs and SACs. The schemes, which were relatively successful in dealing with obvious commercial activity (i.e. moss peat developments), were less successful in dealing with small scale, semi-commercial to commercial fuel peat operations and have had almost negligible impact on domestic cutting. The schemes do not appear to have significantly reduced the numbers of cutters and thus the negative effects of cutting on raised bog priority habitats (Fernandez *et al*. 2006). Thus, unless a more restrictive approach (i.e. mandatory cessation of cutting coupled by compensation packages) is taken, turf cutting is likely to continue at current levels or even increase with increasing fuel prices.

## 6.4. Afforestation

Forestry, which mainly consists of coniferous plantations, is found either on the raised or blanket bog or on the cutover area adjacent to these bog types bog. Surface drainage is always associated with forestry plantations and has similar negative effects to that carried out to facilitate peat cutting and land reclamation. However, other impacts such as shading of vegetation and compression of the peat caused by heavy machinery are related to afforestation.

Egan (1999) mentioned that in 1987, Coillte initiated a major afforestation programme on cutaway bogland and up to 1998 over 4,000 ha were planted.

### Afforestation Trend

EU grant aid for private forestry, which is administered by the Forest Service of the Department of Agriculture and Food, is now withheld for designated peatlands. Indeed, according to the Forestry Service biodiversity strategy, areas designated as SAC or SPA are not considered for afforestation grants. NHAs may also be excluded if the proposed development is incompatible with their protection (McAree, 2002). On the other hand, all grant-aided development in Ireland must also conform to the Forest Service Forest biodiversity guidelines which set out measures to protect existing habitats and wildlife and to maximise the biodiversity of forest.

Coillte Teoranta, one of the major owners of peatland in the country, has ceased planting conifers on intact peatlands on its ownership, principally on economic grounds. It has also made strong commitments to the implementation of the Helsinki Process on Sustainable Forest Management and as part of their Nature Conservation Program. Coillte has initiated *Blanket Bog & Raised Bog Restoration Projects* that will result in the felling of coniferous plantations and drain blocking on some of their peatland sites.

The threat from afforestation on SAC & NHA designated sites therefore appears to be declining in particular. The current trend for un-designated sites is unknown.

## 6.5. Other Impacting Activities

Impacting activities such as over grazing by cattle and sheep, associated poaching by grazing animals, reduction in grazing leading to scrub invasion, burning, dumping of domestic waste, landfill dumping, fertilisation, water pollution, communication routes, cultivation, mowing/cutting, modification of inland water structures, sand and gravel extraction are among the impacting activities that have been reported on sites with the habitat (Foss 2007; see Table 6.1).

Specifically they may occur within and around locations for this habitat. These activities are considered to have negative impact on the habitat where they occur or where they affect the aquifer.

With the exception of damage caused by grazing, landfill and the possible effects of water pollution which are widely reported from fen sites, the activities listed above are in general less widespread than the impacting activities of land reclamation, drainage, peat cutting, and afforestation discussed earlier.

Although significant changes in water chemistry, caused by water pollution has been cited (Curtis *et al* 2006) as a factor affecting site vulnerability, studies are lacking on the physio-chemical requirements of the habitat in Ireland. Buffering capacity is considered to be high for the habitat (due to nature of the organic peat substrate), but not accurately known. Phosphorus is the limiting nutrient to growth in most fen (Doyle & Ó Críodáin 2003) and elevated levels lead to the vigorous growth of grasses over other species, resulting in the loss of fen species. The role of increased nitrogen levels in the species composition of the habitat is unclear.

**Table 6.1: Severity of impacting activities on Calcareous fens with *Cladium mariscus* sites recognised in the NPWS Fen Study (Foss 2007).**

| Main Pressure – Past and Present | Level of Impact |
|---|---|
| 102 Mowing | Moderate |
| 140 Overgrazing | Significant |
| 143 Overgrazing by cattle | Moderate |
| 150 Restructuring of agricultural land holding | Significant |
| 152 Removal of scrub | Moderate |
| 160 General Forestry management | Moderate |
| 161 Forestry planting | Significant |
| 180 Burning | Moderate |
| 230 Hunting | Minor |
| 300 Sand gravel extraction | Minor |
| 301 Quarries | Minor |
| 310 Peat Extraction | Significant |
| 311 Hand-cutting of peat | Significant |
| 312 Mechanical removal of peat | Significant |
| 400 Urbanised areas, human habitation | Moderate |
| 421 Disposal of household waste | Moderate |
| 502 Communication networks routes, auto routes | Minor |
| 700 Pollution | Moderate |
| 701 Water Pollution | Moderate/Significant |
| 790 Other pollution or human impacts | Minor |
| 800 Landfill, land reclamation and drying out, general | Significant |
| 803 Infilling ditches, dykes, ponds, marshes and pits | Significant |
| 810 Drainage | Significant |
| 890 Other human induced changes in hydraulic conditions | Moderate |
| 950 Biocenotic evolution | Minor |
| 951 Accumulation of organic material | Minor |
| 954 Invasion by a species | Minor |

## 7. Future Prospects

### 7.1. Negative Future Prospects

Deterioration of the Calcareous fens with *Cladium mariscus* hydrology at current rates caused by the main threats of peat cutting, drainage, forestry and land reclamation will continue to affect the viability of the habitat. Other negatively influenecing activities (see Table 6.1 above) may also result in further habitat decline at less significant levels than that caused by the main threats.

No accurate survey data on damage occurring on the known habitat national resource exists. However, the majority of anecdotal information from recent site specific surveys indicate that the Future Prospects for the habitat is Poor or Bad.

Furthermore, climate change predictions of increases in temperatures accompanied by a decrease in summer rainfall would increase the summer moisture deficit of Calcareous fens with *Cladium mariscus* and potentially affect species composition on sites and might possibly result in a reduction or cessation of peat formation. This would result in further habitat losses, reduction in habitat quality and possible reduction in habitat viability.

## 7.2. Positive Future Prospects

No specific national management programme designed to ensure the favourable conservation status of sites with this habitat have been undertaken in Ireland (Ó Críodáin pers comm.).

Calcareous fens with *Cladium mariscus* habitats may, however, benefit indirectly from a number of individual management and restoration programmes being carried out in Ireland, though these benefits are likely to be relatively restricted in terms of the overall extent of the habitat resource benefiting from these initiatives. In addition a variety of national measures under various schemes, Directives and survey and research programmes may also benefit sites with this habitat. The various initiatives occurring are outlined below:

**NPWS National Fen Survey of Ireland**

Due to limitations in the current knowledge of the Irish fen resource, in terms of both the fen types identified on many sites to date, and the extent of the habitat type(s) within sites (Foss 2007), the NPWS initiated the National Fen Survey of Ireland in 2007. The first detailed pilot survey is being undertaken in County Monaghan in conjunction with Monaghan County Council.

The aims of the County Monaghan and future fen surveys, will be to survey known and recently reported fen sites in each Irish County, locate further sites of conservation value, characterise the fen habitats present (including EU Annex I fen habitat types) in terms of their floristics, hydrology and water chemistry parameters, estimate the extent of fen habitat(s) present on each site, rate site and habitat quality, record threats and damaging operations and make management priorities and needs recommendations to ensure long term conservation and viability of the key sites identified, and their associated fen habitats.

Results of the National Fen Survey will feed into the respective County Development Plans and the NPWS conservation designation process.

**NPWS Site Research & Restoration Work**

The NPWS has undertaken an on-going research programme at Pollardstown Fen, Co. Kildare on the relationships between the hydrology and the ecology of Petrifying Springs and Alkaline fen habitats on the site. This has yielded valuable information on the extent of the impacts arising from small decreases in the water levels of the supplying aquifer on the fen habitats occurring at the site.

In response NPWS has taken mitigation actions and are developing plans for habitat enhancement to offset potential future impacts. This work is being and will be used to develop national risk assessment and monitoring approaches under both the Water Framework Directive and Habitats Directive for Petrifying Springs, Alkaline and Cladium Fens.

Curtis et al. 2006 indicate that the potential for restoring stands of *Cladium* is largely untested, though the species ability to rapidly recolonise re-flooded turf ponds is encouraging. Restoration trials are at an early stage on Pollardstown Fen, Co. Kildare and Blackditch, Co. Wicklow. These trials intend to improve the areas of all fens community types including *Cladium* stands. The major tool being tested is restoration of the original water levels at both sites, appropriate ditch and drain management, with scrub removal at the latter site. The situation regarding Pollardstown Fen is reported on in more detail in the assessment for alkaline fen.

**NPWS Raised Bog Restoration Project**

On Irish raised bogs NPWS commenced a *Raised Bog Restoration Project* in 1994, which ran up to the end of 1999 and included 10 sites. This project was assisted by the EU Cohesion Fund (Ryan and Streefkerk, 1998). Objectives of the project were the restoration of the bogs hydrology, acquisition of raised bog land, survey of high bog and lagg systems and establishment of a monitoring program. These restoration works consisted of the blocking of drains, mainly on the high bog, and the construction of dams. NPWS again carried out restoration works (i.e. blocking of drains) on three new sites in 2003 and one in 2006. The results of these restoration works are considered positive overall, as there is some expansion and new Active Raised Bog habitat formation occurring (Fernandez *et al.* 2005). These restoration activities may also benefit other wetland habitat types.

**EU Life - Nature Programme**

Coillte Teoranta initiated a *Raised Bog Restoration Project* in 2004. This was funded by an EU Life - Nature Programme. This project will be completed in 2008 and forms part of Coillte's Nature Conservation Programme. The project will work towards restoring 571.2 hectares of raised bog habitat on its property in the midland counties. This project area will be managed with nature conservation as the primary management objective into the future. The project also involves the felling of 450ha of plantation forest, felling of naturally regenerated exotic trees on open bog, perimeter protection of vulnerable raised bog sites against fire, blocking of drains after felling and ongoing monitoring of vegetation and water levels on 14 sites (Coillte, 2005 - www.raisedbogrestoration.ie).

Coillte Teoranta initiated a *Blanket Bog Restoration Project* in 2002. This project, jointly funded by Coillte and DG-Environment under the EU LIFE-Nature Programme, is a four-year scheme, the primary aim of which is to achieve restoration of blanket bog habitat within 1212 hectares of land owned by Coillte. The main focus of the project, active blanket bog, is listed as a priority habitat for conservation under Annex 1 of the EU Habitats Directive, and the areas for restoration either lie within, or occur adjacent to, proposed Special Areas of Conservation. A total of 14 blanket bog sites, most of which are located along the western seaboard of Ireland, have been selected for restoration. At most sites, the main restoration measures to be employed are the removal of conifers and the blocking of any existing drains (http://www.irishbogrestorationproject.ie/).

**Cutaway Bog Restoration Projects**

A further trend which may facilitate the creation of new secondary Calcareous fens with *Cladium mariscus* sites, over the long term, is the abandonment of former cutaway peat areas following the extraction of commercial peat reserves. On these sites, the cessation of drainage activities used to keep the areas dry enough to allow peat extraction, results in partial re flooding of areas, where contact with the underlying mineral soils or fossil fen peat allows the regeneration of *Cladium* fen communities (Egan 1999, Farrell 2006). Within the NPWS Fen Study database, 3 discrete sites, occurring in former Bord na Móna peat works are listed which contain 63 ha of regenerating secondary Calcareous fens with *Cladium mariscus* habitat.

Bord na Móna (Irish Turf Development Bord) initiated a series of cutaway bog restoration projects in the 1990’s in County Mayo (Anonymous 2003; Farrell & Doyle 1998; 2003) and in the midlands (Farrell 2006). Cutaway bog is the term used to describe peatland from which the economically recoverable layers of peat have been extracted for commercial or domestic purposes. There will be up to 70,000 ha of these lands emerging as a result of Bord na Móna's present peat production activities. The potential exists to create a future landscape of forestry and open grasslands interspersed with lakes, wetlands and natural corridors for wildlife; a landscape which is both economically productive for its communities and which respects and values areas of wilderness alongside commercial enterprise (http://www.bnm.ie).

**NPWS Site Conservation Designations**

One further positive prospect for the habitat in Ireland is that 78% (1,162 ha) of all sites recorded within the NPWS Fen study database (Foss 2007) are located within a candidate SAC (cSAC) and an additional 18% (272 ha) of sites are located within a candidate Natural Heritage Area (cNHA).

In the case of Calcareous fen with *Cladium mariscus* sites 1,434 ha or 97% of the known habitat area falls within a candidate designated area in Ireland, which should in the long term provide an additional degree of protection for these sites. This optimism must, however, be tempered by the fact that habitat loss in terms of extent and quality are still occurring within candidate SAC and NHA due to human interference (see above).

**NPWS SAC, SPA and NHA Conservation Management Plans**

The NPWS is planning to produce Conservation Management Plans for each SAC, SPA and NHA in

Ireland. Each plan will list the wildlife resources of the area, the current human uses, any conflicts between the two, and strategies for retaining the conservation value of sites. The draft plans will be given to a liaison committee and other interested parties for discussion and consultation. The NPWS will then prepare a final version of the conservation plan. Consultation on draft consultation plans has begun. Conservation Plans, once complete, will be reviewed on a 5 year cycle.

Data provided by the Management Planning Services Unit (MPSU) section in NPWS (dated 21 February 2007) indicates that 382 conservation plans are presently planned for wildlife sites in Ireland. In total 274 plans are in preparation, 64 plans are completed an ready to go to consultation, while 44 are in consultation or have gone through this process. Within the NPWS Fen Study database (Foss 2007) of the 808 fen sites listed a total of 219 sites have management plans in preparation, 38 plans are completed an ready to go to consultation, while 40 are in consultation or have gone through this process. Implementation of the recommendations in these plans will provide additional conservation protection to fens within the listed sites.

To provide increased conservation protection under the Habitats Directive to SACs from damaging activities, a series of Notifiable Actions have been drawn up by the Department of the Environment (see Appendix IV) on these areas. A landowner must obtain a written consent before performing and such operations on, or affecting the land or waters within an SAC.

**Rural Environment Protection Scheme**

Rural Environment Protection Scheme (REPS), is a scheme designed to reward farmers for carrying our their farming activities in an environmentally friendly manner and to bring about environmental improvement on existing farms. The objectives of the Scheme are to:

- establish farming practices and production methods which reflect the increasing concern for conservation, landscape protection and wider environmental problems;
- protect wildlife habitats and endangered species of flora and fauna;
- produce quality food in an extensive and environmentally friendly manner.

When properly implemented the scheme can benefit sites with this habitat in Ireland, although the lack of sufficient scientific and management expertise needed at a local level, on sites with the habitat, may be a hindrance to achieving this goal.

**EU Water Framework Directive**

Under the Water Framework Directive (2000/60/E) all inland and coastal waters within defined river basin districts must reach at least good status by 2015 and the Directive further defines how this should be achieved through the establishment of environmental objectives and ecological targets for surface waters. Efforts to protect water dependent habitats, which include Alkaline Fen, Transition Mire, Petrifying Springs and Calcareous Fens with Cladium mariscus are being taken within each River Basin District. This is critical as far as protection of the water supplies for these groundwater dependant systems are concerned.

All SACs and, in future, NHAs in which these fen habitats as a qualifying interests will be listed in the Register of Protected Areas drawn up for each River Basin District.

The Water Framework Directive requires that an integrated monitoring programme be established within each river basin district. These monitoring programmes will in many cases be extensions or modifications of existing programmes and will enable collection of the physical, chemical and biological data necessary to assess the status of surface and groundwater bodies in each river basin district.

Where water quality or supply issues are, or have the potential to, impact adversely on sites, this will have to be dealt with through the Programme of Measures associated with each River Basin District Management Plan.

### 7.3. Overall Habitat Future Prospects

No specific management programmes designed to ensure the favourable conservation status of sites with this habitat have been undertaken in Ireland.

Negative actions such as land reclamation, turf cutting, and drainage continue impacting the habitat: decreasing its extent and degrading its structure and functions. No measures have been introduced to address these damaging activities, which are likely to have increased in severity since the 1990's.

To summarise, the habitat long-term viability is not assured and there are unfavourable prospects for its future. The Future Prospects are therefore deemed to be **Unfavourable Bad**.

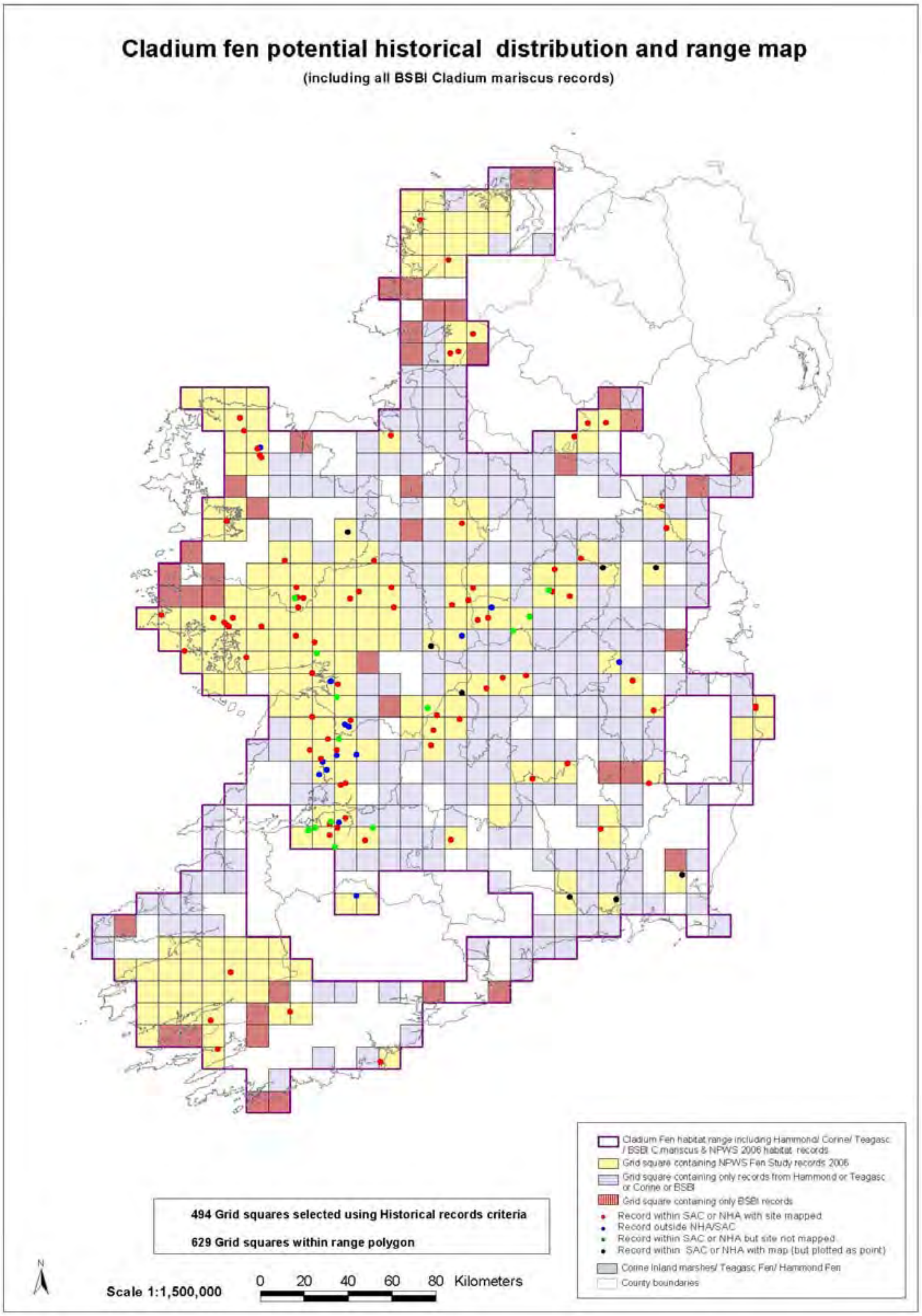
## 8. Overall Assessment of the Habitat Conservation Status

The habitat conservation status of the four main attributes has been assessed as follows:

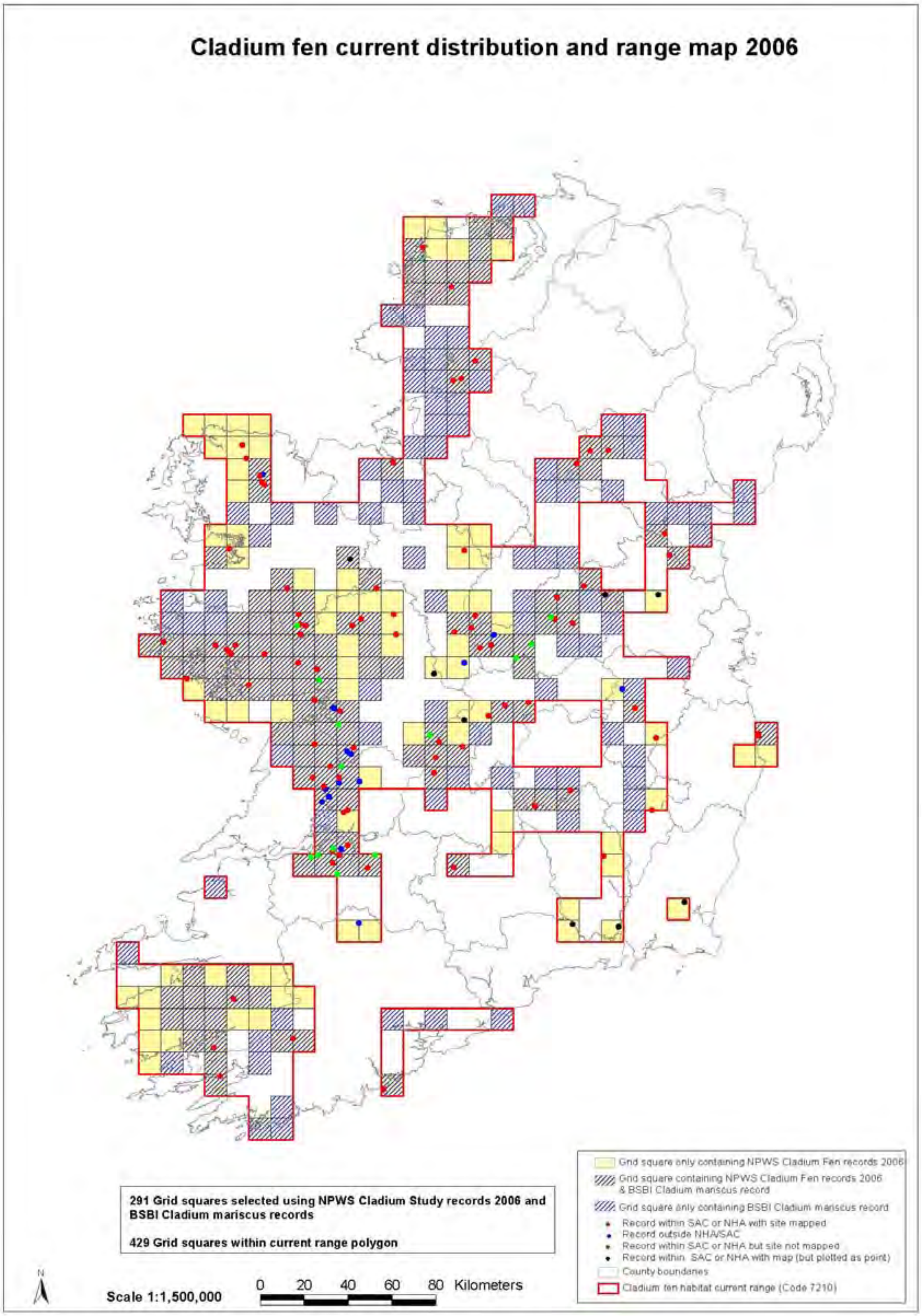
- The **Favourable Reference Range (FRR)** is estimated to be 100% of the current habitat range and thus **Favourable**.
- The **extent of Calcareous fen with *Cladium mariscus*** habitat has decreased, though exact figures for the decline area not available. The extent of the FRA of the habitat is the same as the current extent and therefore deemed **Favourable**.
- An **Unfavourable Bad** assessment is given to the **habitat structures and functions** as the decline in habitat quality indicates.
- The habitat's **Future Prospects** are overall deemed to be **Unfavourable Bad**. Ongoing deterioration of the hydrological conditions of *Cladium* fen at current rates caused by drainage, reclamation, and infilling severely threatens the viability of the habitat. Major positive management actions: land purchase and restoration works are required.

Thus, considering the assessment of the four main habitat's attributes, the overall conservation status for *Cladium* fen habitat is **Unfavourable Bad**.

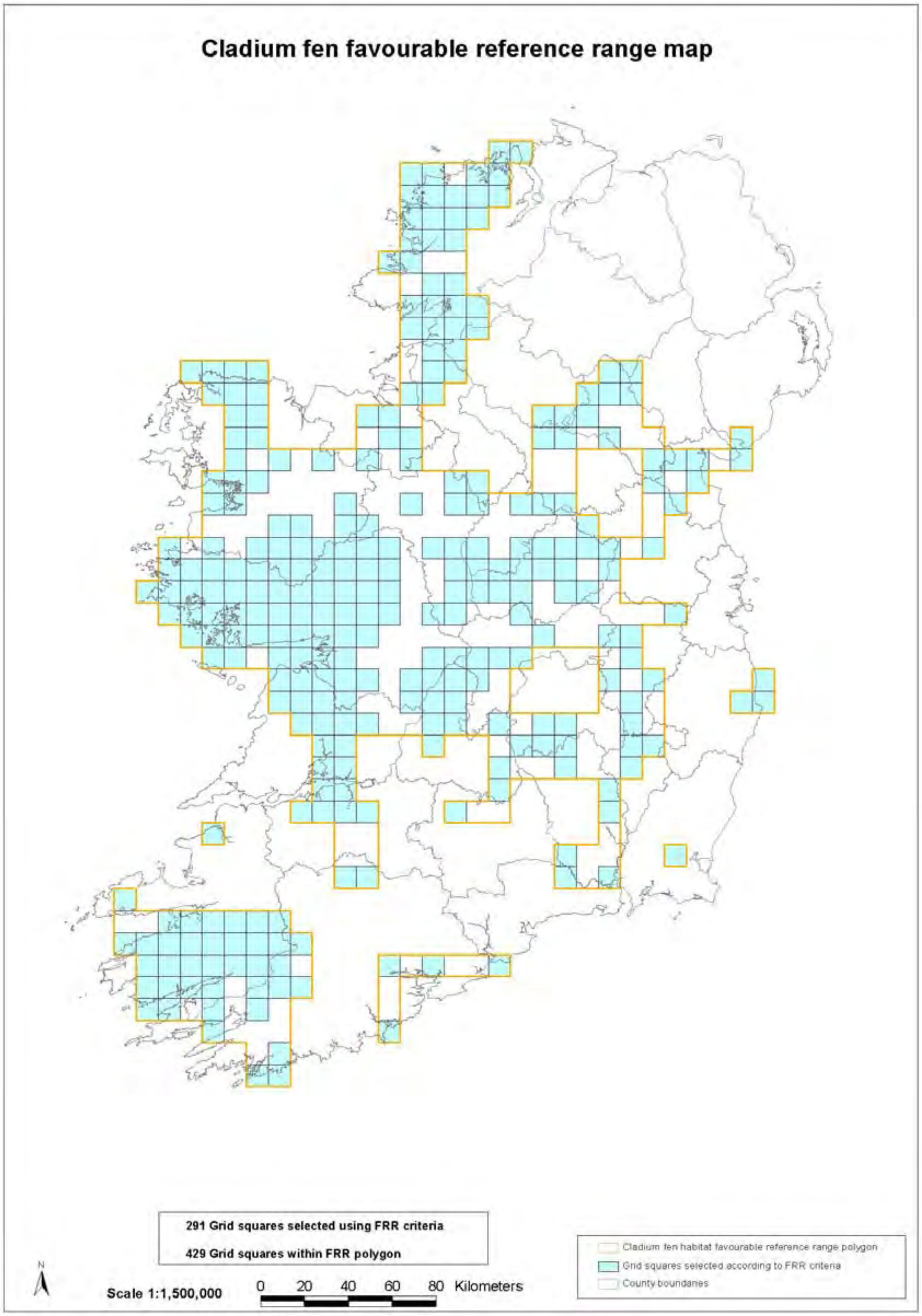
**Map 1: Calcareous fen with *Cladium mariscus* potential historical habitat distribution and range map**



**Map 2: Calcareous fen with *Cladium mariscus* current habitat distribution and range map**



**Map 3: Calcareous fen with *Cladium mariscus* habitat favourable reference range map**



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# APPENDICES

# APPENDIX I

# STUDY OF THE EXENT AND CONSERVATION STATUS OF SPRINGS, FENS AND FLUSHES IN IRELAND

The National Parks and Wildlife Service (NPWS) carried out a *Study of the Extent and Conservation status of Springs, Fens and Flushes in Ireland* (Foss, P.J. 2007) during 2006 with the aim of compiling a comprehensive list of all fen sites in Ireland, classifying these according the EU Habitats Directive fen categories recognised as occurring in Ireland, and assessing the extent of fen vegetation within the sites identified.

No systematic national survey of fens has yet been undertaken in Ireland, in contrast to the situation for raised and blanket bogs. The NPWS Fen study aimed to ascertain our baseline understanding of the fen resource in Ireland.

This study addressed the following research objectives:

- collect and amalgamate data on known fen sites of conservation importance in Ireland from within the NPWS and following consultation with external groups;
- produce a computerised inventory of all sites of known or possible conservation value to include key data on each site, including the specific fen vegetation type(s) present; the known or estimated area of each fen vegetation type; and compile available published and survey information on sites;
- collect data on fen sites without a current conservation designation (outside the NHA and SAC network) but which might be considered for NHA or SAC designation by NPWS following survey and evaluation;
- examine where other sites of conservation interest might be located based on local soil, geological and environmental factors;
- assess the past and present extent of fen habitats in Ireland;
- evaluate each site in terms of its conservation importance, known area information, known survey information, and assign a survey priority to each;
- make recommendations for a future national fen field survey.

The NPWS Fen study focused on 6 fen habitat types of conservation importance (four of which are listed in Annex 1 of the EU Habitats Directive, two of which - denoted with an asterisk - are priority habitats) in Ireland. The Annex 1 fen types investigated during the study include:

**7140 Transition mires and quaking bogs** (Fossitt category PF3)
**7210 *Calcareous fens with *Cladium mariscus*** and species of the *Caricion davallianae* (Fossitt category PF1)
**7220 * Petrifying springs with tufa formation** (*Cratoneurion*) (Fossitt category FP1)
**7230 Alkaline fens** (Fossitt category PF1)

A variety of data sources (reports, publications, databases and other habitat inventory lists), groups and individuals were consulted in the compilation of information for the NPWS Fen Study database, over an eight month period in 2006, from both within NPWS and from external sources. The main sources consulted in the compilation of the NPWS Fen Study database are listed below.

The past extent of fens in Ireland (based on Anonymous 1981; Hammond 1979; Foss, P.J., O'Connell C.A. & Crushell P. (eds.), 2001 *inter alia*) is presented in the report. The original area of fens in Ireland is estimated to have been at least 92,508 ha (Hammond 1979). An estimated 19,660 ha of conservation worthy intact fens, occurring in 367 discrete sites were recognised in Ireland by IPCC in 2001 (Foss *et al*. 2001).

The total area of estimated fen vegetation recorded in the NPWS Fen Study amounted to 22,180 ha within 681 discrete sites (site complex sub-units omitted i.e. sub-sites that occur within existing SAC or NHA). In total the NPWS Fen Study database holds information on 808 sites (which includes 127 sub-site records), where fen habitats are known or believed to occur. This list of sites includes those classified as poor fen and non-calcareous springs.

Annex 1 fens (i.e. Alkaline fen, *Cladium* fen, Transition mire, and Petrifying spring) which most closely relate to the fen types identified in previous studies, was estimated to cover 10,298 ha (in a total of 702 discrete sites) or 46% of the total fen area estimated in the present study. This is an indication that Annex 1 fens are less widespread than previously believed (Foss *et al* 2001).

In relation to the fen habitat types classified within the present NPWS Fen Study, the following number of sites and estimated area (ha) of fen vegetation have been recorded:

- 7210 ***Calcareous fens with *Cladium mariscus*:** 102 discrete sites with a fen area of 1,486 ha
- 7230 Alkaline fens: 348 discrete sites with a fen area of 6,840 ha
- 7140 Transition mires and quaking bogs: 155 discrete sites with a fen area of 1,955 ha
- 7220 * Petrifying springs: 97 discrete sites with a fen area of 36 ha

These fens can be categorised, in terms of their current conservation designation, as follows:

- The number and area (ha) of fens which have been designated for Annex 1 fen habitats under the Habitats Directive: **68 discrete sites with an area of 2,191 ha of designated fen habitat; representing 21% of the total Annex 1 fen resource estimated for Ireland.**

- The number and area (ha) of fen sites with Annex 1 habitats which are within designated Natural Heritage Areas (NHA) or proposed candidate Natural Heritage Areas (cNHA): **281 sites with an area of 2,747 ha; representing 27% of the total estimated Irish fen resource.**

- The number and area (ha) of fen sites with Annex 1 habitats which are located within designated Special Areas of Conservation (SAC) or proposed candidate Special Areas of Conservation (cSAC): **362 sites with an area of 5,681 ha; representing 55% of the total estimated Annex 1 Irish fen resource.**

- The number of Annex 1 fen habitat sites which were "newly" discovered or reported to the NPWS Fen Study and had no conservation designation: **72 sites with an area of 1,947 ha; representing 19% of the total estimated Annex 1 Irish fen resource.**

The NPWS Fen Study also found that it is very probable that sites with conservation worthy fen communities exist outside of the sites which have been identified in the present NPWS Fen Study. Based on the results of the study the following counties were identified as a priority as part of any future NPWS Fen Field Survey: Clare, Galway, Kildare, Leitrim, Limerick, Mayo, Offaly, Roscommon and Westmeath.

The NPWS Fen Study also found that existing knowledge of the fen resource in Ireland is markedly incomplete. Our knowledge in relation to the specific fen type(s) present, is considered wholly lacking or inadequate (confusion over one or more fen types) for 268 (33%) of sites identified in the present NPWS Fen Study database. While knowledge in relation to the extent of fen type(s) present on sites, is considered wholly lacking for 102 sites (13%), and inadequate for a some further 600 sites identified in the NPWS Fen Study database (i.e. 74%, where only estimated data on fen extent is presently available).

These findings make a systematic survey of existing and newly reported sites a high priority for Ireland, if conservation worthy sites are to be identified and the best examples put forward for conservation under the Natural Heritage Area or European Habitats Directive Natura 2000 (SAC) network and provided favourable conservation status.

Data sources used in the compilation of list of site in the NPWS Fen Study database 2007:

- **Habitat Assignment Project (NPWS 2006)**
  This desktop project was undertaken by NPWS and the main aim was classifying sites according to habitats listed in the Annex I of the Habitats Directive (92/43/EEC). Sites were obtained from a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, NGOs shadow list inter alia.

- **NPWS Enquiries (Sites) Database**
  This is a comprehensive NPWS internal database, which includes data on habitat type and extent, and site designation.

- **CORINE Database – Fen sites**
  This is a NPWS internal database, which includes data on designated CORINE habitat types and extent present within sites listed in the NPWS Enquiries database.

- **IPCC Fen Sites Database**
  The Irish Peatland Conservation Council (IPCC) sites database holding a range of information on sites designated as fens.

- **Conaghan (2000) Blanket bog Database – Fen site list**
  An electronic list of blanket bog sites prepared by Conaghan (2000) for the NPWS which records the occurrence of fen habitats within the mire complexes identified, together with data on their extent.

- **Derwin (2003) Blanket bog Database – Fen site list**
  An electronic list of blanket bog sites prepared by Derwin (2003) for the NPWS which records the occurrence of fen habitats within the mire complexes identified, together with data on their extent.

- **External Expert fen site submissions**
  A number of external submissions were made by expert interests groups and individuals which provided additional sites to the NPWS Fen Study. These included submissions from Bord na Mona, Botanical Society of the British Isles County Recorders, and County Council Heritage/Biodiversity Officers.

# APPENDIX II

# SOURCES OF DATA USED IN THE PRODUCTION OF HABITAT DISTRIBUTION MAPS

The following is a summary of the main sources of information employed to produce the habitat's potential historic distribution and range map, current habitat distribution and range map and the Favourable reference range (FRR) map. These maps and area extent were used to carry out the habitats conservation status assessment for this habitat:

**Potential Historic distribution and range map**:
To-date no map of the potential historical distribution and range of this habitat in Ireland has been available. It was decided to create a potential historical distribution and range map for Calcareous fens with *Cladium mariscus* based on a series of data sets which would indicate the possible former location of sites with the habitat in Ireland. Information on the habitat range provided by this map could then be compared with the current distribution and range to ensure that an adequate network of sites has been recognised to ensure favourable conservation of this habitat in Ireland. Such an exercise was felt justified in the absence of a systematic field survey of the habitat to date in Ireland.

<u>Mapping Protocol:</u>

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site or species record occurred as a point source was included in the range map.

For the Hammond; Corine and Teagasc data sets, every grid square which contained a digitised boundary element was included within the range map.

The list of the data sets used in the compilation of the potential habitat distribution and range map (for details of the data sources employed see below) included:

- NPWS Fen Study Database - Foss (2007) - Calcareous fens with *Cladium mariscus* site list (125 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- Corine Land Cover Map (2000) - habitat classified in the following vegetation categories: Inland marshes
- Digitised Peatland Map of Ireland - Hammond (1979) – entire Fen data set
- National Soils and Parent Material Maps - Teagasc (2006)
- Botanical Society of the British Isles 10 km Flora distribution map for: *Cladium mariscus* including all reported records
- British Bryological Society 10 km bryophyte distribution maps for: none

**Current habitat distribution and range map**:
The present habitat distribution and range is defined as the range of 10 km grid cells which contain a Calcareous fens with *Cladium mariscus* site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km grid cells which contain a record for the Calcareous fen with *Cladium mariscus* indicator species *Cladium mariscus*. Extension of the range for this habitat, based on the distribution of *Cladium mariscus* was felt to be justified, in the absence of any National Fen Survey to-date in Ireland.

<u>Mapping Protocol:</u>

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site/ species record occurred as a point source was included in the range map.

The list of the data sets used in the compilation of the current habitat distribution and range map (for details of the data sources employed see this section, below) included:

- NPWS Fen Study Database - Foss (2007) - Calcareous fens with *Cladium mariscus* sites listed within NPWS Fens Database (125 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- Botanical Society of the British Isles 10 km Flora distribution map for: *Cladium mariscus* using species records between 1940 and the present.

**Favourable reference range map (FRR)**:
The favourable reference range for Calcareous fen with *Cladium mariscus* habitat is considered to be the same as the current habitat range.

The FRR is defined as the range of 10 km grid cells which contain a Calcareous fen with *Cladium mariscus* site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km grid cells which contain a record for the Calcareous fen with *Cladium mariscus* indicator species *Cladium mariscus*.

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site/ species record occurred as a point source was included in the range map.

The list of the data sets used to map the Favourable reference range (FRR) (for details of the data sources employed see this section, below) included:

- NPWS Fen Study Database - Foss (2007) - Calcareous fens with *Cladium mariscus* sites listed within NPWS Fens Database (125 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- Botanical Society of the British Isles 10 km Flora distribution map for: *Cladium mariscus* using species records between 1940 and the present.

## Further information on data sources:

A. **NPWS Fen Study Database (2007)**

As part of the NPWS **Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007** (see project details in Appendix I above) a specific NPWS Fens Study database was created at the outset of this project to hold data on the fen sites recorded during the study.

In summary the main NPWS Fen Study database held information on site provenance or proposer, site names, county, SAC and NHA codes, national grid reference, site conservation designations, habitat information on the specific fen habitat type(s) present and the area of each (or an estimate where no accurate area data was available), information on rare species of note, a summary of published reports holding information on the site, and a site evaluation section which ranked each site in terms of its conservation importance, area information, survey information, and survey priority (For a full list of data fields recorded in the NPWS Fen Study database see Foss 2007).

Two secondary relational databases (linked to one together by use of site record number and reference code number), hold a list of fen related reports and publications for Ireland, and a publications / report site records database.

The database was created using the Filemaker Pro 8 database package which runs on both PC and Mac platforms.

This database (NPWSFENSURVEY.fp7 **Version 1.3**) was used to produce distribution maps, habitat area estimates and site lists for the current habitat range and conservation assessment for Calcareous fen with *Cladium mariscus* in Ireland.

## B. Corine Land Cover Map (2000)

Corine Land Cover (CLC) is a map of the European environmental landscape based on interpretation of satellite images. It provides comparable digital maps of land cover for each country for much of Europe. The CLC 2000 project in Ireland forms part of the update of land cover maps for the whole of Europe, which is being co-ordinated by the EEA (European Environmental Agency) with the co-operation of national competent authorities in contributing states. The Environmental Protection Agency (EPA) is the national competent authority for CLC 2000 data in Ireland. The CLC 2000 database was created by first assessing and correcting the existing CLC 1990 land cover database and images for geometric and thematic content, followed by mapping land cover changes using 2000 satellite imagery and ancillary data. The CORINE project provides a coarse quantification of land cover in Ireland (EPA, 2004).

CLC is based on a simple 3-level hierarchy classification system consisting of 44 land cover classes. The land cover inventory was conducted at a scale of 1:100,000 and the minimum area digitised in the updated version, CORINE 2000 is 25 ha.

Fen land cover from this data set is available for the following subtypes:

Wetlands 4/ Inland wetlands 4.1/ 4.1.1 Inland Marshes

Low-lying land usually flooded in winter and more or less saturated by water all year round.

**Extension :**
Non-forested areas of low-lying land flooded or floodable by fresh, stagnant or circulating water. Covered by a specific low ligneous, semi-ligneous or herbaceous vegetation.

**This heading includes :**
- Fens and transitional bogs without peat deposition or on peaty ground (peat layer is less than 30 cm thick) with specific vegetation composed of reeds, bulrushes, rushes, willows, sedges and tall herbs, sphagnum hummocks, often with alder or willows and other water plants,
- marsh vegetation located in margin zones of raised bogs,
- water-fringe vegetation of reed beds, sedge communities, fen-sedge beds, tall rush swamps, riparian cane formations,
- high floating vegetation,
- inland saline (alkali) marshes (prevailing arheic).

**This heading excludes :**
- humid meadows (water logging of between 10 and 30 cm depth) (class 231),
- rice fields (class 213),
- free water space in wetlands (class 512),
- salt marshes (class 421),
- salt meadows in intertidal zone (class 421),
- Garaat, (classified 211 or 411 according to land cover visible from the satellite image)
- polders with reticulated channels bordered by hydrophitic vegetation (class 2xx),
- humid forests with a crown cover more than 30 % (class 31x),
- Peat bogs (class 412)
- low floating aquatic vegetation (class 512).

(http://www.epa.ie/OurEnvironment/Land/CorineLandCover).

## C. Digitised Peatland Map of Ireland - Hammond (1979)

Hammond's *Peatland Map of Ireland* (1979) is the most comprehensive over-view of the distribution of peatlands and fen in Ireland at the end of the 1970s. Hammond mapped the mire subtypes described by Moore (1972).

Hammond's map is based on data from several sources, principally the detailed soil map data from the National Soil Survey carried out by An Foras Talúntais since 1968, these maps covered 10 counties fully and 2 counties partially. Aerial photographs from 1973/74 together with site visits covered the rest of the country. No aerial cover existed however for county Donegal and parts of counties Sligo, Cork, Waterford and Louth. Hammond acknowledges that the these counties were not covered by the same detailed reconnaissance field sheets as the other counties and were mapped principally on the basis of the far cruder 1920 peat map for Ireland. However, Hammond's map is regarded as the only peatland map which has been methodically produced and which specifically targets peatlands and fens.

Although Hammond maps categorised mires (i.e. blanket bog, raised bog and fen) according to the level of disturbance (i.e. man modified, milled peat, moss peat) the current status of those sites considered unmodified is likely to have changed since 1979. Hammond's maps are therefore not reliable for identifying the current site status due to the impact of the Turf Development Act (1981-1995) supported projects and private afforestation grant aids. However, Hammond's map is considered to be the most accurate national map available for indicating the location of fen peat soils.

The Soils Division of Teagasc has now digitised the original Hammond's *Peatland Map of Ireland* (1979). This was used to refine the habitat distribution map produced from other sources by overlaying the Hammond's digital map on it. This provided further validations for those sites already mapped and most importantly identify fen areas in grid squares where they had not been identified by other sources.

**D. National Soils and Parent Material Maps Teagasc (2006) - Map 6**

A digital data set of alkaline fen soils identified in Ireland, produced by Teagasc in 2006.

**E. BSBI Flora Atlas (2000)**

10 km square distribution maps produced by the Botanical Society of the British Isles, as part of the New Atlas of the British & Irish Flora 2002. For access to the most up-to-date data sets see National Biological Network Gateway website at http://www.searchnbn.net/index_homepage

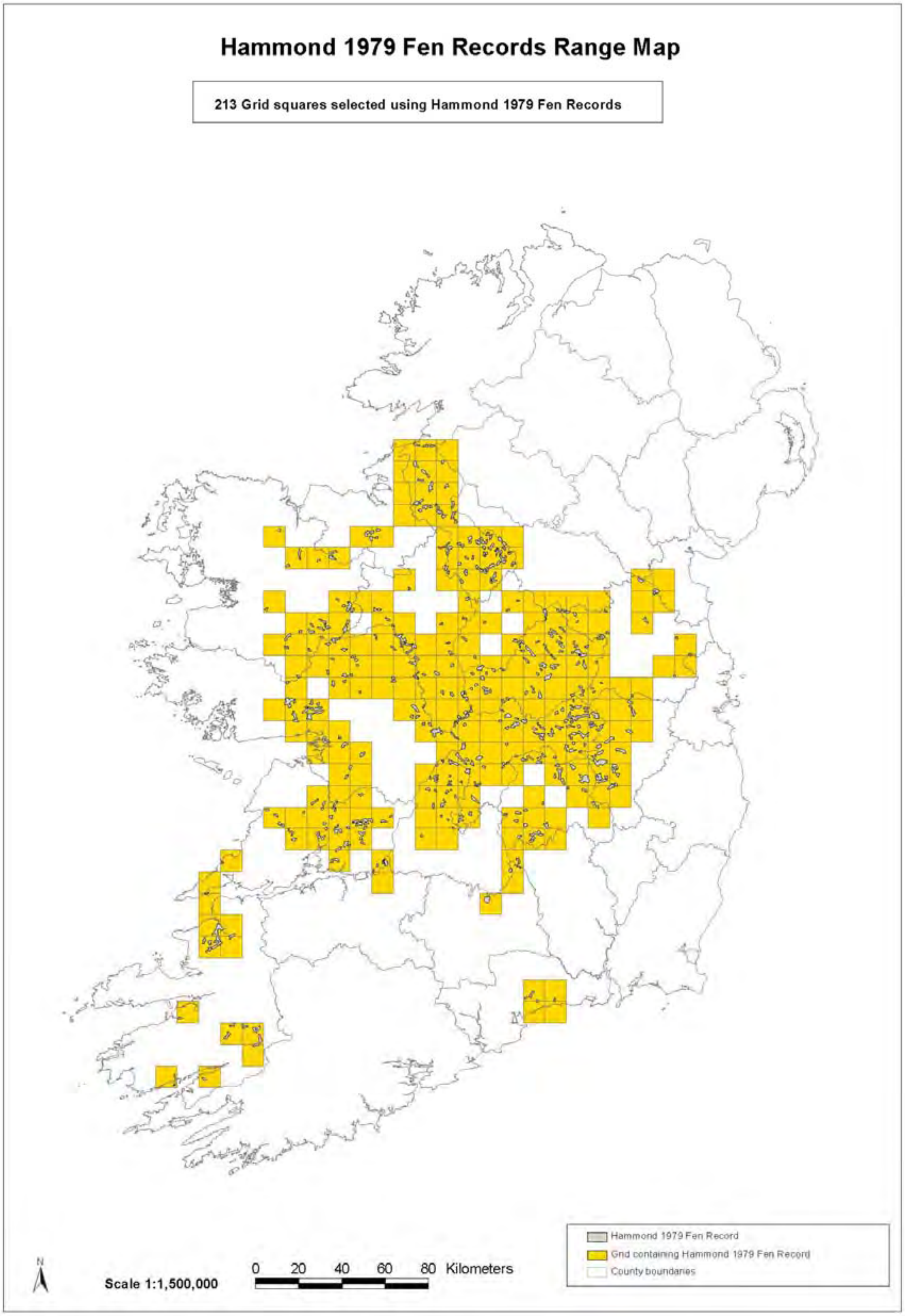
Data sets used in compilation of habitat distribution maps include those for the following species: ***Cladium mariscus***

**F. Bryophyte Distribution data (2007)**

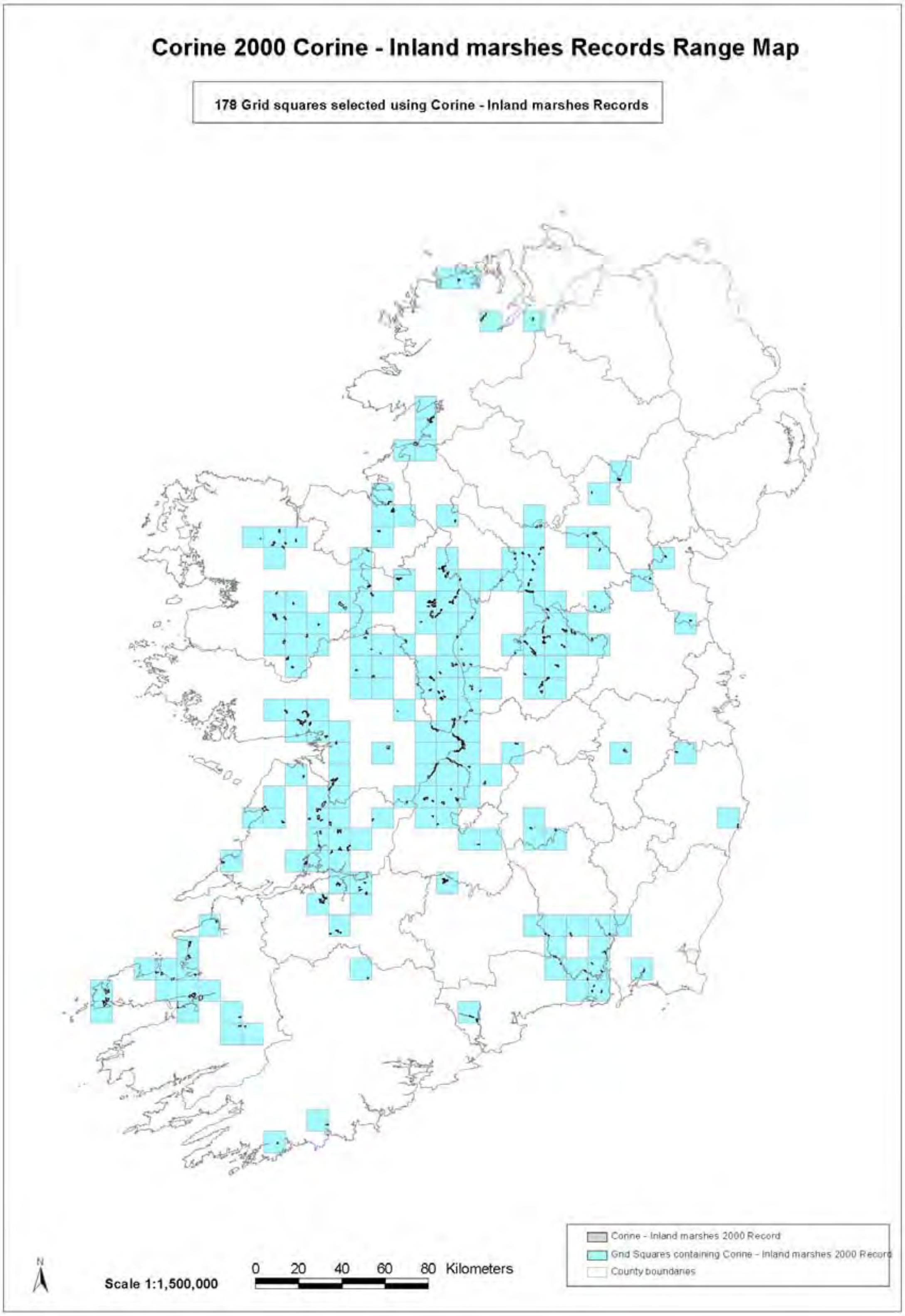
10 km square distribution maps obtained from THE DISTRIBUTION OF BRYOPHYTES IN IRELAND: an annotated review of the occurrence of liverworts and mosses in the Irish vice-counties, based mainly on the records of the British Bryological Society (Holyoak 2003) produced by the British Bryological Society, with additional recent additions provided by N. Lockhart, NPWS (pers. comm.).

Data sets used in compilation of habitat distribution maps include those for the following species: **None**

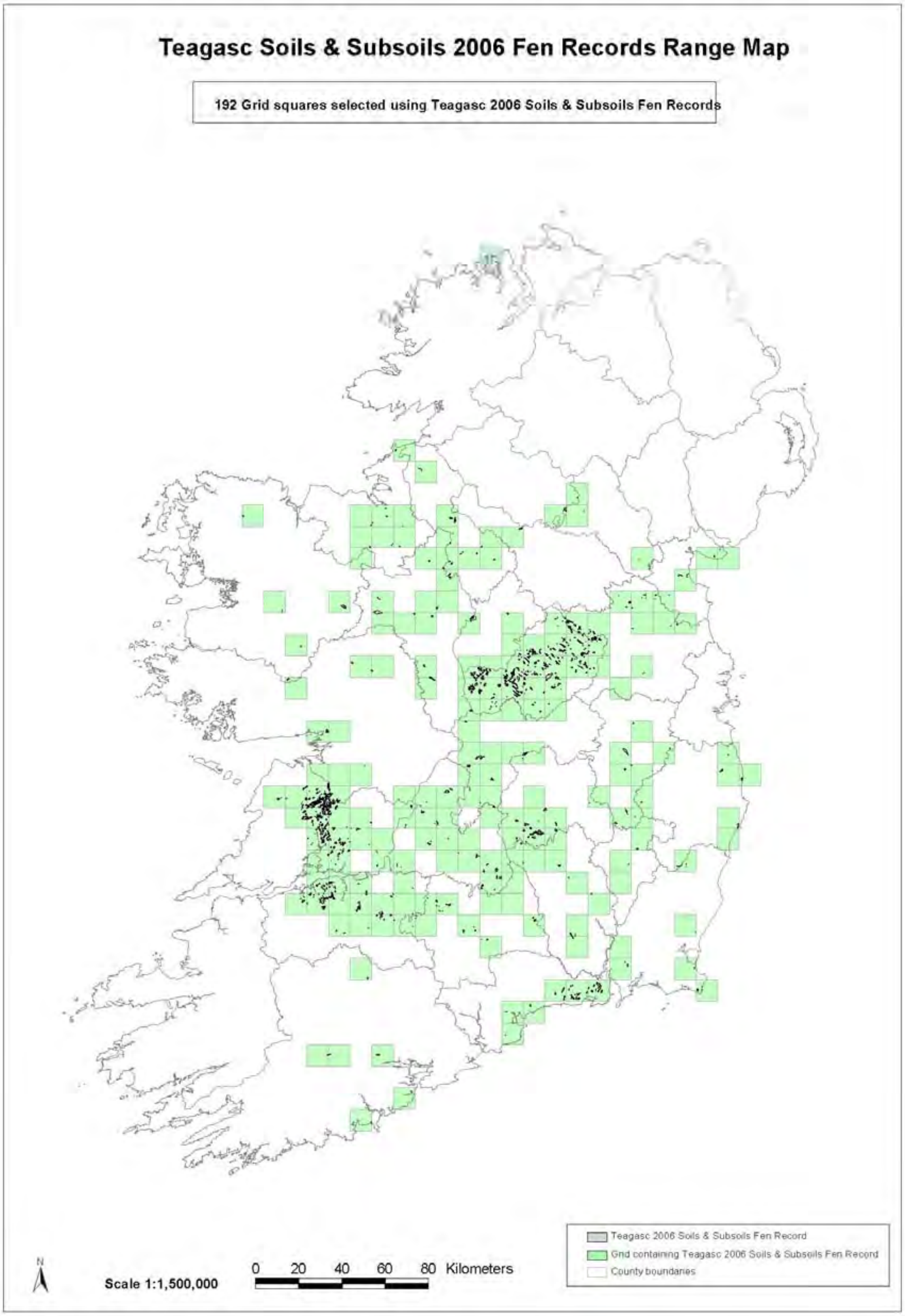
**Map 4: Digitised Peatland Map of Ireland - Hammond (1979)**



**Map 5: Corine Land Cover Map (2000)**



**Map 6: National Soils and Parent Material Maps Teagasc (2006)**



# APPENDIX III

## HABITAT SITE LIST

| Site Code | SAC/NHA Name | New/Subsite Name | Nat Grid E | Nat Grid N |
|---|---|---|---|---|
| F752 | | BALLINDEREEN LOUGH | 138500 | 216300 |
| F758 | | BALLYBEG LOUGH | 133200 | 173900 |
| F749 | | BALLYMACHILL LOUGH | 146600 | 195600 |
| F791 | | CLERA ISLAND | 198000 | 237000 |
| F759 | | CLOONDANNAGH LOUGH | 150200 | 183000 |
| F750 | | COLMAN'S LOUGH | 144700 | 196700 |
| F312 | | CORRAVOKEEN | 106300 | 322500 |
| F2714 | | GLENNAMEADE | 142000 | 152000 |
| F756 | | KILBRECKAN LOUGH | 136500 | 176100 |
| F757 | | LOUGH GIRROGA | 134800 | 179700 |
| F2735 | | LOUGH MAKEEGAN FEN | 211400 | 249800 |
| F754 | | LOUGHANAWARLA | 150000 | 118500 |
| F761 | | O'BRIENS BIG LOUGH | 141000 | 182500 |
| F790 | | PLANTATION | 269500 | 225000 |
| 000014 | BALLYALLIA LAKE | | 134000 | 181000 |
| 000016 | BALLYCULLINAN LAKE | | 129000 | 185000 |
| 000019 | BALLYOGAN LOUGH | | 137000 | 190000 |
| 000087 | GARRYLUCAS MARSH | | 161000 | 043000 |
| 000174 | CURRAGHCHASE WOODS | | 141300 | 149500 |
| 000218 | COOLCAM TURLOUGH | | 158000 | 271000 |
| R000222 | SUCK RIVER CALLOWS NHA | | 184000 | 232000 |
| 000263 | DRUMBULCAUN BOG | | 151000 | 257000 |
| 000268 | GALWAY BAY COMPLEX | | 130000 | 220000 |
| 000289 | KNOCKAVANNY TURLOUGH | | 147100 | 253900 |
| 000297 | LOUGH CORRIB | | 107000 | 241000 |
| 000297 | LOUGH CORRIB | ADDERGOOLE BOG (223) | 131000 | 234000 |
| 000297 | LOUGH CORRIB | GORTACHALLA LOUGH (401) | 122500 | 237000 |
| 000299 | LOUGH CUTRA | | 147496 | 198511 |
| 000301 | LOUGH LURGEEN BOG/GLENAMAD | | 166000 | 259000 |
| 000365 | KILLARNEY NATIONAL PARK, M | | 093000 | 084000 |
| 000396 | POLLARDSTOWN FEN | | 275495 | 216501 |
| 000439 | TORY HILL | | 153911 | 143632 |
| 000440 | LOUGH REE | | 201000 | 253000 |
| 000440 | LOUGH REE | COOSAN LOUGH (LOUGH REE) (171 | 205000 | 244000 |
| 000479 | CLOUGHMOYNE | | 123500 | 250000 |
| 000480 | CLYARD KETTLE-HOLES | | 122800 | 259000 |
| 000500 | GLENAMOY BOG COMPLEX | RATHAVISTEEN (538) | 097000 | 336000 |
| 000525 | SHRULE TURLOUGH | | 126000 | 254000 |
| R000564 | RIVER LITTLE BROSNA CALLOW | | 198000 | 211000 |
| 000606 | LOUGH FINGALL COMPLEX | | 141500 | 215000 |
| 000606 | LOUGH FINGALL COMPLEX | LOUGH FINGALL (300) | 141500 | 215000 |
| 000608 | KILGLASS AND GRANGE LOUGHS | | 198000 | 288000 |
| 000611 | LOUGH FUNSHINAGH | | 193500 | 251000 |
| 000639 | ANNACARTY WETLANDS | | 193000 | 144000 |
| 000684 | LOUGH DERRAVARAGH NHA | | 240000 | 267000 |
| 000688 | LOUGH OWEL | | 239000 | 257000 |
| 000690 | LOUGH SHEEVER FEN/SLEVIN'S | | 247000 | 255000 |
| 000730 | THE MURROUGH | | 331500 | 204000 |

| | | | | |
|---|---|---|---|---|
| 002249 | THE MURROUGH | THE MURROUGH WETLANDS (2249) | 331368 | 204851 |
| R000781 | SLANEY RIVER VALLEY | | 298000 | 128000 |
| 000788 | ARDRISTAN FEN | | 283000 | 170000 |
| 000846 | RED BOG, DUNDARVAN | | 261000 | 149000 |
| 000869 | LISBIGNEY BOG | | 246000 | 179000 |
| 000909 | LOUGH COURA | | 209000 | 213000 |
| 000916 | PALLAS LOUGH | | 227000 | 219000 |
| 000929 | CLAREEN LOUGH | | 184000 | 187000 |
| 001010 | FIN LOUGH (CLARE) | | 143000 | 169000 |
| 001030 | DROMORE & BLEACH LOUGHS | | 145000 | 154000 |
| 001065 | LOUGH ALLUA | | 120000 | 066000 |
| 001125 | DURNAGH LOUGHS/PETTIGO PLA | | 203000 | 374000 |
| 001141 | GWEEDORE BAY AND ISLANDS | | 179000 | 426000 |
| 001242 | CARROWNAGAPPUL BOG | | 167000 | 250000 |
| 001342 | CLOONEE AND INCHIQUIN LOUG | | 084000 | 062000 |
| 001365 | LOUGH BOORA | | 216400 | 217800 |
| 001443 | LOUGH SLAWN | | 203000 | 258500 |
| 001482 | CLEW BAY COMPLEX | | 091000 | 289000 |
| 001536 | MOCORHA LOUGH | | 123300 | 254500 |
| 001587 | MENTRIM LOUGH | | 291000 | 286000 |
| 001683 | LISKEENAN FEN | | 197000 | 199000 |
| 001732 | WATERSTOWN LAKE | | 210000 | 245000 |
| 001772 | DUNLAVIN MARSHES | | 285000 | 203000 |
| 001774 | LOUGH CARRA/MASK COMPLEX | | 117410 | 270991 |
| 001784 | ROSEFIELD LAKE AND WOODLAN | | 263300 | 333700 |
| 001786 | KILROOSKY LOUGH CLUSTER | | 249000 | 327500 |
| 001810 | WHITE LOUGH, BEN LOUGHS AN | | 252000 | 272000 |
| 001828 | REAGHSTOWN MARSH | | 288800 | 295700 |
| 001839 | KILLYVILLY LOUGH | | 255100 | 333400 |
| 001858 | GALMOY FEN | | 230000 | 172000 |
| 001902 | SLIEVEWARD BOG | | 165600 | 328000 |
| 001922 | BELLACORRICK BOG COMPLEX | BRACKLOON (498) | 107000 | 318000 |
| 001922 | BELLACORRICK BOG COMPLEX | CLOONOORAGH (498) | 106000 | 319000 |
| 001922 | BELLACORRICK BOG COMPLEX | FORMOYLE (498) | 105000 | 322000 |
| 001922 | BELLACORRICK BOG COMPLEX | SHRALAHY (540) | 099000 | 330000 |
| 001926 | EAST BURREN COMPLEX | | 130000 | 200000 |
| 001995 | LOUGH AVAN | | 185000 | 194000 |
| 002034 | CONNEMARA BOG COMPLEX | | 090000 | 243000 |
| 002034 | CONNEMARA BOG COMPLEX | BUNSCANNIFF (236) | 094000 | 245000 |
| 002034 | CONNEMARA BOG COMPLEX | DERROUGH SOUTH(259) | 100000 | 227000 |
| 002034 | CONNEMARA BOG COMPLEX | KNOCKADAV (327) | 092000 | 241000 |
| 002034 | CONNEMARA BOG COMPLEX | LETTERSHINNA (294) | 085000 | 245000 |
| 002034 | CONNEMARA BOG COMPLEX | SHANNAVARRA (316) | 091000 | 242000 |
| 002047 | CLOGHERNAGORE BOG AND GLE | CLOGHERNAGORE (126) | 192000 | 408000 |
| 002054 | ROSROE LOUGH | | 145000 | 170000 |
| 002068 | CARRICKNAHORNA LOUGH AND L | | 192800 | 365400 |
| 002074 | SLYNE HEAD PENINSULA | | 061272 | 246552 |
| 002107 | ATTYQUIN LAKE COMPLEX | | 142000 | 190000 |
| 002111 | KILKIERAN BAY AND ISLANDS | | 072000 | 230000 |
| R002137 | LOWER RIVER SUIR | | 247000 | 118000 |
| R002162 | RIVER BARROW AND RIVER NOR | | 268000 | 117000 |
| 002164 | LOUGH GOLAGH AND BREESY HI | | 196500 | 366200 |
| 002241 | LOUGH DERG, NORTH-EAST SHO | | 186592 | 200932 |
| 002279 | ASKEATON FEN COMPLEX | | 137989 | 151391 |

| | | | | |
|---|---|---|---|---|
| 002279 | ASKEATON FEN COMPLEX | CAPPAGH FEN (001429) | 138000 | 146000 |
| 002279 | ASKEATON FEN COMPLEX | GORTEENNAMROCK (001433) | 138000 | 151000 |
| R002298 | RIVER MOY | MANNIN AND ISLAND LAKES (0019 | 146000 | 284000 |
| R002299 | RIVER BOYNE & RIVER BLACKW | | 286083 | 268000 |
| R002299 | RIVER BOYNE & RIVER BLACKW | LOUGH SHESK (556) | 262000 | 268000 |
| 002417 | LEAHILL BOG NHA | | 087000 | 049000 |
| 002439 | OYSTERMANS MARSH NHA | | 141000 | 185000 |
| 002559 | GALLAGHER'S WOOD TURLOUGH | | 182400 | 204200 |
| 002564 | BALLINDOOLY LOUGH AND WETL | | 132000 | 229000 |
| 002589 | CAHERAWONEEN FEN | | 141000 | 209000 |
| 002599 | BALLYELLINAN FEN | | 131400 | 149500 |
| 002600 | BALLYLIN FEN | | 140200 | 140700 |
| 002603 | ELLAHA FEN | | 128400 | 148400 |
| 002604 | FRIARSTOWN FEN | | 157500 | 149500 |
| 002606 | MORNANE LOUGH | | 138400 | 152300 |
| 002618 | HOUNDSWOOD FEN | | 122000 | 254000 |
| 002641 | BALLINDERRY LOUGH | | 221400 | 239200 |
| 002642 | MONROE FEN | | 237300 | 257600 |
| 002653 | CLONYRINA FEN AND GRASSLAN | | 228700 | 245600 |
| 002701 | AHACRONANE RIVER | | 128200 | 148300 |
| 001934 | RIVER SUIR | Cabragh wetlands NHA | | |
| 000402 | RIVER SUIR | Fiddown Island NHA | | |
| 000420 | RIVER BARROW & NORE | Goul River Marsh | | |

## *CLADIUM MARISCUS* BSBI 10 KM SQUARE RECORDS

| Dataset Key | 10km grid reference | First Year recorded | Last Year recorded | Comment |
|---|---|---|---|---|
| GA000091 | B70 | 1990 | 1990 | |
| GA000091 | B71 | 0 | 1989 | |
| GA000091 | B72 | 1987 | 1999 | |
| GA000091 | B80 | 1987 | 1999 | |
| GA000091 | B81 | 1990 | 1990 | |
| GA000091 | B90 | 1990 | 1990 | |
| GA000091 | B91 | 1990 | 1990 | |
| GA000091 | C01 | 1991 | 1991 | |
| GA000091 | C02 | 1950 | 1999 | |
| GA000091 | C03 | 1904 | 1990 | |
| GA000091 | C13 | 1990 | 1990 | |
| GA000091 | C14 | 1898 | 1990 | |
| GA000091 | C24 | 0 | 1989 | |
| GA000091 | C34 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000079 | D05 | 1980 | 1980 | |
| GA000091 | D05 | 1970 | 1986 | |
| GA000091 | D21 | 1500 | 1999 | |
| GA000091 | F90 | 1950 | 1969 | |
| GA000091 | G01 | 1987 | 1999 | |
| GA000091 | G02 | 0 | 1988 | |
| GA000091 | G10 | 1900 | 1999 | |
| GA000091 | G11 | 1900 | 1900 | Omitted from FRR and Current range map |
| GA000091 | G21 | 1900 | 1900 | Omitted from FRR and Current range map |
| GA000091 | G22 | 1900 | 1900 | Omitted from FRR and Current range map |

| | | | | |
|---|---|---|---|---|
| GA000091 | G30 | 1900 | 1988 | |
| GA000091 | G50 | 1988 | 1988 | |
| GA000091 | G52 | 1988 | 1988 | |
| GA000091 | G61 | 1988 | 1988 | |
| GA000091 | G62 | 1987 | 1999 | |
| GA000091 | G69 | 1900 | 1989 | |
| GA000091 | G70 | 1500 | 1969 | |
| GA000091 | G71 | 1988 | 1998 | |
| GA000091 | G73 | 1905 | 1995 | |
| GA000091 | G75 | 1899 | 1899 | Omitted from FRR and Current range map |
| GA000091 | G76 | 1934 | 1999 | |
| GA000091 | G77 | 1950 | 1969 | |
| GA000091 | G79 | 1987 | 1999 | |
| GA000091 | G80 | 1897 | 1897 | |
| GA000091 | G83 | 1994 | 1994 | |
| GA000091 | G84 | 1500 | 1996 | |
| GA000091 | G85 | 1899 | 1995 | |
| GA000091 | G86 | 1987 | 1999 | |
| GA000091 | G87 | 1987 | 1999 | |
| GA000091 | G88 | 1990 | 1990 | |
| GA000091 | G94 | 1500 | 1969 | |
| GA000079 | G95 | 1996 | 1996 | |
| GA000091 | G95 | 1500 | 1999 | |
| GA000079 | G96 | 1988 | 1990 | |
| GA000091 | G96 | 1500 | 1999 | |
| GA000091 | G97 | 1950 | 1999 | |
| GA000091 | G98 | 0 | 1990 | |
| GA000079 | H05 | 1985 | 1997 | |
| GA000091 | H05 | 1500 | 1999 | |
| GA000079 | H06 | 1988 | 1990 | |
| GA000091 | H06 | 1500 | 1999 | |
| GA000091 | H07 | 1987 | 1999 | |
| GA000079 | H14 | 1988 | 1990 | |
| GA000091 | H14 | 1500 | 1999 | |
| GA000079 | H15 | 1985 | 1990 | |
| GA000091 | H15 | 1500 | 1999 | |
| GA000091 | H23 | 1500 | 1969 | |
| GA000079 | H24 | 1988 | 1990 | |
| GA000091 | H24 | 1500 | 1999 | |
| GA000079 | H27 | 1989 | 1996 | |
| GA000091 | H27 | 1987 | 1999 | |
| GA000091 | H30 | 1934 | 1934 | Omitted from FRR and Current range map |
| GA000091 | H31 | 1950 | 1999 | |
| GA000079 | H32 | 1986 | 1990 | |
| GA000091 | H32 | 1500 | 1999 | |
| GA000079 | H41 | 1988 | 1990 | |
| GA000091 | H41 | 1983 | 1999 | |
| GA000079 | H42 | 1980 | 1998 | |
| GA000091 | H42 | 1500 | 1999 | |
| GA000079 | H44 | 1981 | 1988 | |
| GA000091 | H44 | 1970 | 1999 | |
| GA000091 | H52 | 1500 | 1988 | |
| GA000079 | H53 | 1980 | 1994 | |
| GA000091 | H53 | 1500 | 1999 | |

| | | | | |
|---|---|---|---|---|
| GA000079 | H55 | 1989 | 1989 | |
| GA000091 | H55 | 1987 | 1999 | |
| GA000091 | H61 | 1500 | 1969 | |
| GA000091 | H63 | 1900 | 1999 | |
| GA000091 | H64 | 1987 | 1999 | |
| GA000079 | H73 | 1980 | 1997 | |
| GA000091 | H73 | 1500 | 1999 | |
| GA000079 | H74 | 1989 | 1989 | |
| GA000091 | H74 | 1971 | 1999 | |
| GA000079 | H75 | 1989 | 1990 | |
| GA000091 | H75 | 1987 | 1999 | |
| GA000091 | H76 | 1970 | 1986 | |
| GA000091 | H80 | 1987 | 1999 | |
| GA000079 | H84 | 1990 | 1990 | |
| GA000091 | H84 | 1970 | 1999 | |
| GA000091 | H86 | 1950 | 1969 | |
| GA000091 | H87 | 1930 | 1999 | |
| GA000091 | H90 | 1987 | 1999 | |
| GA000091 | H95 | 1500 | 1999 | |
| GA000091 | J00 | 1987 | 1999 | |
| GA000091 | J06 | 1500 | 1969 | |
| GA000091 | J16 | 1500 | 1969 | |
| GA000091 | J20 | 1987 | 1999 | |
| GA000091 | J21 | 1987 | 1999 | |
| GA000079 | J33 | 1990 | 1990 | |
| GA000091 | J33 | 1500 | 1999 | |
| GA000091 | J53 | 1903 | 1903 | Omitted from FRR and Current range map |
| GA000079 | J54 | 1600 | 1997 | |
| GA000091 | J54 | 1500 | 1999 | |
| GA000091 | J55 | 1500 | 1999 | |
| GA000091 | L54 | 1950 | 1999 | |
| GA000091 | L63 | 1896 | 1999 | |
| GA000091 | L64 | 1856 | 1999 | |
| GA000091 | L65 | 1950 | 1999 | |
| GA000091 | L66 | 1987 | 1999 | |
| GA000091 | L73 | 1984 | 1988 | |
| GA000091 | L74 | 1899 | 1999 | |
| GA000091 | L75 | 1987 | 1999 | |
| GA000091 | L77 | 1909 | 1909 | |
| GA000091 | L82 | 1987 | 1999 | |
| GA000091 | L83 | 1962 | 1999 | |
| GA000091 | L84 | 1967 | 1999 | |
| GA000091 | L85 | 1987 | 1999 | |
| GA000091 | L86 | 1987 | 1999 | |
| GA000091 | L88 | 1950 | 1969 | |
| GA000091 | L92 | 1950 | 1999 | |
| GA000091 | L93 | 1950 | 1999 | |
| GA000091 | L94 | 1950 | 1999 | |
| GA000091 | L95 | 1962 | 1999 | |
| GA000091 | L99 | 1899 | 1899 | Omitted from FRR and Current range map |
| GA000091 | M02 | 1500 | 1969 | |
| GA000091 | M03 | 0 | 1969 | |
| GA000091 | M04 | 0 | 1999 | |
| GA000091 | M05 | 1966 | 1966 | |

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|---|---|---|---|---|
| GA000091 | M06 | 1965 | 1965 | |
| GA000091 | M09 | 0 | 1969 | |
| GA000091 | M10 | 0 | 1950 | |
| GA000091 | M12 | 1987 | 1999 | |
| GA000091 | M13 | 1950 | 1999 | |
| GA000091 | M14 | 1987 | 1999 | |
| GA000091 | M15 | 1987 | 1999 | |
| GA000091 | M16 | 1977 | 1977 | |
| GA000091 | M17 | 1950 | 1999 | |
| GA000091 | M20 | 0 | 1999 | |
| GA000091 | M21 | 1966 | 1966 | |
| GA000091 | M22 | 1950 | 1999 | |
| GA000091 | M23 | 1899 | 1999 | |
| GA000091 | M24 | 1899 | 1999 | |
| GA000091 | M25 | 1987 | 1999 | |
| GA000091 | M26 | 1950 | 1983 | |
| GA000091 | M30 | 1963 | 1987 | |
| GA000091 | M31 | 1987 | 1999 | |
| GA000091 | M32 | 1899 | 1999 | |
| GA000091 | M33 | 0 | 1999 | |
| GA000091 | M34 | 1950 | 1999 | |
| GA000091 | M40 | 1950 | 1994 | |
| GA000091 | M41 | 1899 | 1999 | |
| GA000091 | M45 | 1984 | 1999 | |
| GA000091 | M48 | 1992 | 1992 | |
| GA000091 | M50 | 1987 | 1999 | |
| GA000091 | M52 | 1987 | 1999 | |
| GA000091 | M53 | 1987 | 1999 | |
| GA000091 | M54 | 1987 | 1999 | |
| GA000091 | M55 | 1984 | 1984 | |
| GA000091 | M57 | 1990 | 1990 | |
| GA000091 | M60 | 0 | 1897 | Omitted from FRR and Current range map |
| GA000091 | M63 | 1987 | 1987 | |
| GA000091 | M78 | 1950 | 1999 | |
| GA000091 | M80 | 1929 | 1991 | |
| GA000091 | M81 | 1950 | 1969 | |
| GA000091 | M86 | 1990 | 1990 | |
| GA000091 | M95 | 1987 | 1999 | |
| GA000091 | M98 | 1899 | 1899 | |
| GA000091 | N00 | 1987 | 1999 | |
| GA000091 | N03 | 1898 | 1898 | |
| GA000091 | N04 | 1898 | 1999 | |
| GA000091 | N05 | 1987 | 1999 | |
| GA000091 | N11 | 1901 | 1999 | |
| GA000091 | N13 | 1898 | 1898 | |
| GA000091 | N14 | 1898 | 1999 | |
| GA000091 | N15 | 1900 | 1900 | Omitted from FRR and Current range map |
| GA000091 | N21 | 1500 | 1991 | |
| GA000091 | N23 | 1987 | 1999 | |
| GA000091 | N24 | 1899 | 1999 | |
| GA000091 | N25 | 1990 | 1990 | |
| GA000091 | N26 | 1990 | 1990 | |
| GA000091 | N28 | 1987 | 1999 | |
| GA000091 | N32 | 1991 | 1991 | |

| | | | | |
|---|---|---|---|---|
| GA000091 | N35 | 1969 | 1999 | |
| GA000091 | N36 | 1987 | 1999 | |
| GA000091 | N38 | 1940 | 1999 | |
| GA000091 | N44 | 1970 | 1986 | |
| GA000091 | N45 | 1894 | 1999 | |
| GA000091 | N46 | 1934 | 1986 | |
| GA000091 | N48 | 1896 | 1999 | |
| GA000091 | N54 | 1970 | 1986 | |
| GA000091 | N56 | 1971 | 1999 | |
| GA000091 | N57 | 1970 | 1986 | |
| GA000091 | N60 | 1987 | 1999 | |
| GA000091 | N65 | 1970 | 1986 | |
| GA000091 | N66 | 1987 | 1999 | |
| GA000091 | N71 | 1897 | 1999 | |
| GA000091 | N72 | 1974 | 1999 | |
| GA000091 | N80 | 0 | 1933 | Omitted from FRR and Current range map |
| GA000091 | N89 | 0 | 1993 | |
| GA000091 | N93 | 1987 | 1999 | |
| GA000091 | N97 | 1901 | 1901 | Omitted from FRR and Current range map |
| GA000091 | N98 | 1987 | 1999 | |
| GA000091 | N99 | 1897 | 1897 | |
| GA000091 | O09 | 1890 | 1999 | |
| GA000091 | O20 | 0 | 1866 | Omitted from FRR and Current range map |
| GA000091 | O30 | 1987 | 1999 | |
| GA000091 | Q40 | 1987 | 1999 | |
| GA000091 | Q83 | 1500 | 1969 | |
| GA000091 | R19 | 1950 | 1999 | |
| GA000091 | R24 | 1900 | 1999 | |
| GA000091 | R28 | 1962 | 1999 | |
| GA000091 | R29 | 1950 | 1999 | |
| GA000091 | R34 | 1974 | 1992 | |
| GA000091 | R35 | 1950 | 1999 | |
| GA000091 | R36 | 1987 | 1999 | |
| GA000091 | R37 | 0 | 1969 | |
| GA000091 | R38 | 1950 | 1969 | |
| GA000091 | R39 | 1950 | 1999 | |
| GA000091 | R44 | 1950 | 1999 | |
| GA000091 | R45 | 1885 | 1999 | |
| GA000091 | R47 | 1987 | 1999 | |
| GA000091 | R48 | 1962 | 1999 | |
| GA000091 | R49 | 1990 | 1990 | |
| GA000091 | R54 | 1987 | 1999 | |
| GA000091 | R79 | 1950 | 1969 | |
| GA000091 | R87 | 1969 | 1969 | |
| GA000091 | R88 | 1996 | 1996 | |
| GA000091 | R89 | 1950 | 1996 | |
| GA000091 | R94 | 1987 | 1999 | |
| GA000091 | R98 | 1996 | 1996 | |
| GA000091 | R99 | 1990 | 1996 | |
| GA000091 | S08 | 1900 | 1900 | Omitted from FRR and Current range map |
| GA000091 | S18 | 1996 | 1996 | |
| GA000091 | S27 | 1988 | 1988 | |
| GA000091 | S37 | 1979 | 1999 | |

| | | | | |
|---|---|---|---|---|
| GA000091 | S38 | 1959 | 1999 | |
| GA000091 | S46 | 1987 | 1999 | |
| GA000091 | S47 | 1987 | 1999 | |
| GA000091 | S48 | 1950 | 1969 | |
| GA000091 | S67 | 1898 | 1898 | |
| GA000091 | S76 | 1500 | 1969 | |
| GA000091 | S77 | 1950 | 1969 | |
| GA000091 | S78 | 1970 | 1999 | |
| GA000091 | S79 | 1971 | 1971 | |
| GA000091 | S87 | 0 | 1866 | Omitted from FRR and Current range map |
| GA000091 | S93 | 1934 | 1934 | Omitted from FRR and Current range map |
| GA000091 | V65 | 1987 | 1999 | |
| GA000091 | V66 | 1913 | 1913 | Omitted from FRR and Current range map |
| GA000091 | V67 | 1987 | 1999 | |
| GA000091 | V68 | 1987 | 1999 | |
| GA000091 | V75 | 0 | 0 | |
| GA000091 | V76 | 1883 | 1999 | |
| GA000091 | V77 | 1889 | 1999 | |
| GA000091 | V78 | 0 | 1969 | |
| GA000091 | V79 | 1987 | 1999 | |
| GA000091 | V84 | 1950 | 1993 | |
| GA000091 | V85 | 1987 | 1999 | |
| GA000091 | V86 | 1908 | 1999 | |
| GA000091 | V87 | 1987 | 1999 | |
| GA000091 | V88 | 1987 | 1999 | |
| GA000091 | V98 | 1914 | 1999 | |
| GA000091 | V99 | 1987 | 1999 | |
| GA000091 | W02 | 1987 | 1999 | |
| GA000091 | W05 | 0 | 1988 | |
| GA000091 | W06 | 1965 | 1965 | |
| GA000091 | W08 | 0 | 1999 | |
| GA000091 | W12 | 1993 | 1993 | |
| GA000091 | W13 | 1500 | 1969 | |
| GA000091 | W16 | 1987 | 1999 | |
| GA000091 | W17 | 1950 | 1969 | |
| GA000091 | W26 | 0 | 1999 | |
| GA000091 | W64 | 1987 | 1999 | |
| GA000091 | W67 | 1500 | 1969 | |
| GA000091 | W87 | 1987 | 1999 | |
| GA000091 | X17 | 1950 | 1969 | |

# APPENDIX IV

**NOTICE OF NOTIFIABLE ACTIONS**
**HABITAT TYPE 4.2**

Under STATUTORY INSTRUMENT 94 of 1997, made under the EUROPEAN COMMUNITIES ACT 1972 and in accordance with the obligations inherent in the COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 (the Habitats Directive) on the conservation of the natural habitats and species of wild fauna and flora, all persons must obtain the written consent, (in circumstances prescribed at section A and B below) of the Minister for The Environment and Local Government before performing any of the operations on, or affecting, the following habitats where they occur on lands / waters within the candidate Special Area of Conservation.

Please note that where a landowner has a current approved plan under the Rural Environmental Protection Scheme or any scheme which the Minister considers to be equivalent s/he need only notify the Minister of activities not covered in the plan.

**HABITAT TYPE**
**FENS, TRANSITION MIRES, PETRIFYING SPRINGS**

**SECTION A**
Please note that the activities listed in *Section A below* are required to be notified to the Minister for The Environment and Local Government and should not be undertaken before consent.

Section A
THE MINISTER FOR THE ENVIRONMENT AND LOCAL GOVERNMENT IS REQUIRED TO BE NOTIFIED IN RELATION TO THE FOLLOWING ACTIVITIES AND SUCH ACTIVITIES SHOULD NOT PROCEED WITHOUT PRIOR CONSENT:

grazing of livestock above a sustainable density (as defined in approved farm plans)

grazing by livestock treated within the previous week with a pesticide which leaves persistent residues in the dung

changing of traditional use from hay meadow (to either grazing or silage making), or from grazing to silage cutting

adding lime within 50m of the fen or a water course running into it

adding fertiliser of any sort within 50m or a water course running into it

extracting water for irrigation or other purposes

mowing grass before the 30th June (*Note; if you have been notified that your lands hold breeding corncrakes, or certain rare meadows, special provisions will apply)*

supplementary feeding of stock

operation of boat angling or shore angling business

restocking with fish

reclamation, infilling, ploughing or land drainage within 50m of the fen

reseeding, planting of trees or any other species within 50m of the fen

use of any pesticide or herbicide within 50m of fen

dumping, burning or storing any materials within 50m of the fen

alteration of the banks, bed or flow of watercourses within the fen or running into or out of it

harvesting reed or willow

operation of commercial recreation facilities (e.g. bird watching tours)

introduction (or re-introduction) into the wild of plants or animals of species not currently found in the area any other activity of which notice may be given by the Minister from time to time

**SECTION B**

Please note that the activities listed in *Section B below* may, and in most cases do, require a license or consent from another statutory authority (e.g. the local planning authority, the Minister for the Marine and Natural Resources, or the Minister for Agriculture and Food).

If so, these notifiable actions do not apply.

However, if such activities are not regulated by another statutory authority, the said activities are required to be notified to the Minister for The Environment and Local Government.

SECTION B

(NO REQUIREMENT TO NOTIFY IF ALREADY LICENSED BY ANOTHER MINISTER/BODY)

developing leisure facilities including golf courses, sports pitches, caravan or camping facilities

any activity which might cause pollution of the fen

removal of soil, mud, gravel, sand or minerals

developing roads or car parks

construction of fences, buildings or embankments

afforestation

# APPENDIX V

# GLOSSARY

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CUTAWAY BOG - This term describes areas where peat has been removed systematically by industrial means. Any peat remaining can no longer be considered as economically removable (Irish Peatland Conservation Council).

CUTOVER BOG – An NPWS habitat classification that describes areas of bog which have been previously cut (by hand or by mechanical means), although not down to the underlying mineral soils or bedrock. Remaining peat can still be an economic reserve. Cut-over areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DEHLG - Department of Environment, Heritage and Local Government

DESICCATION - Drying out.

DOMESTIC PURPOSES - Used in relation to the cutting of peat. Peat that is cut for domestic purposes is not for commercial sale and is cut at the rate of one year's supply for a household per year.

DRAINAGE DITCHES - An NPWS habitat classification which refers to water channel systems with moving or stagnant water bodies, artificial in origin. Most ditches are cleared cyclically, although this category also includes ditches that are overgrown with wetland plants.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ECOTOPE - The abiotic environment or habitat of a particular biotic system (Kulcher, 1967; Whittaker et al., 1973). According to work carried out by Kelly (1993) on Clara and Raheenmore raised bogs vegetation can be assigned to five different ecotopes. Sub-central and central ecotopes with Active peat formation (Active Raised Bog habitat) and marginal, sub-marginal and face bank ecotopes with little or no peat formation (Degraded Raised Bog habitat).

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

FENS AND FLUSHES - An NPWS habitat classification. Fens are peatlands fed by calcium rich water, either from groundwater or from inflowing surface water. Flushes are wet areas maintained by the seepage of water down slopes of various gradient, and are usually local features. Both are

characterised by an abundance of small sedge forming species-rich mosaics with other species. Orchid species are particularly noticeable in fens and butterworts are more typical of flushes. According to Cross (1990) flushes are areas where nutrient enrichment occurs, usually as a result of more concentrated horizontal water movement. They are particularly common near the bog margin and at the base of low mineral ridges and are characterised by the presence of *Molinia caerulea, Myrica gal*e and often *Sphagnum recurvum*.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT. - Refers to traditional cutting of peat using a slean or spade.

HIGH BOG – This is the area of bog which have not been previously cut and generally its vegetation is characterised by the presence of ericoid and *Cyperaceae* species and an abundant of *Sphagnum* species.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

LAGG - A term used to describe the transition from bog to mineral soil around a raised bog.

LIMESTONE - Sedimentary rock composed predominantly of calcium carbonate, often containing fossils.

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MICROTOPOGRAPHY – This is the small scale variation in surface level within a habitat.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the “health” quantity or quality of a habitat or species.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NGO – Non governmental environmental conservation organisations.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PEAT CUTTING BY HAND. - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

RAISED BOG - An NPWS habitat classification characterised by an elevated dome of peat, the surface of which is isolated from the surrounding ground water table and receiving water solely from precipitation. The peat surface is wet, often with pools and hummock hollow systems and is usually dominated by *Sphagnum* mosses and bushy heather, with Deer-grass, Bog Cottons and other associated species. Raised bogs can be distinguished from blanket bogs by their paucity of grasses which typify blanket bog.

SENSITIVE MARGIN (or Margin with high sensitivity to cutting) - Section of high bog margin that is within 250m of priority habitat (i.e. Active Raised Bog or Bog Woodland).

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPWS is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

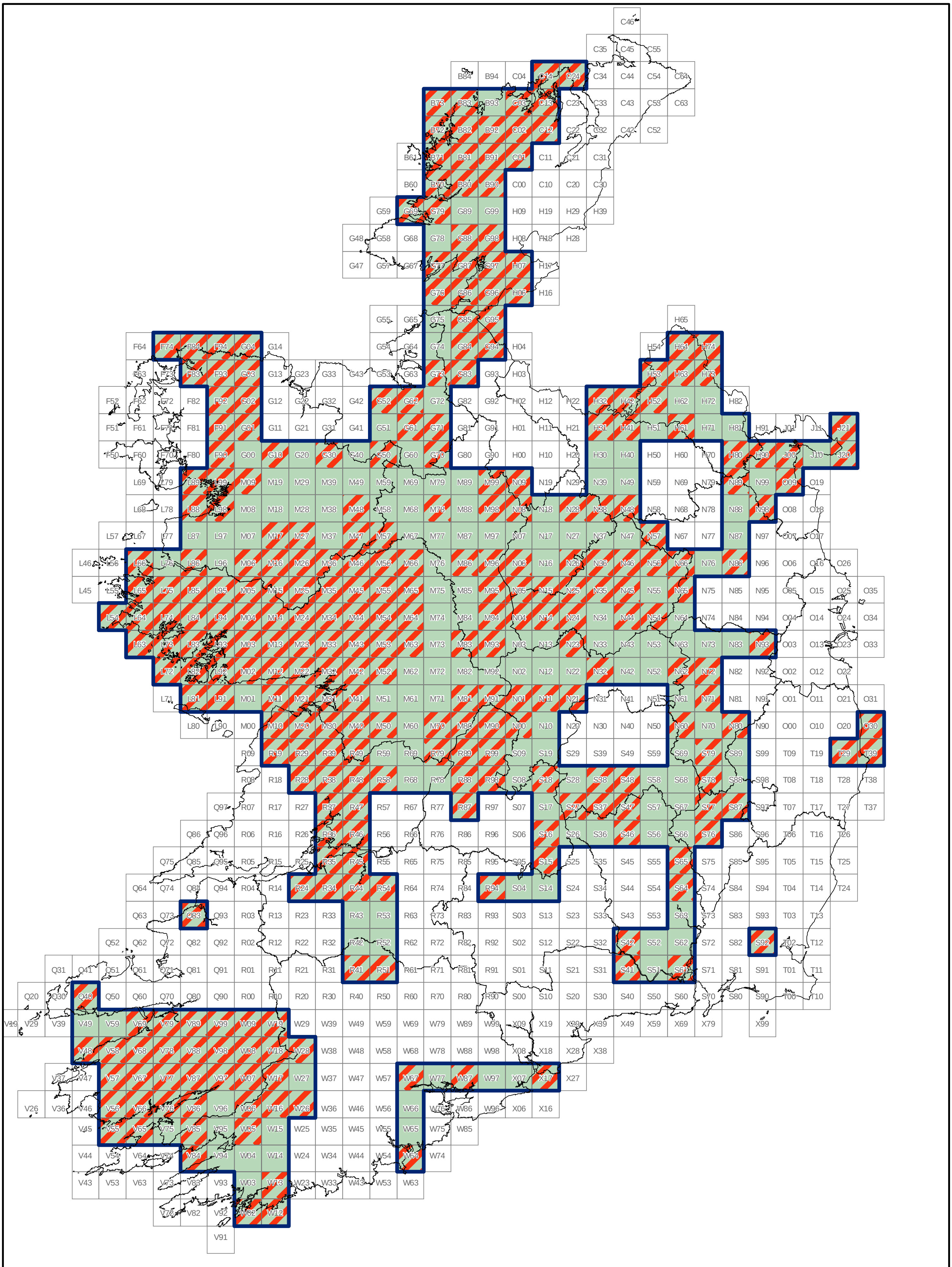
TURBARY – Turbary is the term used to describe the ancient right to cut turf on a particular area of bog. These rights came about with the resettlement of confiscated land or by prescription. Prescription is a legal term meaning that if a person is able to demonstrate that they cut turf without secrecy, without permission and without force continuously for a period of 30 years they have a turbary right. This implies that not all turbary rights will be formally registered.

## 7210 Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae

| National Level | |
|---|---|
| **Habitat Code** | 7210 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | • Crushell P., 2000. *Irish Fen Inventory - A review of the status of fens in Ireland*, Irish Peatland Conservation Council, Dublin, pp. 100.<br>• Foss, P.J. 2007. National Parks & Wildlife Service Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007. Unpublished report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.<br>▪ Hammond, R.F. 1984. *The Classification of Irish peats as surveyed by the National Soil Survey of Ireland*. 7th International Peat Congress, Dublin. |
| **Range** | Throughout Ireland, most commonly in Midlands, West and South-East. See Map 2 attached |
| Surface area | 42,900 km² (429 grid cells selected x 100 km² - area polygon derived from grid cells) see Map 2 |
| Date | 02/2007 Data for habitat distribution and range covers data collection period from surveys of the early 1980's; the NHA surveys of the 1990's to NPWS Fen Study Project 2006. |
| Quality of data | 2 = moderate (based on partial data with some extrapolation) |
| Trend | Decreasing |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| **Area covered by habitat** | 14.68 km$^2$ |
| Distribution map | See map actual present distribution and range attached; NPWS Fen Study database 2007 |
| Surface area | 14.68 km$^2$ |
| Date | 02/2007 Data for habitat area covers data collection period from surveys of the early 1980's; the NHA surveys of the 1990's to NPWS Fen Study Project 2006. |
| Method used | 3 = ground based survey |
| Quality of data | 1 = poor (based on very incomplete data or on expert judgement) |
| Trend | - = decreasing |
| Trend-Period | 1980-2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| Justification of % thresholds for trends | There has been an unquantified decline in area since the beginning of the trend period, however this decline is not considered to be significant since the Directive came into force. |
| Main pressures | 140 Overgrazing<br>150 Restructuring agricultural land holding<br>161 Forestry Planting<br>310 Peat Extraction<br>311 Hand-cutting of peat<br>312 Mechanical removal of peat<br>701 Water pollution<br>800 Landfill, land reclamation and drying out, general<br>803 Infilling ditches, dykes, ponds, marshes and pits<br>810 Drainage |
| Threats | 140 Overgrazing<br>150 Restructuring agricultural land holding<br>310 Peat Extraction<br>312 Mechanical removal of peat<br>701 Water pollution<br>800 Landfill, land reclamation and drying out, general<br>803 Infilling ditches, dykes, ponds, marshes and pits |

| | |
|---|---|
| | 810 Drainage<br>890 Other human induced changes in hydraulic conditions |
| ***Complementary information*** | |
| **Favourable reference range** | 42,900 km² (429 grid cells selected x 100 km² - area polygon derived from grid cells) See Map 3 attached |
| **Favourable reference area** | 14.68 km² |
| **Typical species** | **Vascular plants***: Cladium mariscus, Schoenus nigricans, Eriophorum latifolium, Carex dioica, C. viridula ssp. brachyrrhyncha, C. pulicaris, C. viridula ssp. oedocarpa, Juncus subnodulosus, Eleocharis quinqueflora, Dactylorhiza traunsteineri, Selaginella selaginoides, Epipactis palustris, Parnassia palustris, Pinguicula vulgaris*<br>**Mosses, Liverworts and Lichens***: Scorpidium scorpioides, Campylium stellatum, Drepanocladus revolvens, Palustriella commutata, Ctenidium molluscum, Fissidens adianthoides, Bryum pseudotriquetrum*<br><br>Species information based on: Ó Críodáin, C. & Doyle, G.J., 1994; 1997; Doyle, G.J. & Ó Críodáin, C., 2003; White, J. & Doyle, G.J., 1982; Foss 2007.<br><br>Further characteristic vascular plants, mosses, lichens and liverworts see Table 5.1.<br><br>**Other species:**<br>**Dragonflies and Butterflies***: Euphydryas aurinia*<br>**Other invertebrates**: *Vertigo geyeri*, *V. angustior, V. moulinsiana*<br>**Vertebrates**: *Lutra lutra*<br><br>Methods: all the species above are characteristic of *Cladium* fen habitat in Ireland. |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Typical species were assessed as unfavourable/bad using best expert judgement. |
| **Other relevant information** | Restoration initiatives have been undertaken by: Very limited; NPWS |
| ***Conclusions (assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Favourable (FV) |
| **Specific structures and functions (incl. typical species)** | Unfavourable Bad (U2) - ongoing deterioration of the condition of Calcareous fen with *Cladium mariscus* habitats at current rates caused by drainage, land reclamation, peat cutting, forestry etc. threatens the structures and functions of the habitat as well as habitat quality indicator and typical species. |
| **Future prospects** | Unfavourable Bad (U2) - ongoing deterioration of Calcareous fen with *Cladium mariscus* habitats at current rates caused by drainage, land reclamation, peat cutting, forestry etc. threatens the future prospects for the habitat. |
| **Overall assessment of CS** | Unfavourable Bad (U2) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Calcareous fens with Cladium mariscus and species of the Caricion davallianae 7210**

Current Distribution (291 cells)
Current Range (429 cells)
Favourable Reference Range (429 cells)
W48 10km grid cells

Date: October 2007

# 7220 Petrifying Springs with tufa formation (Cratoneurion)

## CONSERVATION STATUS ASSESSMENT REPORT

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## 1. Habitat characteristics in Ireland

Petrifying springs are permanently irrigated and kept moist by water that is calcareous and oligotrophic in nature. The water supply may be from upwelling groundwater sources, or from seepage sources or sometimes from geo-thermal sources. Petrifying springs may be closely associated with Alkaline fens but with less fluctuations in water table (Curtis *et al* 2006). A key requirement is a steady flow of water, though this may dry up periodically.

Springs are often very small features covering no more than some tens of meters. Petrifying springs occur on shallow peaty or skeletal mineral soils.

On contact with the atmosphere at the spring head, carbon dioxide is lost from the water or is depleted by photosynthetic activities of plants growing in the spring, which results in the precipitation of a calcium bicarbonate marl or tufa. The vegetation in such areas, and especially mosses may be coated in a thick crust of lime. Larger petrifying springs may form tufa cones that constitute a singular habitat.

Springs occur in lowland and upland areas and may be associated with a variety of different habitats such as alkaline fen, woodland, heathland, grassland, limestone rich boulder clay or gravel deposits or on exposed rock.

Spring vegetation is characterized by an abundant or dominant moss cover and may or may not be peat-forming.

Petrifying springs vegetation in Ireland is classified in the class Montio - Cardaminetea, in the alliance Cratoneurion. (*sensu* White & Doyle, 1982) within which 2 associations are recognised in Ireland.

<u>Cratoneuretum filicino - commutatum</u>
Lowland or sub-montane vegetation of calcareous springs is characterised by *Cratoneuron filicinum* and *Palustriella commutata* which form dense yellow-orange mats at the spring head in association with several other bryophytes such as *Philonotis calcarea, Bryum pseudotriquetrum, Drepanocladus revolvens* and other rare mosses. Higher plants tend to be few, none are as constant as the above bryophytes, and may include grasses and low growing sedges including *Carex panicea, C. flacca, Festuca rubra, Cardamine pratensis, Pinguicula vulgaris,* and *Chrysosplenium oppositifolium.*

<u>Saxifragetum aizoidis</u>

In montane areas vegetation of calcareous springs is characterised by *Saxifraga aizoides*, with the community occurring on wet silty soils with a high pH.

Petrifying springs usually occur in mosaics with other communities such as alkaline fens, bogs or reed beds in which case they may be of relatively limited extent.

In Ireland Petrifying springs occur in a variety of situations including topogenous fens found in valleys or depressions, within transition mire and tall reed beds, calcium rich flush areas in blanket bogs, dune slack areas, on exposed limestone cliffs, along seepage lines or springs in woodlands or on areas of exposed alkaline soil, and wet hollows in machair.

## 2. Habitat mapping

To-date no potential historic distribution or range map of the occurrence of this habitat has been available in Ireland (Foss 2007). A potential historic distribution and range map for Petrifying springs based on a series of data sets which would indicate the possible location of sites with the habitat in Ireland was produced as a part of the current assessment of the habitat in Ireland. Information on the habitat range provided by this map could then be compared with the present range to ensure that an adequate network of sites has been recognised to ensure favourable conservation of this habitat in Ireland. Such an exercise was felt justified in the absence of a systematic field survey of the habitat to date in Ireland.

The most recent mapping of the fen resource in Ireland was undertaken by Hammond in 1979. This study mapped only deep fen peat (>30cm in depth), and furthermore all fen peat areas were considered to be man modified and no attempt was made to distinguish between the various fen types.

A map of the **potential historic distribution and range** of Petrifying springs, based on a 10 km² grid basis was produced by selecting those grid squares in which sites listed for the habitat had been recorded in the NPWS Fen Study database (based on Foss 2007) together with the total distribution for selected species characteristic of the habitat including *Saxifraga aizoides*, *Palustriella commutata; Palustriella commutata var. commutata; Palustriella commutata var. falcata; Eucladium verticillatum* (based on BSBI Flora Atlas 2000 and British

Bryological Society Atlas 2007) (see Map 1) or was believed to occur in the past (Hammond 1979). Further information on the specific data sets use to produce the map are listed in Appendix I.

The mapping of the **current habitat distribution and range** of Petrifying springs (see Map 2) is based on National Parks and Wildlife Service (NPWS) study of the extent and conservation status of springs, fens and flushes undertaken in 2006 (Foss 2007). In the absence of any detailed fen survey in Ireland to-date, this desk study compiled a list of all known fens of conservation value in Ireland based on data held within NPWS and from external NGO and expert sources (see Appendix I & II). In addition to recognised sites for the habitat in Ireland, all 10 km² grid cells which contain a record for the Petrifying spring indicator species *Saxifraga aizoides*, *Palustriella commutata; Palustriella commutata var. commutata; Palustriella commutata var. falcata; Eucladium verticillatum* were also mapped as part of the current habitat distribution, using records recorded between 1940 and the present. Extension of the range for this habitat, based on the distribution of these species was felt to be justified, in the absence of any National Fen Survey to-date in Ireland.

The NPWS Fen Study (Foss 2007) involved compilation of a list of all known fen sites in Ireland, classification of these according to fen type (using the fen habitats recognised in the EU Habitats Directive), and accurately assessing or estimating the area of fen vegetation present on sites where this was possible. Fen type and area data was obtained from a variety of related wetland studies previously undertaken within NPWS (see Appendix I). In the case of some of these surveys, accurate fen area data were available for the extent of fen vegetation on sites. In other cases only an estimated area figure could be assigned to fen sites.

It is likely that due to small size of many Petrifying springs sites, the diversity of larger habitats in which Petrifying Springs occur, and the lack of any systematic survey of this habitat to date in Ireland, that the habitat is significantly under recorded especially in sites with a geological nature such as exposed limestone and calcareous boulder clay deposits. Within the NPWS Fen Study database 73% of the sites listed for Petrifying spring also include a second fen type (Alkaline fen being the most common), with only 27% of sites (30 discrete sites) being listed exclusively for Petrifying spring. As a result it was decided that in addition to the sites listed for the habitat in the NPWS Fen Study Database, the locations where moss assemblages characteristic of petrifying spring (i.e. *Palustriella commutata; Palustriella commutata var. commutata; Palustriella commutata var. falcata; Eucladium verticillatum)* occurred should also to be included as sites in the current range of the habitat (Lockhart *pers. comm.*).

The Petrifying spring **current habitat distribution and range map** (see Map 2) was produced by selecting the smallest polygon size containing all grid squares, where the habitat was recorded in the NPWS Fen Study database (Foss 2007), or species indicative of the habitat were located (Lockhart *pers. comm.*), using a minimum number of 90 degree angles. Gaps in the habitat distribution of at least two 10 km² square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range. The map produced should be taken as indicative of the distribution and range of Petrifying springs until such time as a national fen survey is completed. One exception to the mapping criteria used involved the extensive river system SACs where only known sub sites containing fen vegetation were mapped on the 10 km² square grids rather than the entire river system.

The **Petrifying springs favourable reference range** (see Map 3) is considered to be the same as the current habitat range. The FRR is defined as the range of 10 km² grid cells which contain a Petrifying spring site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km² grid cells which contain a record for the Petrifying spring indicator species *Saxifraga aizoides*, *Palustriella commutata; Palustriella commutata var. commutata; Palustriella commutata var. falcata; Eucladium verticillatum.* Gaps in the habitat distribution of at least two 10 km² square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range.

## 3. Habitat Range

The first attempt to map the range of general fen habitats in more recent times undertaken by Hammond (1979) indicates that the habitat type is widespread in Ireland, with the greatest concentration of sites occurring in the midlands and westwards into counties Galway, Mayo and Clare (see Table 4.1). Hammond (1979) records no fens in Counties Carlow, Cork, Donegal, Dublin, Monaghan or Wicklow. Subsequent reports show in fact that these counties also contain fen (see Crushell 2000, Foss et al 2001, Foss 2007). It is therefore likely that the total range of fen in Ireland recognised in Hammond (1979) is an under representation of the habitat in Ireland.

In part, this shortcoming may be related to the fact that Hammond recorded only fen habitats occurring on a deep peat layer (greater than 30 cm).

Nonetheless, Hammond (1979) distribution map of man-modified fen still represents a minimum "best estimate" of the total extent of fen soils and fen habitats in Ireland. One further short coming of the report is that no subdivision is made in Hammond in terms of fen types (i.e. Petrifying springs, Alkaline fen, *Cladium* fen or Transition mires). The digitised version of this fen distribution data produces a **Hammond fen range map** which covers an area of 21,300 $km^2$ (213 grid squares x 100 $km^2$) containing fen, with a significant concentration of grid squares in the midlands and mid-west of Ireland (see Map 4).

A map of the **potential historic distribution and range** of Petrifying springs, based on a 10 $km^2$ grid basis and undertaken as part of this assessment project (see section 2 above) indicates that Petrifying springs occurred throughout Ireland with the possible exception of parts of counties Wicklow, Carlow, Wexford, Waterford, Cork, parts of Kerry and Monaghan. In the potential historical distribution and range map, Petrifying springs has a range cover of 40,600 $km^2$ (406 grid squares x 100 $km^2$, see Map 1). The range polygon (area polygon derived from grid squares) derived for this habitat cover 55,100 $km^2$ (551 total grid squares x 100 $km^2$).

A distribution map for the occurrence of this habitat produced by Crushell (2000) based on the location of 21 sites identified for this habitat in the IPCC fen survey reveals a distribution of sites running from Dublin on the east coast westwards through the midlands into county Galway. With a small cluster of sites in south Donegal, Leitrim and north Sligo.

The most recent NPWS Fen Study (Foss 2007) undertaken to obtain a information on the distribution and extent of Alkaline fen, *Cladium* fen, Transition mires or Petrifying springs in Ireland, found that Petrifying springs occur widely throughout Ireland, with a zone of sites recognised running from the East coast through the Midlands, into the Mid-West and North West of the country (see Table 4.3 below; and Map 2). A more diffuse pattern of distribution was seen in the southern half of the country and North East Ireland.

The **current distribution and range map for Petrifying springs** indicates that the habitat has a range of 27,000 $km^2$ (270 grid squares x 100 $km^2$, see Map 2). The current range polygon (area polygon derived from grid squares) derived for this habitat covers 44,500 $km^2$ (445 grid squares x 100 $km^2$).

The current range based on grid cells shows a decline of 34% over the total predicted historical range of the habitat. The range polygon shows a significant decline (19 %) over the total predicted historical range polygon of the habitat. The overall distribution pattern of the range, as found in the NPWS Fen Study (2007), although based on a larger number of reported sites, shows similarities to that found by Crushell (2000).

Until a detailed field survey of this habitat is completed in Ireland it remains unclear whether this observed decline in the range is the in fact due to loss of sites, or lack of knowledge of the occurrence of sites within these grid squares.

Expert opinion would indicate that the current range of the habitat, based on the known sites listed within the NPWS Fen Study database (Foss 2007), when taken together with the likely sites for the habitat indicated by the presence of selected moss and *Saxifraga aizoides* records, is sufficient to represent the ecological variation of the habitat across its distribution and range in Ireland when compared to the potential historic distribution and range, mapped as part of this conservation status assessment.

It is, however, likely that following a future detailed field based fen survey of Ireland, additional sites will be discovered (as indicated by species distribution data) within the area formerly believed to contain the habitat, which would increase the number of 10 $km^2$ grid cells which contain Petrifying spring. Such new sites may add somewhat to the range of the habitat in Ireland above that proposed in this assessment.

Based on available data the **Favourable Reference Range** (FRR) (see Map 3) is therefore considered to be the same as the current range for the habitat in Ireland as mapped in this assessment, which should be regarded as a minimum until detailed habitat surveys are completed.

### 3.1. Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the

- **Current Habitat Rang:** Can be considered as the area of the polygon which contains all of the grid cells with the habitat which is 44,500 $km^2$ (445 grid cells x 100$km^2$).
- **Favourable Reference Range** 44,500 $km^2$ (445 grid cells x 100 $km^2$) ²) the area of the polygon which contains all of the grid cells with the habitat.

assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relationship between current habitat range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

No specific studies have been undertaken on conservation status of the habitat range in Ireland during the reporting period making any assessment of the annual decline in the habitat extent or range problematic. Thus, although the actual trend cannot be quantified it is considered to be negative based on expert opinion.

An assessment based on current and favourable reference range indicates that the **current range polygon of the habitat** in Ireland (see Map 2), as defined by the list of sites for this habitat held in the NPWS Fen Study database (Foss 2007) and related species range, covers 44,500 $km^2$ (445 total grid squares x 100 $km^2$).

The **Favourable Reference Range** (FRR) (see Map 3) is considered to be the same as the current range.

The difference between the current Transition Mire habitat range and the FRR for this habitat reveals that the current habitat range is the same as the FRR which is considered to be **Favourable** according to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive).

## 4. Habitat Extent

The first attempt to estimate the original extent of fen habitats in the Republic of Ireland (Hammond 1979) indicated that 92,508 ha of fen occurred. Although Hammond did not differentiate between the different fen types recognised today, it is probable that a significant proportion of this original area of fen was Alkaline fen, with associated but limited areas of Petrifying springs. Many of these fens were associated with or occurred adjacent to midland raised bogs and in more western blanket bog habitats.

**Table 4.1: The original area (ha) of fen by County in Ireland after Hammond 1979**

| County | Area (ha) |
|---|---|
| Carlow | 7,883 |
| Cavan | 81 |
| Clare | 0 |
| Cork | 0 |
| Donegal | 0 |
| Dublin | 0 |
| Galway | 10,012 |
| Kerry | 5,844 |
| Kildare | 316 |
| Kilkenny | 4,654 |
| Laois | 1,232 |
| Leitrim | 81 |
| Limerick | 16,030 |
| Longford | 5,140 |
| Louth | 352 |
| Mayo | 3,901 |
| Meath | 0 |
| Monaghan | 469 |
| Offaly | 13,901 |
| Roscommon | 4,828 |
| Sligo | 1,279 |
| Tipperary | 4,298 |
| Waterford | 11,026 |
| Westmeath | 0 |
| Wexford | 566 |
| Wicklow | 615 |
| **Total** | **92,508** |

Significant decline in this Alkaline fen habitat, due to the activities of human influences, have occurred in Ireland over the last 400 years, a feature noted by Hammond (1979) who included only a “man modified” fen category in his report. In his word “Undisturbed fens are rare and can only be found in a few counties in Ireland. Owing to their small size their representation on the map is not possible, even their continued existence as natural entities is under threat from agriculture and urban pressures”.

The two activities which are most important for the decline of Alkaline fen are drainage activities associated with the related activities of land reclamation and the development of turf extraction schemes on bogs, in particular midland raised bogs (Crushell 2000). It is assumed that the former activity, would have had the most significantly impacted on Petrifying springs which are dependent on a continuous supply of water for their survival.

Subsequent studies undertaken by the Irish Peatland Conservation Council indicated that the intact resource of fen in Ireland has declined significantly since the Hammond study, with just 19,660 ha of intact conservation worthy fen remaining by the year 2000 (Crushell 2000; Foss et al. 2001).

Crushell (2000) identified a total of 20 Petrifying springs in Ireland with a total area of 634 ha in the IPCC fen study. The average total site size was given as 21 ha for this habitat. The habitat was recorded in the midland and west of Ireland. Crushell indicated that this fen type was probably under recorded in Ireland, and that many calcareous springs have yet to be inventoried, given the area of Ireland dominated by limestone bedrock and glacial sediments.

The rarity of the habitat In Ireland was also acknowledged by Ó Críodáin in 1995, as part of the SAC designation process, when he estimated that national extent of the Petrifying spring resource remaining in Ireland could be as little as 0.5ha.

The most recent analysis of conservation worthy sites recognised in Ireland, the NPWS Fen Study (Foss 2007) found that the total area of estimated fen vegetation recorded in the NPWS Fen Study amounted to 22,180 ha within 681 discrete sites (site complex sub-units omitted i.e. sub-sites that occur within existing SAC or NHA). In total the NPWS Fen Study database holds information on 808 sites (which includes 127 sub-site records), where fen habitats are known or believed to occur. This list of sites includes two fen types, poor fen and non-calcareous springs, which were not recorded as part of many of the earlier studies (i.e. Hammond 1979; Foss 2001 inter alia).

**Table 4.2: The extent of Annex 1 fen habitats recognised in Ireland within each county in the NPWS Fen Study (Foss 2007). Area in ha with the number of sites in brackets [#].**

| **County** | * Cladium fen 7210 | Alkaline fen 7230 | Transition Mire 7140 | *** Tufa springs 7220** |
|---|---|---|---|---|
| Clare | 303 (15) | 856 (25) | 149 (13) | 7.92 (10) |
| Cavan | 0 (1) | 120 (7) | 0 (1) | 0.1 (3) |
| Carlow | 4 (2) | 4 (1) | | 0.01 (1) |
| Cork | 24 (3) | 501 (17) | 43 (8) | 5.6 (3) |
| Donegal | 21 (5) | 365 (25) | 375 (16) | 1.01 (2) |
| Dublin | | 61 (3) | | 0.1 (2) |
| Galway | 356 (29) | 1,282 (50) | 426 (23) | 7.6 (17) |
| Kildare | 84 (4) | 147 (11) | 2 (3) | 1.3 (8) |
| Kilkenny | 6 (4) | 118 (7) | 3 (2) | 1.9 (7) |
| Kerry | 10 (2) | 183 (9) | 1 (4) | 5.6 (4) |
| Longford | 0 (2) | 156 (7) | 13 (2) | |
| Louth | 3 (2) | 61 (6) | 1 (3) | 0 (1) |
| Leitrim | | 164 (6) | 59 (11) | 0.3 (2) |
| Laois | 10 (2) | 158 (10) | 0.1 (2) | 1.12 (5) |
| Limerick | 127 (13) | 436 (14) | 19 (3) | 0.16 (2) |
| Meath | 36 (4) | 81 (16) | 13 (3) | 0.12 (5) |
| Monaghan | 6 (3) | 9 (4) | 126 (14) | 0.1 (1) |
| Mayo | 249 (16) | 566 (34) | 548 (22) | 1.91 (10) |
| Offaly | 14 (5) | 1,955 (38) | 25 (7) | 2.67 (10) |
| Roscommon | 41 (5) | 386 (23) | 2 (3) | 1.01 (4) |
| Sligo | 0 (1) | 261 (20) | 13 (11) | 2.54 (11) |
| Tipperary | 163 (7) | 1,080 (19) | 16 (6) | 6.13 (7) |
| Westmeath | 11 (11) | 316 (56) | 95 (14) | 1.31 (8) |
| Wicklow | 60 (3) | 110 (8) | 30 (2) | 6.52 (9) |
| Wexford | 0 (2) | 63 (9) | 6 (1) | 0.11 (2) |
| Waterford | 0 (1) | 207 (11) | 4 (6) | 0.01 (1) |

[#] The data presented in this table includes a limited number of sites which cross one or more county boundaries. In such cases the area data and site is duplicated for the occurrence of the site in each of the respective counties in which it occurs.

The extent of Annex 1 fens (i.e. Alkaline fen, *Cladium* fen, Transition mire, and Petrifying spring) which most closely relate to the fen types identified in previous studies, was estimated to cover just 10,298 ha (in a total of 702 sites) or 46% of the total fen area estimated in the NPWS Fen Study (Foss 2007). This is an indication that Annex 1 fens are less widespread in Ireland than estimated by previous workers (Crushell 2000; Foss et al. 2001).

In relation specifically to Petrifying springs, a total of 112 sites with this habitat were identified in the Republic of Ireland. Area estimates indicate that a total of 36 ha of this habitat occurred within the conservation worthy sites recognized by the NPWS Fen Study (Foss 2000), making it the rarest, least widespread Annex 1 fen habitat in Ireland.

Of the 112 sites listed for this habitat in the NPWS Fen Study database (Foss 2007) 19 sites have no habitat area data. Assuming an average size of 0.32 ha per site (based on site extent data from the NPWS Fen Study, Foss 2007) it is possible that the cover of this habitat may increase by an estimated 6.08 ha.

In addition to the sites listed in the NPWS Fen Study database (Foss 2007) for this habitat, the additional 77 potential sites identified for this habitat, based on the occurrence and distribution of *Saxifraga aizoides*, *Palustriella commutata, Palustriella commutata var. commutata, Palustriella commutata var. falcata* and *Eucladium verticillatum* species distribution records, may add further to the overall habitat area. Assuming an average size of 0.32 ha per site it is possible that the cover of this habitat may increase by an estimated 24.64 ha in Ireland.

It is therefore possible, that when outstanding site surveys and habitat extent data are completed on these sites that the habitat area in Ireland may increase to as much as 67 ha. Confirmation of this increase in extent will only be possible following detailed site surveys undertaken as part of a National Fen Survey.

In the light of the missing data on extent referred to above, expert opinion would lead one to infer that the current area of the habitat, based on the known sites listed within the NPWS Fen Study database (Foss 2007), is insufficient to represent the ecological variation of the habitat across its distribution and range in Ireland.

Additional habitat areas will be discovered as part a future detailed field based fen survey of Ireland, which is likely to increase the known extent of Petrifying spring. The present extent of 36 ha of the habitat in Ireland should therefore be regarded as a minimum area until detailed surveys are completed. This qualification should also be applied to the **Favourable Reference Area** (FRA).

Based on available data the **Favourable Reference Area** (FRA) (see Map 3) is therefore considered to be the same as the current known area of the habitat in Ireland, which should be regarded as a minimum until detailed habitat surveys are completed.

### 4.1. Conservation Status of Habitat Extent

No specific studies have been undertaken on the conservation status of the habitat extent in Ireland. The IPCC fen study of Crushell (2000) lists 10 fen sites with a total site area of 190 ha that had “undergone complete habitat loss since their conservation value was recognised” during the 1990’s. A further 47 fen sites with a total site area of 2,463 ha, out of a total of 342 sites recognised in the IPCC study, were reported to have been “damaged since their conservation value was recognised”. This represents some 14% of the sites listed in this study. A further 86 sites are listed by Crushell as being threatened by a variety of activities including drainage, agricultural reclamation, afforestation, infilling, turbary *inter alia* (25% of the sites listed by the IPCC).

It is unclear, from the Crushell study, whether the annual incremental decline in habitat area exceeds the 1% per annum threshold set as unfavourably bad by the assessment criteria for this specific habitat.

Analysis of the sites held in the NPWS Fen Study database (Foss 2007), showed that of the 808 sites listed 448 sites (55% of the total) had been affected by damaging operations or were threatened by such activities. In total 377 sites had experienced serious or very serious damage as defined by the NHA standard data forms (data mainly compiled in the 1993-1995 period), representing 47 % of all fen sites in the NPWS Fen Study database (Foss 2007). A further 311 sites were threatened by such activities which represents 39% of the listed sites. Of the sites assessed for damaging activities and threats within the NPWS Fen Study database, only 86 sites (11% of the total) showed no damaging activity, while 83 sites (10% of the total) were considered to have no threats.

Specifically for Petrifying spring, the results of the NPWS Fen Study (Foss 2007) showed that, 41 sites with a habitat area of 10 ha (28%) have been damaged by human activities, while 47 sites with a habitat area of 18.5 ha (52%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 19.8 ha or 55% of the presently recorded Petrifying spring resource. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum area estimate.

Again it is unclear, from this study, whether the annual incremental decline in habitat area exceeds the 1% per annum threshold set as unfavourably bad by the assessment criteria for this specific habitat.

The NPWS Fen Study (Foss 2007) found that the **current habitat area** in Ireland (based on known and predicted area information), as defined by the list of sites for this habitat listed in the NPWS Fen Study database (Foss 2007) covers an area of 0.36 $km^2$ in a total of 112 sites.

The **Favourable Reference Area (FRA)** is considered to be the area of this habitat in all sites listed in the NPWS Fen Study (Foss 2007) database, and is the same as the current area.

According to the to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive) the area covered by the habitat type within the range is **Favourable**.

- **Known area covered by the habitat:** 0.36 $km^2$. **Should be regarded as a minimum until detailed surveys completed.**
- **Favourable Reference Area:** 0.36 $km^2$. **All known site with the habitat. Should be regarded as a minimum until detailed surveys completed.**

## 5. Structures and Functions

### 5.1. Habitat Structures and Functions

Satisfactory data on habitat quality, and habitat change trends are lacking for this habitat in Ireland.

The IPCC fen study of Crushell (2000) referred to in section 4.1 above, showed that 10 fen sites with a total site area of 190 ha that had “undergone complete habitat loss since their conservation value was recognised “ during the 1990’s. A further 47 fen sites with a total site area of 2,463 ha, out of a total of 342 sites recognised in the IPCC study, were reported to have been “damaged since their conservation value was recognised”. This represents some 14% of the sites listed in this study. A further 86 sites are listed by Crushell as being threatened by a variety of activities including drainage, agricultural reclamation, afforestation, infilling, turbary *inter alia.* (25% of the sites listed by the IPCC).

Analysis of the sites held in the NPWS Fen Study database (Foss 2007) showed for Petrifying spring, 41 sites with a habitat area of 10 ha (28%) have been damaged by human activities, while 47 sites with a habitat area of 18.5 ha (52%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 19.8 ha or 55% of the Petrifying spring resource. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum area estimate.

The damage caused to fen habitats and reported by Crushell (2000) and noted during the NPWS Fen Study (Foss 2007) has presumably been coupled with a decline in habitat quality (i.e. structure and functions).

It is likely that the number of sites for the habitat which have experienced damage in the past from a variety of negative factors (i.e. burning, peat extraction, dumping, infilling, over grazing) or suffered alteration in hydrological conditions (i.e. local drainage, arterial drainage, water abstraction etc.) or are threatened by these and other activities, is in fact much higher than indicated by these two studies. However, without a national survey to record such damage and threats no more specific assessment of conservation status can be undertaken at present.

Although, the overall extent of the habitat may remain unchanged in some cases, adverse changes in some of the above attributes would indicate deterioration in overall habitat structure and function.

### 5.1.1. Conservation Status of Habitat Structures and Functions

Satisfactory data on habitat quality, and habitat change or species trends are lacking. Based on available information and expert opinion it is likely that more than 55% of the area of the habitat in Ireland is unfavourable conserved as regards its specific structures and functions (including typical species). Conservation status of habitat structures and functions is therefore regarded as unknown but likely to be **Unfavourable Bad**.

## 5.2. Typical Species

Petrifying springs are irrigated and kept permanently moist by water that is calcareous and oligotrophic. These springs may be associated with shallow peaty or skeletal mineral soils. There may be some precipitation of marl, or tufa formation. Calcareous springs are typically dominated by mosses, and by *Cratoneuron* spp. in particular; *Bryum pseudotriquetrum* is also characteristic. Other common components of the vegetation include grasses (*Festuca rubra, Briza media*), sedges (*Carex dioica, C. pulicaris, C. flacca, C. nigra*), Common Butterwort (*Pinguicula vulgaris*) and Marsh Horsetail (*Equisetum palustre*). The relatively rare Yellow Saxifrage (*Saxifraga aizoides*) can occur in calcareous springs and is diagnostic of this habitat (Fossitt 2000).

According to the 2003 version of the Interpretation Manual the characteristic plant communities and species of Petrifying spring habitat (7220) are as follows:

Hard water springs with active formation of travertine or tufa. These formations are found in such diverse environments as forests or open countryside. They are generally small (point or linear formations) and dominated by bryophytes (Cratoneurion commutati). Plants: *Arabis soyeri, Cochlearia pyrenaica* (in sites with heavy metals), *Pinguicula vulgaris, Saxifraga aizoides*. Mosses: *Catoscopium nigritum, Cratoneuron commutatum, C. commutatum* var. *falcatum*, *C. filicinum, Eucladium verticillatum, Gymnostomum recurvirostrum*. In the Boreal region also *Carex appropinquata, Epilobium davuricum, Juncus triglumis, Drepanocladus vernicosus, Philonotis calcarea, Scorpidium revolvens, S. cossonii, Cratoneuron decipiens, Bryum pseudotriquetrum.* Can form complexes with transition mires, fens, chasmophytic communities of cold and humid environments and heaths and calcareous grassland (Festuco-Brometalia).

While CORINE defines the habitat and species as "Gushing springs, spring basins and seepages and the communities closely associated with them and dependent on the peculiar micro climatic and hydrological situations created by springs. These comprise the specialised spring communities (Montio-Cardaminetea) as well as the fen communities (Caricetalia davallianae 54.2, Caricetalia fuscae 54.4) or other communities (Caricion bicoloris-atrofuscae 54.3, Festuco-Brometea 34.3) that are interwoven with them".

Table 3.1 shows characteristic species for the habitat as defined by the Habitats Directive; phytosociological association character and prominent species; characteristic species for the habitat in general in Ireland as well species considered to be indicators of good site quality or typical species as defined by the Directive (Ó Críodáin, C. *pers. comm.*).

**Table 3.1 List of typical species of Petrifying Springs habitat in Ireland**

| Species | Characteristic species in the Habitats Directive Interpretation Manual (2003) | Association Character & prominent species on Petrifying springs (White & Doyle, G.J., 1982) | Typical or good site quality indicator species (Ó Críodáin, C. *pers. comm.*) | Characteristic Irish Petrifying spring species |
|---|---|---|---|---|
| Alchemilla glabra | | Character | | Yes |
| Briza media | | | | Yes |
| Bryum pseudotriquetrum | | | Yes | Yes |
| Calliergonella cuspidata | | | | Yes |
| Caltha palustris | | | | Yes |
| Carex dioica | | | Yes | Yes |
| Carex flacca | | | | Yes |
| Carex nigra | | | | Yes |
| Carex pulicaris | | | | Yes |
| Cratoneuron filicinum | Yes | Character | Yes | Yes |
| Equisetum palustre | | | | Yes |
| Equisetum telmateia | | | | Yes |
| Equisetum variegatum | | | | Yes |
| Eucladium verticillatum | Yes | | Yes | Yes |
| Festuca rubra | | | | Yes |
| Galium palustre | | | | Yes |
| Hamatocaulis vernicosus | | | | Yes |
| Juncus bulbosus | | | | Yes |
| Palustriella commutata | Yes | Character | Yes | Yes |
| Palustriella commutata var. falcatum | Yes | Character | Yes | Yes |
| Philonotis calcarea | | Character | Yes | Yes |
| Pinguicula vulgaris | Yes | | Yes | Yes |
| Plagiomnium ellipticum | | | Yes | Yes |
| Potamogeton polygonifolius | | | | Yes |
| Sagina nodosa | | | | Yes |
| Saxifraga aizoides | Yes | Character | Yes | Yes |
| Saxifraga hirculus | | | Yes | Yes |
| Saxifraga oppositifolia | | Character | | Yes |
| Selaginella selaginoides | | Character | Yes | Yes |
| Sphagnum teres | | | | Yes |
| Tomentypnum nitens | | | Yes | Yes |
| Warnstorfia exannulata | | | | Yes |

The final list includes species that are characteristic of the habitat expanded to include those species indicative of good habitat quality, which might be included in future surveys of the habitat. An over representation of a single species does always indicate good habitat quality.

This list is slightly different from that in the Interpretation Manual of the Habitats Directive, as certain species are included in the Interpretation Manual as characteristic of the habitat but do not occur on Irish site. The list also reflects recent changes in species nomenclature.

### 5.2.1. Conservation Status of Habitat Typical Species

No specific studies have been undertaken on conservation status of habitat typical species in Ireland.

Nonetheless, the assessment of the habitat quality (i.e. Structure and Functions, see above) is partially based on changes in habitat extent and can be used to assess the conservation status of Typical Species. The definition of a habitat is based on the presence and dominance of certain typical species, with particular emphasis on sedges and brown mosses. Thus, a decline in habitat quality (estimated at 55% of the area of this habitat damaged and threatened in Ireland) is likely to have resulted in a decline in the presence of Typical Species. The conservation status of habitat structures and functions is regarded as **Unknown** for this habitat.

As habitat quality and typical species are so interdependent, it can be suggested that an **Unknown** but likely to be **Unfavourable Bad** conservation status can also be inferred for Typical Species.

## 6. Impacts and Threats

As Petrifying springs are dependent on a constant flow of water, any change in the hydrological condition of these often sites of limited expanse may result in their rapid disappearance. To preserve the habitat it is essential to preserve the whole hydrological system concerned.

A variety of impacts and threats are recognised which have resulted in the historic decline of Alkaline fen, and the their associated Petrifying Springs in Ireland to the levels we see today, and continue to threaten the habitat. Peat or turf cutting, arterial drainage, local drainage, water abstraction and agricultural reclamation are reported as being the most significant activities affecting the conservation status of Alkaline fens (Foss *et al*. 2001, Hammond 1979, Crushell 2000, Curtis *et al* 2006). Most, if not all of these would also lead to a decline in Petrifying Spring habitats.

In more recent times a series of additional factors have also damaged fen sites of conservation value (Foss *et al*. 2001, Crushell 2000). These impacting activities include drainage associated with reclamation for agriculture or general land "improvement", infilling of sites with building waste, dumping of household refuse, afforestation, water pollution and urban expansion (Foss *et al*. 2001, Crushell 2000, Curtis & McGough 1981). Crushell (2000) list some 46 fen sites with a total site area of 2,463 ha that have been damaged by these activities, while 86 fen sites are listed as being threatened by these activities.

These activities were found to seriously disrupt the hydrological conditions needed to maintain these habitats, leading to desiccation of the fen and loss of the characteristic micro-topographical features and eventually change in flora and fauna (Foss *et al*. 2001). These activities have resulted in at least a 79% decline in the extent of Irish fens (Foss *et al*. 2001) with only an estimated 21% remaining in a conservation worthy condition.

Of the remaining sites, 80% are reported to be small in size (less than 100ha) making their future management particularly susceptible to external environmental changes (Foss *et al*. 2001). While in the most recent NPWS Fen Study (Foss 2007) of the 112 Petrifying springs identified in Ireland, almost 50% (56 sites) had a total site area smaller than 50 ha.

A review of damaging activities and threats reported on sites from 1993 to-date was also undertaken as part of this conservation assessment. Data on activities affecting or likely to affect sites were collated against individual sites from various sources.

These included:

- Recent site surveys undertaken by NPWS where damage to fens was reported
- Damage reported to fen sites in the IPCC Fen Study (Crushell 2000)
- Damage assessment section of the NHA standard data forms held by NPWS created as part of the NHA surveys of the mid to late 1990's. Only serious or very serious damage, as reported on the NHA data

forms, and likely to affect the fen habitats on sites was recorded in the NPWS Fen Study database (Foss 2007)

- Site Inspection Reporting (SIR) programme. Reporting under SIR is carried out on a three yearly cycle that began in 1998 (i.e. 1998-2000; 2001-2003; 2004-2006). The Research Branch Monitoring Section (NPWS) developed the SIR programme to be used as a monitoring tool. Local NPWS staff log the following info: activities occurring on the site and their effects on the site's integrity, follow-up actions including all outcomes such as prosecutions, notifiable actions and positive management undertaken and site patrolling frequency and purpose.

Analysis showed that of the 808 sites listed in the NPWS Fen Study database 448 sites (55% of the total) had been affected by damaging operations or were threatened by such activities. In total 377 sites had experienced serious or very serious damage as defined by the NHA standard data forms, representing 47 % of all fen sites in the NPWS Fen Study database (Foss 2007). A further 311 sites were threatened by such activities which represents 39% of the listed sites.

For Petrifying spring, 41 sites with a habitat area of 10 ha (28%) have been damaged by human activities, while 47 sites with a habitat area of 18.5 ha (52%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 19.8 ha or 55% of the Petrifying spring resource. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum area estimate.

### 6.1. Agriculture & Land Reclamation

Crushell (2000) reported that the most serious impact on fens has been for their reclamation for agricultural land. The process involves drainage, fertilisation, reclamation and the removal of peat. The fact that alkaline fens (and associated areas of Petrifying springs, calcareous species rich Cladium fen, and Transition mires) are most commonly found over limestone and are indicative of fertile land has resulted in many areas with such communities being drained and utilised for agriculture (O'Criodain & Doyle 1997). Drainage is undertaken to dry out the actual fen habitat surface, or the agricultural land or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural.

From the mid 1800's to the present day the total area of and drained under the various Acts and Schemes amounted to more than 2 million hectares, or some 30% of the total land area in Ireland (Anonymous 1999). Much of this work was carried out under the following: the 1945 Arterial Drainage Act, the Land Project of 1949, the Farm Modernisation Scheme 1974-1985, and the Western Drainage Package 1979-1988. These schemes are likely to have had a serious impact on many fen systems, a fact that is supported by evidence from the Arterial drainage act which resulted in drainage works being carried out on 38 catchments in Ireland, affecting some 262,800 ha of land. Since the mid 1980's there has been a substantial decline in grant aided drainage schemes.

Land reclamation has also been grant aided under the now suspended Farm Improvement Programme and the Programme for Western Development. Between 1981 and 1990 more than 25,000 approvals for intensive lowland reclamation works were made and provided with Euro 25 million in grant aid.

#### Agriculture & Land Reclamation Trend

No specific studies have been undertaken on agriculture and land reclamation trends of the habitat in Ireland.

Although larger grant aided schemes have now ceased, small scale drainage and improvements works often carried out on agricultural land surrounding the fen habitat continue to damage these sensitive wetland systems.

### 6.2. Drainage

Drainage is conducted to dry out the actual fen habitat surface, or the agricultural or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural purposes and the cutting of turf.

These drainage activities seriously disrupt the hydrological conditions needed to maintain these water dependent habitats, leading to desiccation of the habitat, disruption of the continuous water supply that is needed and loss of the characteristic micro-topographical features which eventually leads to change in flora and fauna, through the loss of character species and/or the invasion of species that thrive in drier conditions (Foss *et al*. 2001).

To preserve the habitat it is essential to preserve the whole hydrological system concerned and maintain the constant supply of water

### Drainage Trend

No specific studies have been undertaken on drainage trends of the habitat in Ireland

Although, according to the findings of numerous surveys conducted on sites with this habitat, drainage operations are a recurring feature that continues to threaten the integrity of sites or to lead to their degradation.

## 6.3. Turf cutting

Although turf cutting has its most significant affect on the acid bogs from which the turf is cut, drainage works associated with this activity may adversely affect many low lying areas, where fen and spring communities occur. In addition, with more modern forms of mechanised peat extraction (see below), the peat must be spread over dry marginal land beside the bog to allow it to dry, a feature which necessitates improved drainage on these marginal areas.

Turf cutting, which in the past mainly consisted of hand cutting, became mechanised since the 1980's and was stimulated by the introduction of the Turf Development Act in 1981. The mechanisation of peat extraction by private producers allowed the exploitation of small bogs by small commercial companies and co-operatives. This has been accompanied by intensive drainage of the high bog, which was practically non-existent on the smaller bogs up to 1981.

Therefore, in the last two decades, medium and small size bogs have been increasingly severely impacted by mechanised turf cutting. In the view of the IPCC (Foss *et al*. 2001), the widespread use of machinery has in recent years greatly accelerated the process of decline in peatland resource, particularly Lowland Raised Bogs. They consider that, more peat is now being harvested over a wider area of bog and on a semi-commercial basis since the decline of hand cutting. This has in many cases altered the scale of cutting from the traditional domestic small scale level to much more intensive semi-industrial scale extraction.

### Turf Cutting Trend

The mechanisation of peat extraction has increased the amount of peat extracted from active turf plots and thus the negative effects of this activity. Mechanisation has correlated with a reduction in manual extraction.

Following the publication of the list of SAC raised bog sites in 1997, there was prolonged and strenuous objection from turf cutters. The objectors especially concerned about loss of property rights, loss of future fuel supplies and loss of a way of life in the summer months. The then Minister, Síle de Valera T.D., addressed the objections of bog owners by allowing them cut for domestic use for 10 years, up to and including 2008, at which stage all cutting would have to cease. When the NHAs were designated in 2004, a similar 10-year derogation was put in place, allowing cutting until 2014.

The Department of Environment, Heritage and Local Government (DEHLG) has introduced two voluntary turf cutting cessation schemes since 1999 to buy out turbary rights in NHAs and SACs. The schemes, which were relatively successful in dealing with obvious commercial activity (i.e. moss peat developments), were less successful in dealing with small scale, semi-commercial to commercial fuel peat operations and have had almost negligible impact on domestic cutting. The schemes do not appear to have significantly reduced the numbers of cutters and thus the negative effects of cutting on raised bog priority habitats (Fernandez *et al*. 2006). Thus, unless a more restrictive approach (i.e. mandatory cessation of cutting coupled by compensation packages) is taken, turf cutting is likely to continue at current levels or even increase with increasing fuel prices.

## 6.4. Afforestation

Forestry, which mainly consists of coniferous plantations, is found either on the raised or blanket bog or on the cutover area adjacent to these bog types bog. Surface drainage is always associated with forestry plantations and has similar negative effects to that carried out to facilitate peat cutting and land reclamation. However, other impacts such as shading of vegetation and compression of the peat caused by heavy machinery are related to afforestation.

Egan (1999) mentioned that in 1987, Coillte initiated a major afforestation programme on cutaway bogland and up to 1998 over 4,000 ha were planted.

### Afforestation Trend

EU grant aid for private forestry, which is administered by the Forest Service of the Department of Agriculture and Food, is now withheld for designated peatlands. Indeed, according to the Forestry Service biodiversity strategy, areas designated as SAC or SPA are not considered for afforestation grants. NHAs may also be excluded if the proposed development is incompatible with their protection (McAree, 2002). On the other hand, all grant-aided development in Ireland must also conform to the Forest Service Forest biodiversity guidelines which set out measures to protect existing habitats and wildlife and to maximise the biodiversity of forest.

Coillte Teoranta, one of the major owners of peatland in the country, has ceased planting conifers on intact peatlands on its ownership, principally on economic grounds. It has also made strong commitments to the implementation of the Helsinki Process on Sustainable Forest Management and as part of their Nature Conservation Program. Coillte has initiated *Blanket Bog & Raised Bog Restoration Projects* that will result in the felling of coniferous plantations and drain blocking on some of their peatland sites.

The threat from afforestation on SAC & NHA designated sites therefore appears to be declining particularly. The current trend for un-designated sites is unknown.

## 6.5. Other Impacting Activities

Impacting activities such as over grazing by cattle and sheep, associated poaching by grazing animals, reduction in grazing leading to scrub invasion, burning, dumping of domestic waste, landfill dumping, fertilisation, water pollution, communication routes, cultivation, mowing/cutting, modification of inland water structures, sand and gravel extraction are among the impacting activities that have been reported on sites with the habitat (Foss 2007; Curtis *et al* 2006 see Table 6.1).

Specifically they may occur within and around locations for this habitat. These activities are considered to have negative impact on the habitat where they occur or where they affect the aquifer.

Water pollution, especially by phosphate, is considered by Curtis *et al* (2006) to be less likely to affect Petrifying springs than adjacent areas of Alkaline fen due to the co-deposition of calcium phosphate with calcium carbonate in Petrifying springs.

However, Curtis considered the sensitivity to nitrogen pollution to be a factor more likely to affect Petrifying springs due to the absence of peat and its buffering capacity. Detailed studies are lacking on the physio-chemical requirements of the habitat in Ireland.

Phosphorus is the limiting nutrient to growth in most fen (Doyle & Ó Críodáin 2003) and elevated levels lead to the vigorous growth of grasses over other species, resulting in the loss of fen species. The role of increased nitrogen levels in the species composition of the habitat is unclear.

Impacting activities may occur within or at some distance from the locations for this habitat. These activities are considered to have negative impact on the habitat where they occur. In terms of their scale, however, they tend to be less widespread than the impacting activities of land reclamation, drainage, peat cutting, and afforestation discussed above.

**Table 6.1: Severity of impacting activities recorded on Petrifying springs fen sites recognised in the NPWS Fen Study (Foss 2007)**

| Main Pressure - Past and present | Level of Impact |
|---|---|
| 143 Overgrazing by cattle | Moderate/Significant |
| 150 Restructuring of agricultural land holding | Significant |
| 152 Removal of scrub | Minor |
| 160 General Forestry management | Moderate |
| 161 Forestry planting | Moderate |
| 300 Sand gravel extraction | Moderate |
| 301 Quarries | Moderate |
| 310 Peat Extraction | Moderate |
| 312 Mechanical removal of peat | Moderate |
| 400 Urbanised areas, human habitation | Moderate |
| 421 Disposal of household waste | Minor |
| 502 Communication networks routes, auto routes | Moderate |
| 701 Water Pollution | Moderate |
| 790 Other pollution or human impacts | Minor |
| 800 Landfill, land reclamation and drying out, general | Significant |
| 803 Infilling ditches, dykes, ponds, marshes and pits | Significant |
| 810 Drainage | Significant |
| 890 Other human induced changes in hydraulic conditions | Significant |
| 900 Erosion | Moderate |
| 954 Invasion by a species | Minor |

## 7. Future Prospects

### 7.1. Negative Future Prospects

Deterioration of the Petrifying spring hydrology at current rates caused by the main threats of water abstraction and related drainage activities, forestry and land reclamation will continue to affect the viability of the habitat. Other negatively influenecing activities (see Table 6.1 above) may also result in further habitat decline at less significant levels than that caused by the main threats.

No accurate survey data on damage occurring on the known habitat national resource exists. However, the majority of anecdotal information from recent site specific surveys indicate that the Future Prospects for the habitat is Poor or Bad.

Furthermore, climate change predictions of increases in temperatures accompanied by a decrease in summer rainfall would increase the summer moisture deficit of Petrifying spring and potentially affect species composition on sites. This would result in further habitat losses, reduction in habitat quality and possible reduction in habitat viability.

### 7.2. Positive Future Prospects

No specific national management programme designed to ensure the favourable conservation status of sites with this habitat have been undertaken in Ireland (Ó Críodáin pers comm.).

Petrifying spring habitats may, however, benefit indirectly from a number of individual management and restoration programmes being carried out in Ireland, though these benefits are likely to be relatively restricted in terms of the overall extent of the habitat resource benefiting from these initiatives. In addition a variety of national measures under various schemes, Directives and survey and research programmes may also benefit sites with this habitat. The various initiatives occurring are outlined below:

### NPWS National Fen Survey of Ireland

Due to limitations in the current knowledge of the Irish fen resource, in terms of both the fen types identified on many sites to date, and the extent of the habitat type(s) within sites (Foss 2007), the NPWS initiated the National Fen Survey of Ireland in 2007. The first detailed pilot survey is being undertaken in County Monaghan in conjunction with Monaghan County Council.

The aims of the County Monaghan and future fen surveys, will be to survey known and recently reported fen sites in each Irish County, locate further sites of conservation value, characterise the fen habitats present (including EU Annex I fen habitat types) in terms of their floristics, hydrology and water chemistry parameters, estimate the extent of fen habitat(s) present on each site, rate site and habitat quality, record threats and damaging operations and make management priorities and needs recommendations to ensure long term conservation and viability of the key sites identified, and their associated fen habitats.

Results of the National Fen Survey will feed into the respective County Development Plans and the NPWS conservation designation process.

### NPWS Site Research & Restoration Work

The NPWS has undertaken an on-going research programme at Pollardstown Fen, Co. Kildare on the relationships between the hydrology and the ecology of Petrifying Springs and Alkaline fen habitats on the site. This has yielded valuable information on the extent of the impacts arising from small decreases in the water levels of the supplying aquifer on the fen habitats occurring at the site.

In response NPWS has taken mitigation actions and are developing plans for habitat enhancement to offset potential future impacts. This work is being and will be used to develop national risk assessment and monitoring approaches under both the Water Framework Directive and Habitats Directive for Petrifying Springs and Alkaline Fens.

Curtis *et al*. 2006 indicates that the potential for restoring stands of Alkaline fen and associated Petrifying Spring areas is largely untested, and is dependent on the nature and extent of the damage. Restoration trials are at an early stage on Pollardstown Fen, Co. Kildare and Blackditch, Co. Wicklow. These trials intend to improve the areas of all fens community types including Petrifying Springs. The major tool being tested is restoration of the original water levels at both sites, appropriate ditch and drain management, with scrub or woodland removal and re-introduction of grazing at the latter site. The work on Pollardstown Fen is reported on in more detail in the conservation assessment for alkaline fen.

### EU Life - Nature Programme

Coillte Teoranta initiated a *Raised Bog Restoration Project* in 2004. This was funded by an EU Life - Nature Programme. This project will be completed in 2008 and forms part of Coillte's Nature Conservation Programme. The project will work towards restoring 571.2 hectares of raised bog habitat on its property in the midland counties. This project area will be managed with nature conservation as the primary management objective into the future. The project also involves the felling of 450ha of plantation forest, felling of naturally regenerated exotic trees on open bog, perimeter protection of vulnerable raised bog sites against fire, blocking of drains after felling and ongoing monitoring of vegetation and water levels on 14 sites (Coillte, 2005 - www.raisedbogrestoration.ie).

Coillte Teoranta initiated a *Blanket Bog Restoration Project* in 2002. This project, jointly funded by Coillte and DG-Environment under the EU LIFE-Nature Programme, is a four-year scheme, the primary aim of which is to achieve restoration of blanket bog habitat within 1212 hectares of land owned by Coillte. The main focus of the project, active blanket bog, is listed as a priority habitat for conservation under Annex 1 of the EU Habitats Directive, and the areas for restoration either lie within, or occur adjacent to, proposed Special Areas of Conservation. A total of 14 blanket bog sites, most of which are located along the western seaboard of Ireland, have been selected for restoration. At most sites, the main restoration measures to be employed are the removal of conifers and the blocking of any existing drains (http://www.irishbogrestorationproject.ie/).

## Cutaway Bog Restoration Projects

A further trend which may facilitate the creation of new secondary Petrifying spring sites, over the long term, is the abandonment of former cutaway peat areas following the extraction of commercial peat reserves. On these sites, the cessation of drainage activities used to keep the areas dry enough to allow peat extraction, results in partial re flooding of areas, which due to contact with the underlying mineral soils or fossil fen peat allows the regeneration of Alkaline fen communities and possibly associated Petrifying spring habitats (Egan 1999, Farrell 2006).

Bord na Móna (Irish Turf Development Bord) initiated a series of cutaway bog restoration projects in the 1990's in County Mayo (Anonymous 2003; Farrell & Doyle 1998; 2003) and in the midlands (Farrell 2006). Cutaway bog is the term used to describe peatland from which the economically recoverable layers of peat have been extracted for commercial or domestic purposes. There will be up to 70,000 ha of these lands emerging as a result of Bord na Móna's present peat production activities. The potential exists to create a future landscape of forestry and open grasslands interspersed with lakes, wetlands and natural corridors for wildlife; a landscape which is both economically productive for its communities and which respects and values areas of wilderness alongside commercial enterprise (http://www.bnm.ie).

## NPWS Site Conservation Designations

One further positive prospect for the habitat in Ireland is that 67% (24 ha) of all sites recorded within the NPWS Fen study database (Foss 2007) are within a candidate SAC (cSAC) and an additional 33% (12 ha) of sites are within a candidate Natural Heritage Area (cNHA).

In the case of Petrifying Spring sites 36 ha or 100% of the known habitat area falls within a candidate designated (SAC or NHA) area in Ireland, which should in the long term provide an additional degree of protection for these sites. This optimism must, however, be tempered by the fact that habitat loss in terms of extent and quality are still occurring within candidate SAC and NHA due to human interference (see above).

## NPWS SAC, SPA and NHA Conservation Management Plans

The NPWS is planning to produce Conservation Management Plans for each SAC, SPA and NHA in Ireland. Each plan will list the wildlife resources of the area, the current human uses, any conflicts between the two, and strategies for retaining the conservation value of sites. The draft plans will be given to a liaison committee and other interested parties for discussion and consultation. The NPWS will then prepare a final version of the conservation plan. Consultation on draft consultation plans has begun. Conservation Plans, once complete, will be reviewed on a 5 year cycle.

Data provided by the Management Planning Services Unit (MPSU) section in NPWS (dated 21 February 2007) indicates that 382 conservation plans are presently planned for wildlife sites in Ireland. In total 274 plans are in preparation, 64 plans are completed an ready to go to consultation, while 44 are in consultation or have gone through this process. Within the NPWS Fen Study database (Foss 2007) of the 808 fen sites listed a total of 219 sites have management plans in preparation, 38 plans are completed an ready to go to consultation, while 40 are in consultation or have gone through this process. Implementation of the recommendations in these plans will provide additional conservation protection to fens within the listed sites.

To provide increased conservation protection under the Habitats Directive to SACs from damaging activities, a series of Notifiable Actions have been drawn up by the Department of the Environment (see Appendix IV) on these areas. A landowner must obtain a written consent before performing and such operations on, or affecting the land or waters within an SAC.

## Rural Environment Protection Scheme

Rural Environment Protection Scheme (REPS), is a scheme designed to reward farmers for carrying our their farming activities in an environmentally friendly manner and to bring about environmental improvement on existing farms. The objectives of the Scheme are to:

- establish farming practices and production methods which reflect the increasing concern for conservation, landscape protection and wider environmental problems;

- protect wildlife habitats and endangered species of flora and fauna;
- produce quality food in an extensive and environmentally friendly manner.

When properly implemented the scheme can benefit sites with this habitat in Ireland, although the lack of sufficient scientific and management expertise needed at a local level, on sites with the habitat, may be a hindrance to achieving this goal.

**EU Water Framework Directive**

Under the Water Framework Directive (2000/60/E) all inland and coastal waters within defined river basin districts must reach at least good status by 2015 and the Directive further defines how this should be achieved through the establishment of environmental objectives and ecological targets for surface waters. Efforts to protect water dependent habitats, which include Alkaline Fen, Transition Mire, Petrifying Springs and Calcareous Fens with Cladium mariscus are being taken within each River Basin District. This is critical as far as protection of the water supplies for these groundwater dependant systems are concerned.

All SACs and, in future, NHAs in which these fen habitats as a qualifying interests will be listed in the Register of Protected Areas drawn up for each River Basin District.

The Water Framework Directive requires that an integrated monitoring programme be established within each river basin district. These monitoring programmes will in many cases be extensions or modifications of existing programmes and will enable collection of the physical, chemical and biological data necessary to assess the status of surface and groundwater bodies in each river basin district.

Where water quality or supply issues are, or have the potential to, impact adversely on sites, this will have to be dealt with through the Programme of Measures associated with each River Basin District Management Plan.

### 7.3. Overall Habitat Future Prospects

No specific management programmes designed to ensure the favourable conservation status of sites with this habitat have been undertaken in Ireland.

Negative actions such as land reclamation, turf cutting, and drainage continue impacting the habitat: decreasing its extent and degrading its structure and functions. Only limited measures have been introduced to address these damaging activities, which are likely to have increased in severity since the 1990's.

To summarise the habitat long-term viability is not assured and there are bad prospects for its future. The Future Prospects are unknown but deemed to be **Unfavourable Bad**.

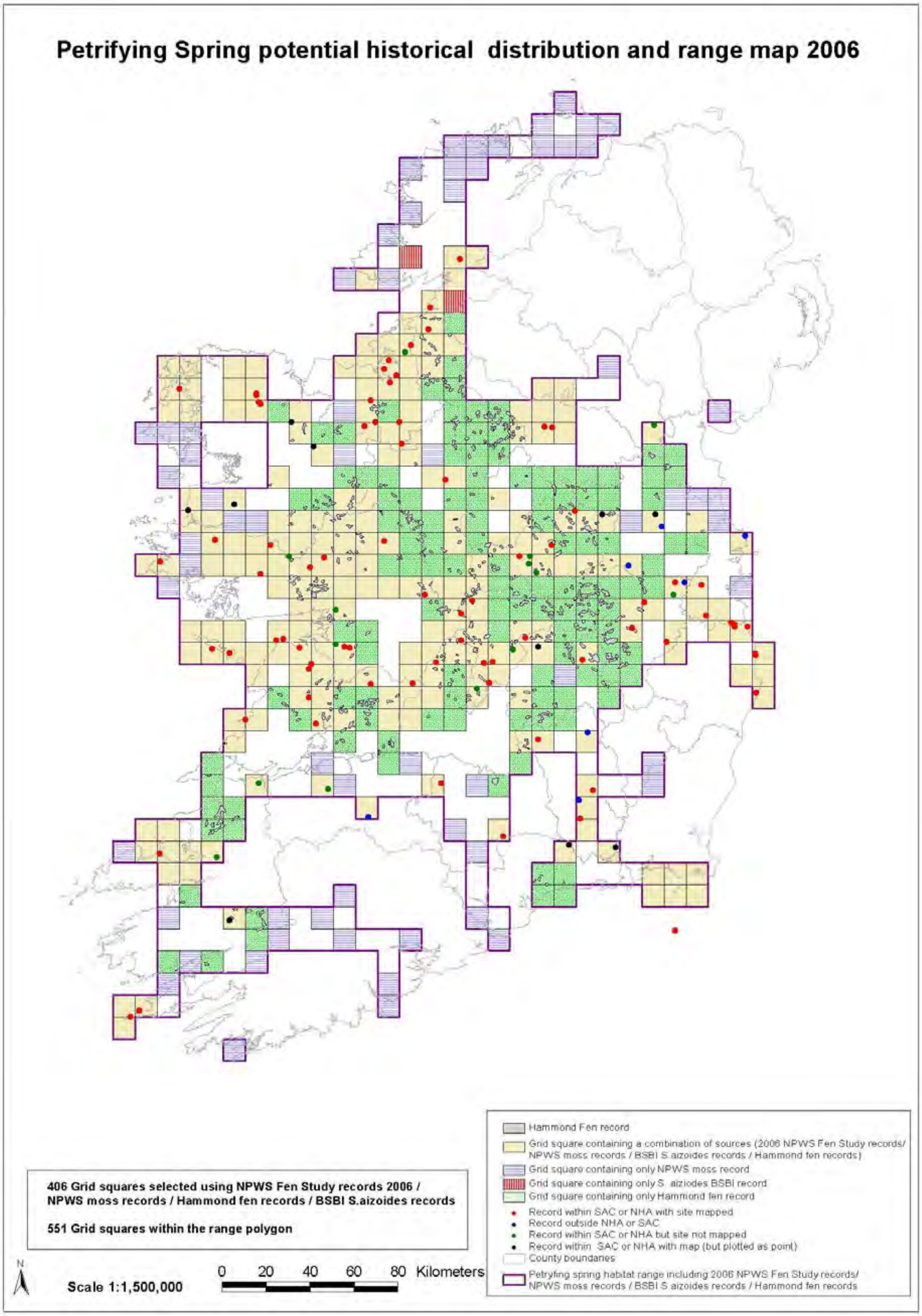
## 8. Overall Assessment of the Habitat Conservation Status

The habitat conservation status of the four main attributes has been assessed as follows:

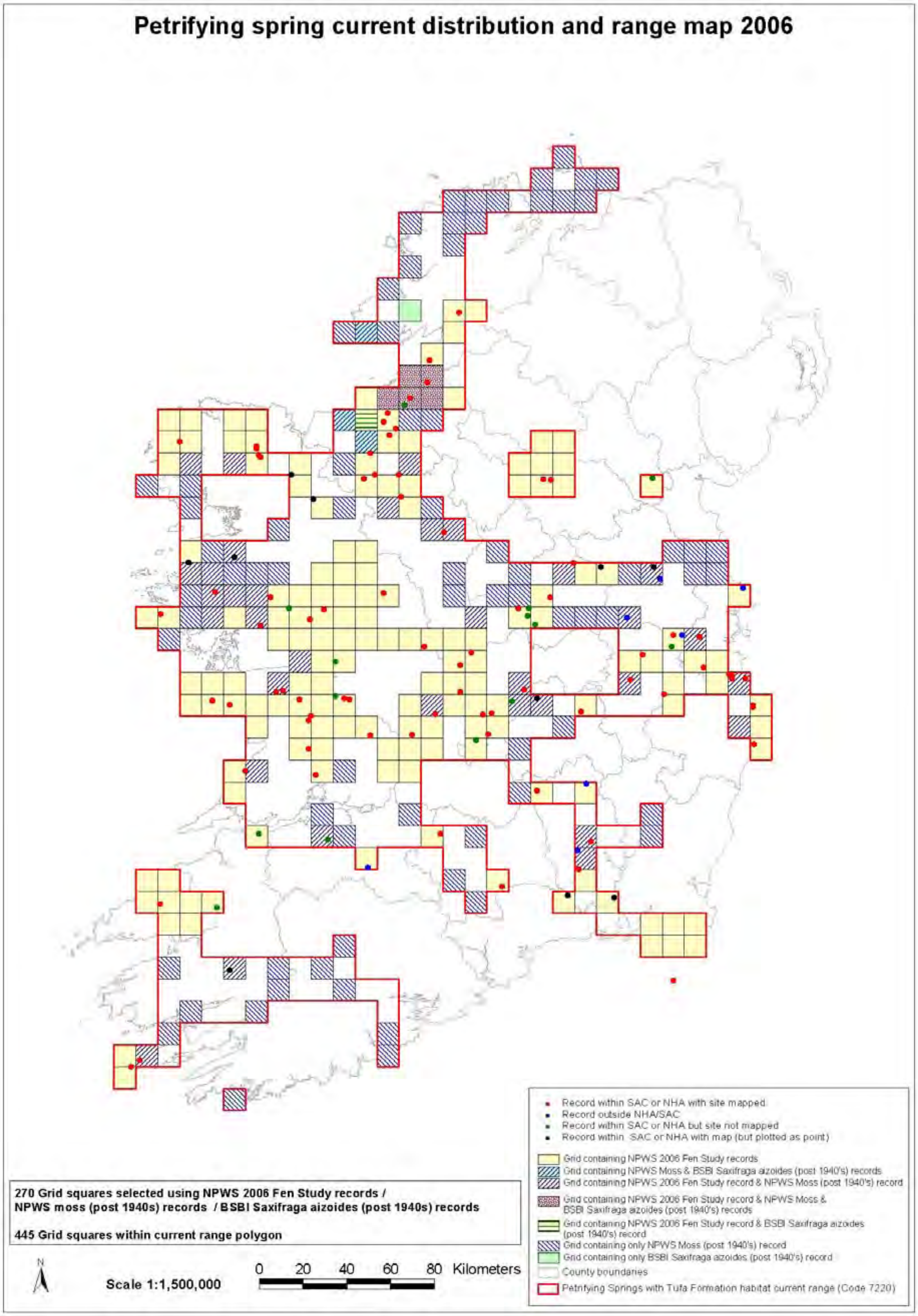
- The **Favourable Reference Range (FRR)** is estimated to be 100% of the current habitat range and thus **Favourable**.
- The extent of Petrifying springs habitat has decreased, though exact figures for the decline area not available. The extent of the FRA of the habitat is the same as the current extent and therefore deemed **Favourable**.
- An **Unfavourable Bad** assessment is given to the **habitat structures and functions** as the decline in habitat quality indicates.
- The **habitat's Future Prospects** are overall deemed to be **Unfavourable Bad**. Ongoing deterioration of the hydrological conditions of Petrifying spring at current rates caused by drainage, reclamation, and infilling threatens the viability of the habitat.

Thus, considering the assessment for the four main habitat's attributes the overall conservation status for Petrifying spring habitat is **Unfavourable Bad**.

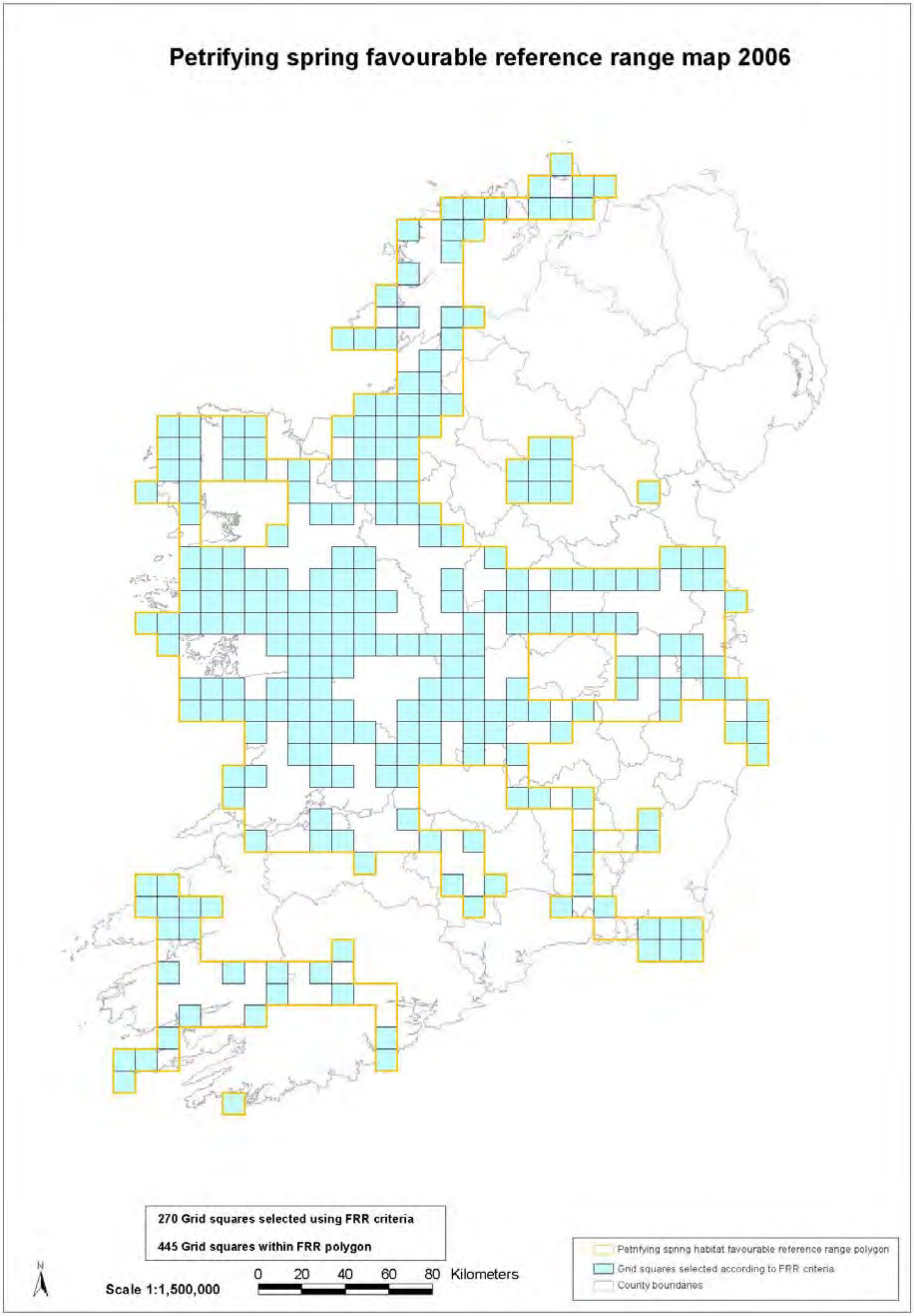
**Map 1: Petrifying springs with tufa formation potential historical habitat distribution and range map**



**Map 2: Petrifying springs with tufa formation current habitat distribution and range map**



**Map 3: Petrifying springs with tufa formation habitat favourable reference range map**

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# APPENDICES

# APPENDIX I

# STUDY OF THE EXENT AND CONSERVATION STATUS OF SPRINGS, FENS AND FLUSHES IN IRELAND

The National Parks and Wildlife Service (NPWS) carried out a *Study of the Extent and Conservation status of Springs, Fens and Flushes in Ireland* (Foss, P.J. 2007) during 2006 with the aim of compiling a comprehensive list of all fen sites in Ireland, classifying these according the EU Habitats Directive fen categories recognised as occurring in Ireland, and assessing the extent of fen vegetation within the sites identified.

No systematic national survey of fens has yet been undertaken in Ireland, in contrast to the situation for raised and blanket bogs. The NPWS Fen study aimed to ascertain our baseline understanding of the fen resource in Ireland.

This study addressed the following research objectives:

- collect and amalgamate data on known fen sites of conservation importance in Ireland from within the NPWS and following consultation with external groups;
- produce a computerised inventory of all sites of known or possible conservation value to include key data on each site, including the specific fen vegetation type(s) present; the known or estimated area of each fen vegetation type; and compile available published and survey information on sites;
- collect data on fen sites without a current conservation designation (outside the NHA and SAC network) but which might be considered for NHA or SAC designation by NPWS following survey and evaluation;
- examine where other sites of conservation interest might be located based on local soil, geological and environmental factors;
- assess the past and present extent of fen habitats in Ireland;
- evaluate each site in terms of its conservation importance, known area information, known survey information, and assign a survey priority to each;
- make recommendations for a future national fen field survey.

The NPWS Fen study focused on 6 fen habitat types of conservation importance (four of which are listed in Annex 1 of the EU Habitats Directive, two of which - denoted with an asterisk - are priority habitats) in Ireland. The Annex 1 fen types investigated during the study include:

**7140 Transition mires and quaking bogs** (Fossitt category PF3)
**7210 *Calcareous fens with *Cladium mariscus*** and species of the *Caricion davallianae* (Fossitt category PF1)
**7220 * Petrifying springs with tufa formation** (*Cratoneurion*) (Fossitt category FP1)
**7230 Alkaline fens** (Fossitt category PF1)

A variety of data sources (reports, publications, databases and other habitat inventory lists), groups and individuals were consulted in the compilation of information for the NPWS Fen Study database, over an eight month period in 2006, from both within NPWS and from external sources. The main sources consulted in the compilation of the NPWS Fen Study database are listed below.

The past extent of fens in Ireland (based on Anonymous 1981; Hammond 1979; Foss, P.J., O'Connell C.A. & Crushell P. (eds.), 2001 *inter alia*) is presented in the report. The original area of fens in Ireland is estimated to have been at least 92,508 ha (Hammond 1979). An estimated 19,660 ha of conservation worthy intact fens, occurring in 367 discrete sites were recognised in Ireland by IPCC in 2001 (Foss *et al.* 2001).

The total area of estimated fen vegetation recorded in the NPWS Fen Study amounted to 22,180 ha within 681 discrete sites (site complex sub-units omitted i.e. sub-sites that occur within existing SAC or NHA). In total the NPWS Fen Study database holds information on 808 sites (which includes 127 sub-site records), where fen habitats are known or believed to occur. This list of sites includes those classified as poor fen and non-calcareous springs.

Annex 1 fens (i.e. Alkaline fen, *Cladium* fen, Transition mire, and Petrifying spring) which most closely relate to the fen types identified in previous studies, was estimated to cover 10,298 ha (in a total of 702 discrete sites) or 46% of the total fen area estimated in the present study. This is an indication that Annex 1 fens are less widespread than previously believed (IPCC 2001).

In relation to the fen habitat types classified within the present NPWS Fen Study, the following number of sites and estimated area (ha) of fen vegetation have been recorded:

- 7210 *Calcareous fens with *Cladium mariscus:* 102 discrete sites with a fen area of 1,486 ha
- 7230 Alkaline fens: 348 discrete sites with a fen area of 6,840 ha
- 7140 Transition mires and quaking bogs: 155 discrete sites with a fen area of 1,955 ha
- 7220 * Petrifying springs: 97 discrete sites with a fen area of 36 ha

These fens can be categorised, in terms of their current conservation designation, as follows:

- The number and area (ha) of fens which have been designated for Annex 1 fen habitats under the Habitats Directive: **68 discrete sites with an area of 2,191 ha of designated fen habitat; representing 21% of the total Annex 1 fen resource estimated for Ireland.**

- The number and area (ha) of fen sites with Annex 1 habitats which are within designated Natural Heritage Areas (NHA) or proposed candidate Natural Heritage Areas (cNHA): **281 sites with an area of 2,747 ha; representing 27% of the total estimated Irish fen resource.**

- The number and area (ha) of fen sites with Annex 1 habitats which are located within designated Special Areas of Conservation (SAC) or proposed candidate Special Areas of Conservation (cSAC): **362 sites with an area of 5,681 ha; representing 55% of the total estimated Annex 1 Irish fen resource.**

- The number of Annex 1 fen habitat sites which were "newly" discovered or reported to the NPWS Fen Study and had no conservation designation: **72 sites with an area of 1,947 ha; representing 19% of the total estimated Annex 1 Irish fen resource.**

The NPWS Fen Study also found that it is very probable that sites with conservation worthy fen communities exist outside of the sites which have been identified in the present NPWS Fen Study. Based on the results of the study the following counties were identified as a priority as part of any future NPWS Fen Field Survey: Clare, Galway, Kildare, Leitrim, Limerick, Mayo, Offaly, Roscommon and Westmeath.

The NPWS Fen Study also found that existing knowledge of the fen resource in Ireland is markedly incomplete. Our knowledge in relation to the specific fen type(s) present, is considered wholly lacking or inadequate (confusion over one or more fen types) for 268 (33%) of sites identified in the present NPWS Fen Study database. While knowledge in relation to the extent of fen type(s) present on sites, is considered wholly lacking for 102 sites (13%), and inadequate for a some further 600 sites identified in the NPWS Fen Study database (i.e. 74%, where only estimated data on fen extent is presently available).

These findings make a systematic survey of existing and newly reported sites a high priority for Ireland, if conservation worthy sites are to be identified and the best examples put forward for conservation under the Natural Heritage Area or European Habitats Directive Natura 2000 (SAC) network and provided favourable conservation status.

Data sources used in the compilation of list of site in the NPWS Fen Study database 2007:

- **Habitat Assignment Project (NPWS 2006)**
  This desktop project was undertaken by NPWS and the main aim was classifying sites according to habitats listed in the Annex I of the Habitats Directive (92/43/EEC). Sites were obtained from a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, NGOs shadow list inter alia.

- **NPWS Enquiries (Sites) Database**
  This is a comprehensive NPWS internal database, which includes data on habitat type and extent, and site designation.

- **CORINE Database – Fen sites**
  This is a NPWS internal database, which includes data on designated CORINE habitat types and extent present within sites listed in the NPWS Enquiries database.

- **IPCC Fen Sites Database**
  The Irish Peatland Conservation Council (IPCC) sites database holding a range of information on sites designated as fens.

- **Conaghan (2000) Blanket bog Database – Fen site list**
  An electronic list of blanket bog sites prepared by Conaghan (2000) for the NPWS which records the occurrence of fen habitats within the mire complexes identified, together with data on their extent.

- **Derwin (2003) Blanket bog Database – Fen site list**
  An electronic list of blanket bog sites prepared by Derwin (2003) for the NPWS which records the occurrence of fen habitats within the mire complexes identified, together with data on their extent.

- **External Expert fen site submissions**
  A number of external submissions were made by expert interests groups and individuals which provided additional sites to the NPWS Fen Study. These included submissions from Bord na Mona, Botanical Society of the British Isles County Recorders, and County Council Heritage/Biodiversity Officers.

# APPENDIX II

# SOURCES OF DATA USED IN THE PRODUCTION OF HABITAT DISTRIBUTION MAPS

The following is a summary of the main sources of information employed to produce the habitat's potential historic distribution and range map, current habitat distribution and range map and the Favourable reference range (FRR) map. These maps and area extent were used to carry out the habitats conservation status assessment for this habitat:

**Potential Historic distribution and range map**:
To-date no map of the potential historical distribution and range of this habitat in Ireland has been available. It was decided to create a potential historical distribution and range map for Petrifying spring based on a series of data sets which would indicate the possible former location of sites with the habitat in Ireland. Information on the habitat range provided by this map could then be compared with the current distribution and range to ensure that an adequate network of sites has been recognised to ensure favourable conservation of this habitat in Ireland. Such an exercise was felt justified in the absence of a systematic field survey of the habitat to date in Ireland.

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site or species record occurred as a point source was included in the range map.

For the Hammond data sets, every grid square which contained a digitised boundary element was included within the range map.

The list of the data sets used in the compilation of the potential habitat distribution and range map (for details of the data sources employed see below) included:

- NPWS Fen Study Database - Foss (2007) – Petrifying spring site list (109 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- Digitised Peatland Map of Ireland - Hammond (1979) – entire Fen data set
- Botanical Society of the British Isles 10 km Flora distribution map for: *Saxifraga aizoides* including all reported records
- British Bryological Society 10 km bryophyte distribution maps for*: Palustriella commutata; Palustriella commutata var. commutata; Palustriella commutata var. falcata; Eucladium verticillatum* including all reported records

**Current habitat distribution and range map**:
The present habitat range is defined as the range of 10 km grid cells which contain a Petrifying spring site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km grid cells which contain a record for the Petrifying spring indicator species *Saxifraga aizoides*, *Palustriella commutata, Palustriella commutata var. commutata, Palustriella commutata var. falcata* and *Eucladium verticillatum.* Extension of the range for this habitat, based on the distribution of these species was felt to be justified, in the absence of any National Fen Survey to-date in Ireland.

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site/ species record occurred as a point source was included in the range map.

The list of the data sets used in the compilation of the current habitat distribution and range map (for details of the data sources employed see this section, below) included:

- NPWS Fen Study Database - Foss (2007) – Petrifying spring site list (109 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- British Bryological Society 10 km bryophyte distribution maps for: *Palustriella commutata; Palustriella commutata var. commutata; Palustriella commutata var. falcata; Eucladium verticillatum* using species records between 1940 and the present.
- Botanical Society of the British Isles 10 km Flora distribution map for: *Saxifraga aizoides* using species records between 1940 and the present.

**Favourable reference range (FRR)**:
The favourable reference range for Petrifying spring habitat is considered to be the same as the current habitat range.

The FRR for Petrifying spring is defined as the range of 10 km grid cells which contain a Petrifying spring site as recorded in the NPWS Fen Study database (Foss 2007), as well as 10 km grid cells which contain a record for the Petrifying spring indicator species *Saxifraga aizoides*, *Palustriella commutata, Palustriella commutata var. commutata, Palustriella commutata var. falcata* and *Eucladium verticillatum.* Extension of the range for this habitat, based on the distribution of these species was felt to be justified, in the absence of any National Fen Survey to-date in Ireland.

<u>Mapping Protocol:</u>

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site/ species record occurred as a point source was included in the range map.

The list of the data sets used to map the Favourable reference range (FRR) (for details of the data sources employed see this section, below) included:

- NPWS Fen Study Database - Foss (2007) – Petrifying spring site list (109 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- British Bryological Society 10 km bryophyte distribution maps for: *Palustriella commutata; Palustriella commutata var. commutata; Palustriella commutata var. falcata; Eucladium verticillatum* using species records between 1940 and the present.
- Botanical Society of the British Isles 10 km Flora distribution map for: *Saxifraga aizoides* using species records between 1940 and the present.

## Further information on data sources:

### A. NPWS Fen Study Database (2007)

As part of the NPWS **Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007** (see project details in Appendix I above) a specific NPWS Fens Study database was created at the outset of this project to hold data on the fen sites recorded during the study.

In summary the main NPWS Fen Study database held information on site provenance or proposer, site names, county, SAC and NHA codes, national grid reference, site conservation designations, habitat information on the specific fen vegetation type(s) present and the area of each (or an estimate where no accurate area data was available), information on rare species of note, a summary of published reports holding information on the site, and a site evaluation section which ranked each site in terms of its conservation importance, area information, survey information, and survey priority (For a full list of data fields recorded in the NPWS Fen Study database see Foss 2007).

Two secondary relational databases (linked to one together by use of site record number and reference code number), hold a list of fen related reports and publications for Ireland, and a publications / report site records database.

The database was created using the Filemaker Pro 8 database package which runs on both PC and Mac platforms.

This database (NPWSFENSURVEY.fp7 Version 1.3) was used to produce distribution maps, habitat area estimates and site lists for the current habitat range and conservation assessment for alkaline fen in Ireland.

**B. Digitised Peatland Map of Ireland - Hammond (1979)**

Hammond's *Peatland Map of Ireland* (1979) is the most comprehensive over-view of the distribution of peatlands and fen in Ireland at the end of the 1970s. Hammond mapped the mire subtypes described by Moore (1962).

Hammond's map is based on data from several sources, principally the detailed soil map data from the National Soil Survey carried out by An Foras Talúntais since 1968, these maps covered 10 counties fully and 2 counties partially. Aerial photographs from 1973/74 together with site visits covered the rest of the country. No aerial cover existed however for county Donegal and parts of counties Sligo, Cork, Waterford and Louth. Hammond acknowledges that the these counties were not covered by the same detailed reconnaissance field sheets as the other counties and were mapped principally on the basis of the far cruder 1920 peat map for Ireland. However, Hammond's map is regarded as the only peatland map which has been methodically produced and which specifically targets peatlands and fens.

Although Hammond maps categorised mires (i.e. blanket bog, raised bog and fen) according to the level of disturbance (i.e. man modified, milled peat, moss peat) the current status of those sites considered unmodified is likely to have changed since 1979. Hammond's maps are therefore not reliable for identifying the current site status due to the impact of the Turf Development Act (1981-1995) supported projects and private afforestation grant aids. However, Hammond's map is considered to be the most accurate national map available for indicating the location of fen peat soils.

The Soils Division of Teagasc has now digitised the original Hammond's *Peatland Map of Ireland* (1979). This was used to refine the habitat distribution map produced from other sources by overlaying the Hammond's digital map on it. This provided further validations for those sites already mapped and most importantly identify fen areas in grid squares where they had not been identified by other sources..

**C. BSBI Flora Atlas (2000)**

10 km square distribution maps produced by the Botanical Society of the British Isles, as part of the New Atlas of the British & Irish Flora 2002. For access to the most up-to-date data sets see National Biological Network Gateway website at http://www.searchnbn.net/index_homepage

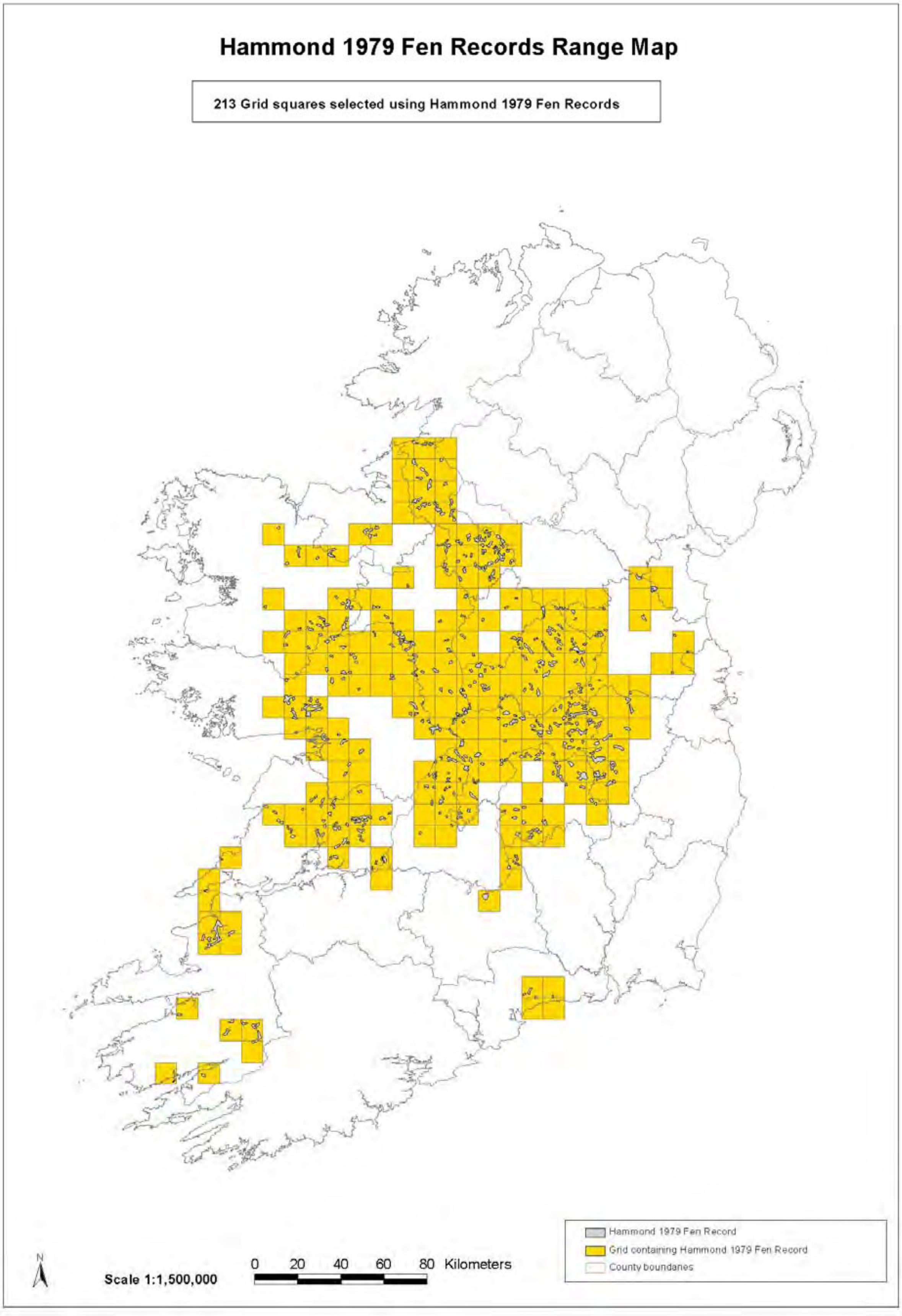
Data sets used in compilation of habitat distribution maps include those for the following species: ***Saxifraga aizoides***

**D. Bryophyte Distribution data (2007)**

10 km square distribution maps obtained from THE DISTRIBUTION OF BRYOPHYTES IN IRELAND: an annotated review of the occurrence of liverworts and mosses in the Irish vice-counties, based mainly on the records of the British Bryological Society (Holyoak 2003) produced by the British Bryological Society, with additional recent additions provided by N. Lockhart, NPWS (pers. comm.).

Data sets used in compilation of habitat distribution maps include those for the following species: ***Palustriella commutata; Palustriella commutata var. commutata; Palustriella commutata var. falcata; Eucladium verticillatum***

**Map 4: Digitised Peatland Map of Ireland - Hammond (1979)**



# APPENDIX III

# HABITAT SITE LIST

| Site Code | SAC/NHA Name | New/Subsite Name | Nat Grid E | Nat Grid N |
|---|---|---|---|---|
| F2705 | | ARDSALLAGH/GRANGE | 289000 | 262600 |
| F771 | | DAINGEAN BEG | 251500 | 138400 |
| F308 | | KNOCKSOUNA SPRING | 155900 | 130800 |
| F307 | | LEIXLIP COLD SPRING, | 299200 | 237000 |
| F778 | | LOUGHSHINNY | 326800 | 258400 |
| F234 | | MUCKALEE | 255300 | 169000 |
| F305 | | ST GORMANS WELL | 273900 | 244900 |
| 000007 | LOUGH OUGHTER AND ASS | | 235800 | 307900 |
| 000007 | LOUGH OUGHTER AND ASS | FARNHAM LOUGH 000981 | 239300 | 307500 |
| 000011 | LOUGH DERG | | 176000 | 191400 |
| 000011 | LOUGH DERG | LOUGH ALEWNAGHTY | 176000 | 191400 |
| 000016 | BALLYCULLINAN LAKE | | 129000 | 185000 |
| 000020 | BLACK HEAD-POULSALLAG | | 114000 | 211000 |
| 000020 | BLACK HEAD-POULSALLAG | GLENINAGH SPRING | 117303 | 211455 |
| 000054 | MONEEN MOUNTAIN | | 124746 | 207500 |
| 000086 | DURSEY ISLAND | | 048000 | 040000 |
| 000128 | LIFFEY VALLEY | | 307000 | 236000 |
| 000139 | ERNE ESTUARY/FINNER D | | 184000 | 362000 |
| 000163 | LOUGH ESKE AND ARDNAM | | 197500 | 384000 |
| 000212 | INISHMAAN ISLAND | | 093000 | 205000 |
| 000213 | INISHMORE ISLAND | | 085000 | 207000 |
| 000216 | RIVER SHANNON CALLOWS | | 198000 | 223000 |
| 000297 | LOUGH CORRIB | | 107000 | 241000 |
| R000365 | KILLARNEY NATIONAL PA | | 093000 | 084000 |
| 000393 | LIFFEY VALLEY MEANDER | | 291000 | 210000 |
| 000396 | POLLARDSTOWN FEN | | 275495 | 216501 |
| 000404 | HUGGINSTOWN FEN | | 252000 | 130000 |
| R000412 | SLIEVE BLOOM MOUNTAIN | GLENLAHAN RIVER VALLE | 233000 | 208000 |
| 000470 | MULLET/BLACKSOD BAY C | | 070004 | 325002 |
| 000474 | BALLYMAGLANCY CAVE, C | | 111376 | 254169 |
| 000564 | RIVER LITTLE BROSNA C | | 198000 | 211000 |
| 000576 | FIN LOUGH (OFFALY) | | 203000 | 229000 |
| 000587 | LOUGH GARA | CALLOW BOG (595) | 171000 | 300000 |
| 000623 | BEN BULBEN, GLENIFF A | | 175120 | 344920 |
| 000627 | CUMMEEN STRAND/DRUMCL | | 165000 | 338000 |
| 000707 | SALTEE ISLANDS | | 295000 | 079000 |
| 000713 | BALLYMAN GLEN | | 322000 | 218000 |
| 000714 | BRAY HEAD | | 328000 | 217000 |
| 000725 | KNOCKSINK WOOD | | 320508 | 218868 |
| 000730 | THE MURROUGH | | 331500 | 204000 |
| 002249 | THE MURROUGH | THE MURROUGH WETLANDS | 331368 | 204851 |
| 000849 | SPAHILL AND CLOMANTAG | | 233000 | 166000 |
| 000859 | CLONASLEE ESKERS AND | | 227000 | 212000 |
| 000881 | THE GREAT HEATH OF PO | | 253000 | 202000 |
| 000900 | DRUMAKEENAN, EAGLE HI | | 210700 | 191700 |
| 001021 | CARROWMORE POINT TO S | | 100000 | 175000 |

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|---|---|---|---|---|
| 001209 | GLENASMOLE VALLEY | | 309000 | 222000 |
| 001279 | KILKERRIN TURLOUGH | | 163000 | 256000 |
| 001288 | KNOCKMAA HILL | | 135700 | 248500 |
| 001387 | BALLYNAFAGH LAKE | | 281000 | 228000 |
| 001398 | RYE WATER VALLEY/CART | LOUISA BRIDGE WARM SP | 295000 | 237000 |
| 001403 | ARROO MOUNTAIN | | 183000 | 352000 |
| 001626 | ANNAGHMORE LOUGH (ROS | | 190690 | 283708 |
| 001656 | BRICKLIEVE MOUNTAINS | | 170000 | 310000 |
| 001670 | KNOCKNAREA MOUNTAIN A | | 163000 | 334000 |
| 001677 | MOYLOUGH TURLOUGH | | 154000 | 308000 |
| 001714 | LOUGH GRANEY WOODS | | 157000 | 191000 |
| 001731 | WALSHESTOWN FEN (SLAN | | 239000 | 254000 |
| 001766 | MAGHERABEG DUNES | | 332000 | 187000 |
| 001768 | POWERSCOURT WOODLAND | | 322000 | 217000 |
| 001779 | BALLINASLOE ESKER | | 181500 | 231500 |
| 001788 | TURLOUGHCOR | | 129500 | 244000 |
| 001842 | ST. PATRICKS HILL THE | | 294400 | 231600 |
| 001847 | PHILIPSTON MARSH | | 189001 | 146002 |
| 001900 | MEHARTH LOUGH | | 157000 | 319700 |
| 001901 | QUARRYFIELD WEST TURL | | 159100 | 310000 |
| 001902 | SLIEVEWARD BOG | | 165600 | 328000 |
| 001922 | BELLACORRICK BOG COMP | | 105000 | 323000 |
| 001922 | BELLACORRICK BOG COMP | BRACKLOON (498) | 107000 | 318000 |
| 001922 | BELLACORRICK BOG COMP | CLOONOORAGH (498) | 106000 | 319000 |
| 001922 | BELLACORRICK BOG COMP | FORMOYLE (498) | 105000 | 322000 |
| 1926 | EAST BURREN COMPLEX | | 130000 | 200000 |
| 1926 | EAST BURREN COMPLEX | Carran Turlough | 129000 | 198000 |
| R001932 | MWEELREA/SHEEFFRY/ERR | DERRYAUN (488) | 095000 | 272500 |
| R001932 | MWEELREA/SHEEFFRY/ERR | DOOAGHTRY MACHAIR (49 | 074000 | 270000 |
| 001981 | MARLFIELD LAKE | | 217000 | 122000 |
| 001986 | GARINISH POINT | | 051900 | 042800 |
| 002008 | MAUMTURK MOUNTAINS | | 086327 | 256421 |
| 002070 | TRALEE BAY AND MAGHAR | | 061000 | 114000 |
| 002074 | SLYNE HEAD PENINSULA | | 061272 | 246552 |
| 002091 | NEWHALL AND EDENVALE | | 132000 | 173000 |
| 002121 | LOUGH LENE | WINDTOWN | 249600 | 269600 |
| R002137 | LOWER RIVER SUIR | | 247000 | 118000 |
| 002147 | LISDUFF FEN | | 208200 | 200500 |
| R002162 | RIVER BARROW AND RIVE | | 268000 | 117000 |
| 002194 | DRUMMASKIBBOLE REEDBE | | 168500 | 331000 |
| 002236 | ISLAND FEN | | 212300 | 201100 |
| 002241 | LOUGH DERG, NORTH-EAS | | 186592 | 200932 |
| 002252 | THOMASTOWN QUARRY | | 257671 | 142775 |
| 002293 | CARROWBAUN, NEWHALL A | | 147482 | 207476 |
| 002295 | BALLINDUFF TURLOUGH | | 144922 | 208030 |
| R002298 | RIVER MOY | | 131045 | 298734 |
| R002298 | RIVER MOY | LOUGH CONN AND LOUGH | 121000 | 310000 |
| R002299 | RIVER BOYNE & RIVER B | | 286083 | 268000 |
| R002299 | RIVER BOYNE & RIVER B | LOUGH SHESK (556) | 262000 | 268000 |
| 002313 | BALLYMORE (DUNEEL) FE | | 224333 | 249135 |
| 002473 | BOULTRY FEN | | 205000 | 189000 |
| 002499 | DOONARD UPPER FEN | | 106000 | 146000 |

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|---|---|---|---|---|
| 002531 | MOYLAN LOUGH | | 285500 | 308500 |
| 002555 | ORANBEG | | 141000 | 224800 |
| 002588 | BALLYCURRIN FEN | | 120000 | 249000 |
| 002589 | CAHERAWONEEN FEN | | 141000 | 209000 |
| 002602 | DOOHYLE LOUGH FEN | | 137500 | 143500 |
| 002630 | LUGNAGALL FLUSH | | 172500 | 341700 |
| 002653 | CLONYRINA FEN AND GRA | | 228700 | 245600 |
| 002657 | DROMORE FEN | | 232200 | 241600 |
| 002661 | HILL OF USHNAGH GRASS | | 229200 | 249000 |
| 002696 | BEALAGRELLAGH WETLAND | | 087000 | 112500 |
| 002712 | PIGEONSTOWN SPRINGS | | 221590 | 206760 |

## *SAXIFRAGA AIZOIDES* BSBI 10 KM SQUARE RECORDS

| Dataset Key | 10km grid reference | First Year recorded | Last Year recorded | Comment |
|---|---|---|---|---|
| GA000079 | D14 | 1988 | 1988 | |
| GA000079 | D24 | 1988 | 1988 | |
| GA000091 | D14 | 0 | 1999 | |
| GA000091 | D24 | 1500 | 1999 | |
| GA000091 | G43 | 1999 | 1999 | |
| GA000091 | G52 | 1896 | 1999 | |
| GA000091 | G53 | 1999 | 1999 | |
| GA000091 | G57 | 1950 | 1999 | |
| GA000091 | G63 | 1904 | 1904 | Omitted from FRR and Current range map |
| GA000091 | G64 | 1500 | 1999 | |
| GA000091 | G74 | 1500 | 1998 | |
| GA000091 | G75 | 1998 | 1998 | |
| GA000091 | G78 | 1985 | 1999 | |
| GA000091 | G84 | 1500 | 1984 | |
| GA000091 | G85 | 1939 | 1996 | |
| GA000091 | G94 | 1896 | 1896 | Omitted from FRR and Current range map |
| GA000091 | G96 | 1898 | 1898 | Omitted from FRR and Current range map |
| GA000091 | H05 | 1500 | 1999 | |
| GA000091 | H15 | 1902 | 1902 | Omitted from FRR and Current range map |

## SELECTED PETRIFYING SPRING MOSS SPECIES 10 KM SQUARE RECORDS

| Record Number | Taxon | 10km grid reference | Year Recorded | Comment |
|---|---|---|---|---|
| 4672643 | Palustriella commutata var.falcata | X99 | 1913 | Omitted from FRR and Current range map |
| 4026445 | Eucladium verticillatum | X17 | 1880 | Omitted from FRR and Current range map |
| 4531404 | Palustriella commutata | X08 | | Omitted from FRR and Current range map |

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|---|---|---|---|---|
| 4531405 | Palustriella commutata var. commutata | X08 | | Omitted from FRR and Current range map |
| 4248385 | Eucladium verticillatum | X08 | | Omitted from FRR and Current range map |
| 4672633 | Palustriella commutata var. commutata | W77 | 1845 | Omitted from FRR and Current range map |
| 4248384 | Eucladium verticillatum | W65 | 1966 | |
| 4248383 | Eucladium verticillatum | W64 | 1966 | |
| 4248382 | Eucladium verticillatum | W49 | 1967 | |
| 4510178 | Palustriella commutata var. commutata | W47 | 1967 | |
| 4248381 | Eucladium verticillatum | W38 | 1967 | |
| 4641484 | Palustriella commutata var. commutata | W18 | 1967 | |
| 4509924 | Palustriella commutata var. commutata | W17 | 1967 | |
| 4509748 | Palustriella commutata var.falcata | W06 | 1979 | |
| 4025523 | Eucladium verticillatum | V98 | 1872 | Omitted from FRR and Current range map |
| 4507242 | Palustriella commutata var.falcata | V98 | 1966 | |
| 4506979 | Palustriella commutata var.falcata | V92 | 1973 | |
| 4022642 | Eucladium verticillatum | V76 | 1983 | |
| 4669035 | Palustriella commutata var.commutata | V68 | 1951 | |
| 4506333 | Palustriella commutata | V65 | 1973 | |
| 4506201 | Palustriella commutata | V54 | 1962 | |
| 4539684 | Palustriella commutata var.commutata | T29 | 1975 | |
| 4532560 | Palustriella commutata var.commutata | S85 | 1969 | |
| 4669045 | Palustriella commutata var.falcata | S85 | 1969 | |
| 4248395 | Eucladium verticillatum | S85 | 1969 | |
| 4248394 | Eucladium verticillatum | S84 | 1969 | |
| 4532197 | Palustriella commutata var.falcata | S54 | 1968 | |
| 4248393 | Eucladium verticillatum | S53 | 1966 | |
| 4617235 | Palustriella commutata | S49 | 1956 | |
| 4617234 | Palustriella commutata | S28 | 1956 | |
| 4531956 | Palustriella commutata var.falcata | S26 | 1966 | |
| 4248387 | Eucladium verticillatum | S04 | 1966 | |
| 4248386 | Eucladium verticillatum | S01 | 1966 | |
| 4512208 | Palustriella commutata var.commutata | R92 | 1966 | |
| 4512268 | Palustriella commutata var.commutata | R92 | 1975 | |
| 4511629 | Palustriella commutata | R75 | 1972 | |
| 4511695 | Palustriella commutata var.commutata | R75 | 1979 | |
| 4248392 | Eucladium verticillatum | R75 | 1979 | |
| 4511076 | Palustriella commutata var.falcata | R47 | 1979 | |
| 4248390 | Eucladium verticillatum | R47 | 1979 | |
| 4510994 | Palustriella commutata var.commutata | R44 | 1979 | |
| 4248388 | Eucladium verticillatum | R35 | 1979 | |
| 4669044 | Palustriella commutata var.falcata | R34 | 1975 | |

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|---|---|---|---|---|
| 4641567 | Palustriella commutata var.falcata | R07 | 1960 | |
| 4248389 | Eucladium verticillatum | R07 | 1960 | |
| 4669043 | Palustriella commutata var.falcata | Q41 | 1935 | Omitted from FRR and Current range map |
| 4669037 | Palustriella commutata var.commutata | O23 | 1850 | Omitted from FRR and Current range map |
| 4025524 | Eucladium verticillatum | O23 | 1850 | Omitted from FRR and Current range map |
| 4026446 | Eucladium verticillatum | O23 | 1901 | Omitted from FRR and Current range map |
| 4540318 | Palustriella commutata var.commutata | O21 | 1975 | |
| 4540319 | Palustriella commutata var.falcata | O21 | 1975 | |
| 4248402 | Eucladium verticillatum | O21 | 1975 | |
| 4540257 | Palustriella commutata var.commutata | O21 | | Omitted from FRR and Current range map |
| 4248410 | Eucladium verticillatum | O17 | 1978 | |
| 4540163 | Palustriella commutata var.falcata | O16 | 1978 | |
| 4248409 | Eucladium verticillatum | O16 | 1978 | |
| 4672635 | Palustriella commutata var.commutata | O12 | 1853 | Omitted from FRR and Current range map |
| 4248435 | Eucladium verticillatum | O07 | 1960 | |
| 4248408 | Eucladium verticillatum | O07 | 1978 | |
| 4358573 | Palustriella commutata var.commutata | O06 | 1966 | |
| 4669036 | Palustriella commutata var.commutata | O03 | 1949 | |
| 4248407 | Eucladium verticillatum | N97 | 1978 | |
| 4025525 | Eucladium verticillatum | N93 | 1938 | Omitted from FRR and Current range map |
| 4248406 | Eucladium verticillatum | N86 | 1978 | |
| 4248405 | Eucladium verticillatum | N76 | 1978 | |
| 4248404 | Eucladium verticillatum | N74 | 1978 | |
| 4535447 | Palustriella commutata | N71 | 1976 | |
| 4248403 | Eucladium verticillatum | N64 | 1978 | |
| 4533874 | Palustriella commutata var.falcata | N54 | 1979 | |
| 4248412 | Eucladium verticillatum | N54 | 1979 | |
| 4669038 | Palustriella commutata var.commutata | N46 | 1953 | |
| 4533718 | Palustriella commutata var.falcata | N44 | 1979 | |
| 4248397 | Eucladium verticillatum | N31 | 1934 | Omitted from FRR and Current range map |
| 4248396 | Eucladium verticillatum | N30 | 1981 | |
| 4533274 | Palustriella commutata var.falcata | N26 | 1980 | |
| 4248413 | Eucladium verticillatum | N25 | 1980 | |
| 4669046 | Palustriella commutata var.falcata | N21 | 1965 | |
| 4533144 | Palustriella commutata var.commutata | N21 | 1972 | |
| 4533145 | Palustriella commutata var.falcata | N21 | 1972 | |
| 4248401 | Eucladium verticillatum | N21 | 1972 | |
| 4672634 | Palustriella commutata var.commutata | N20 | 1912 | Omitted from FRR and Current range map |
| 4533102 | Palustriella commutata | N20 | 1972 | |
| 4644764 | Palustriella commutata var.falcata | N17 | 1982 | |

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|---|---|---|---|---|
| 4248411 | Eucladium verticillatum | N15 | 1979 | |
| 4532844 | Palustriella commutata var.falcata | N04 | 1970 | |
| 4514281 | Palustriella commutata var.falcata | M98 | 1981 | |
| 4248414 | Eucladium verticillatum | M98 | 1981 | |
| 4514168 | Palustriella commutata var.falcata | M96 | 1981 | |
| 4669039 | Palustriella commutata var.commutata | M95 | 1973 | |
| 4514000 | Palustriella commutata var.falcata | M89 | 1981 | |
| 4513948 | Palustriella commutata var.falcata | M88 | 1981 | |
| 4513859 | Palustriella commutata | M80 | 1979 | |
| 4513723 | Palustriella commutata var.falcata | M69 | 1982 | |
| 4513525 | Palustriella commutata var.commutata | M49 | 1982 | |
| 4026447 | Eucladium verticillatum | M26 | 1910 | Omitted from FRR and Current range map |
| 4513420 | Palustriella commutata var.commutata | M22 | 1968 | |
| 4513421 | Palustriella commutata var.falcata | M22 | 1968 | |
| 4618514 | Palustriella commutata var.falcata | M18 | 1987 | |
| 4513039 | Palustriella commutata | M16 | 1962 | |
| 4513077 | Palustriella commutata var.falcata | M16 | 1970 | |
| 4512821 | Palustriella commutata var.falcata | M11 | 1969 | |
| 4512781 | Palustriella commutata var.commutata | M11 | 1981 | |
| 4248391 | Eucladium verticillatum | M11 | 1981 | |
| 4512687 | Palustriella commutata | M06 | 1960 | |
| 4512573 | Palustriella commutata | M05 | 1960 | |
| 4512555 | Palustriella commutata | M05 | 1966 | |
| 4641757 | Palustriella commutata var.falcata | M04 | 1968 | |
| 4512468 | Palustriella commutata var.falcata | M04 | 1970 | |
| 4354602 | Palustriella commutata var.falcata | L97 | 1987 | |
| 4509222 | Palustriella commutata var.falcata | L96 | 1968 | |
| 4618513 | Palustriella commutata var.commutata | L96 | 1987 | |
| 4509083 | Palustriella commutata | L95 | 1968 | |
| 4508966 | Palustriella commutata var.commutata | L87 | 1982 | |
| 4508801 | Palustriella commutata var.commutata | L86 | 1968 | |
| 4508802 | Palustriella commutata var.falcata | L86 | 1968 | |
| 4508843 | Palustriella commutata var.commutata | L86 | 1970 | |
| 4618512 | Palustriella commutata var.commutata | L86 | 1987 | |
| 4248400 | Eucladium verticillatum | L85 | 1957 | |
| 4508729 | Palustriella commutata var.commutata | L85 | 1968 | |
| 4508730 | Palustriella commutata var.falcata | L85 | 1968 | |
| 4641309 | Palustriella commutata var.commutata | L84 | 1962 | |
| 4508662 | Palustriella commutata var.falcata | L84 | 1962 | |
| 4641312 | Palustriella commutata | L84 | 1973 | |
| 4248416 | Eucladium verticillatum | L79 | 1965 | |
| 4508392 | Palustriella commutata var.falcata | L76 | 1968 | |

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|---|---|---|---|---|
| 4656530 | Palustriella commutata var.falcata | L76 | 1987 | |
| 4508236 | Palustriella commutata | L75 | 1966 | |
| 4508184 | Palustriella commutata var.commutata | L75 | 1968 | |
| 4508115 | Palustriella commutata var.commutata | L75 | 1970 | |
| 4508329 | Palustriella commutata var.falcata | L75 | 1970 | |
| 4248399 | Eucladium verticillatum | L75 | 1970 | |
| 4508062 | Palustriella commutata var.commutata | L74 | 1968 | |
| 4508063 | Palustriella commutata var.falcata | L74 | 1968 | |
| 4248398 | Eucladium verticillatum | L74 | 1968 | |
| 4508007 | Palustriella commutata var.falcata | L74 | 1970 | |
| 4617236 | Palustriella commutata var.commutata | L68 | 1910 | Omitted from FRR and Current range map |
| 4617237 | Palustriella commutata var.falcata | L68 | 1910 | Omitted from FRR and Current range map |
| 4248415 | Eucladium verticillatum | L68 | 1910 | Omitted from FRR and Current range map |
| 4507903 | Palustriella commutata | L63 | 1966 | |
| 4672645 | Palustriella commutata var.falcata | J11 | 1890 | Omitted from FRR and Current range map |
| 4672636 | Palustriella commutata var.commutata | J11 | 1915 | Omitted from FRR and Current range map |
| 4672637 | Palustriella commutata var.commutata | H63 | 1910 | Omitted from FRR and Current range map |
| 4672644 | Palustriella commutata var.falcata | H30 | 1908 | Omitted from FRR and Current range map |
| 4248441 | Eucladium verticillatum | G85 | 1937 | Omitted from FRR and Current range map |
| 4530758 | Palustriella commutata var.commutata | G85 | 1965 | |
| 4530798 | Palustriella commutata var.commutata | G85 | 1970 | |
| 4644507 | Palustriella commutata var.falcata | G85 | 1970 | |
| 4530623 | Palustriella commutata var.commutata | G84 | 1963 | |
| 4248433 | Eucladium verticillatum | G84 | 1963 | |
| 4530733 | Palustriella commutata var.commutata | G84 | 1969 | |
| 4248434 | Eucladium verticillatum | G84 | 1969 | |
| 4530687 | Palustriella commutata var.commutata | G84 | 1970 | |
| 4530688 | Palustriella commutata var.falcata | G84 | 1970 | |
| 4530553 | Palustriella commutata var.commutata | G83 | 1963 | |
| 4530554 | Palustriella commutata var.falcata | G83 | 1963 | |
| 4248432 | Eucladium verticillatum | G83 | 1963 | |
| 4530296 | Palustriella commutata var.commutata | G75 | 1970 | |
| 4644447 | Palustriella commutata var.commutata | G75 | 1970 | |
| 4248426 | Eucladium verticillatum | G75 | 1970 | |
| 4248427 | Eucladium verticillatum | G75 | 1976 | |
| 4617238 | Palustriella commutata var.falcata | G74 | 1937 | Omitted from FRR and Current |

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|---|---|---|---|---|
| | | | | range map |
| 4530195 | Palustriella commutata var.commutata | G74 | 1960 | |
| 4530110 | Palustriella commutata var.commutata | G74 | 1960 | |
| 4644434 | Palustriella commutata var.falcata | G74 | 1960 | |
| 4248421 | Eucladium verticillatum | G74 | 1960 | |
| 4530024 | Palustriella commutata var.commutata | G74 | 1961 | |
| 4248429 | Eucladium verticillatum | G74 | 1961 | |
| 4529932 | Palustriella commutata var.commutata | G74 | 1961 | |
| 4248422 | Eucladium verticillatum | G74 | 1961 | |
| 4529894 | Palustriella commutata var.commutata | G74 | 1962 | |
| 4529895 | Palustriella commutata var.falcata | G74 | 1962 | |
| 4248423 | Eucladium verticillatum | G74 | 1962 | |
| 4529973 | Palustriella commutata var.commutata | G74 | 1963 | |
| 4248430 | Eucladium verticillatum | G74 | 1963 | |
| 4529846 | Palustriella commutata var.commutata | G74 | 1963 | |
| 4529847 | Palustriella commutata var.falcata | G74 | 1963 | |
| 4530261 | Palustriella commutata var.commutata | G74 | 1970 | |
| 4530262 | Palustriella commutata var.falcata | G74 | 1970 | |
| 4248431 | Eucladium verticillatum | G74 | 1970 | |
| 4530145 | Palustriella commutata var.commutata | G74 | 1970 | |
| 4530146 | Palustriella commutata var.falcata | G74 | 1970 | |
| 4248424 | Eucladium verticillatum | G74 | 1970 | |
| 4669053 | Palustriella commutata var. virescens | G74 | 1972 | |
| 4535366 | Palustriella commutata var.commutata | G74 | 1976 | |
| 4248425 | Eucladium verticillatum | G74 | 1976 | |
| 4529748 | Palustriella commutata var.falcata | G73 | 1960 | |
| 4529767 | Palustriella commutata var.commutata | G73 | 1963 | |
| 4248428 | Eucladium verticillatum | G73 | 1963 | |
| 4515398 | Palustriella commutata var.falcata | G71 | 1963 | |
| 4515313 | Palustriella commutata var.commutata | G69 | 1970 | |
| 4515312 | Palustriella commutata var.falcata | G69 | 1970 | |
| 4515212 | Palustriella commutata var.commutata | G67 | 1969 | |
| 4515108 | Palustriella commutata var.commutata | G64 | 1970 | |
| 4515067 | Palustriella commutata var.commutata | G63 | 1963 | |
| 4248420 | Eucladium verticillatum | G63 | 1963 | |
| 4514720 | Palustriella commutata var.commutata | G57 | 1967 | |
| 4514804 | Palustriella commutata var.falcata | G57 | 1969 | |
| 4642028 | Palustriella commutata var.falcata | G57 | 1970 | |

| | | | | |
|---|---|---|---|---|
| 4514674 | Palustriella commutata var.commutata | G52 | 1967 | |
| 4248446 | Eucladium verticillatum | G47 | 1963 | |
| 4514619 | Palustriella commutata var.falcata | G47 | 1969 | |
| 4248447 | Eucladium verticillatum | G47 | 1969 | |
| 4514550 | Palustriella commutata var.commutata | G43 | 1965 | |
| 4248419 | Eucladium verticillatum | G43 | 1965 | |
| 4514453 | Palustriella commutata var.falcata | G41 | 1970 | |
| 4509700 | Palustriella commutata var.commutata | F91 | 1982 | |
| 4617982 | Palustriella commutata var.falcata | F71 | 1987 | |
| 4509601 | Palustriella commutata var.falcata | F70 | 1962 | |
| 4248418 | Eucladium verticillatum | F70 | 1962 | |
| 4617981 | Palustriella commutata var.falcata | F70 | 1987 | |
| 4617980 | Palustriella commutata var.falcata | F70 | 1987 | |
| 4509499 | Palustriella commutata var.falcata | F60 | 1962 | |
| 4617978 | Palustriella commutata var.commutata | F60 | 1987 | |
| 4617979 | Palustriella commutata var.falcata | F60 | 1987 | |
| 4509476 | Palustriella commutata var.commutata | F60 | | Omitted from FRR and Current range map |
| 4617977 | Palustriella commutata var.commutata | F50 | 1987 | |
| 4248417 | Eucladium verticillatum | F50 | 1987 | |
| 4538586 | Palustriella commutata var.commutata | C64 | 1968 | |
| 4538305 | Palustriella commutata var.commutata | C54 | 1968 | |
| 4538262 | Palustriella commutata var.commutata | C53 | 1967 | |
| 4248445 | Eucladium verticillatum | C53 | 1967 | |
| 4538221 | Palustriella commutata var.commutata | C53 | 1969 | |
| 4645539 | Palustriella commutata var.commutata | C45 | 1969 | |
| 4248444 | Eucladium verticillatum | C45 | 1969 | |
| 4248443 | Eucladium verticillatum | C43 | 1967 | |
| 4537862 | Palustriella commutata var.commutata | C34 | 1962 | |
| 4537863 | Palustriella commutata var.falcata | C34 | 1962 | |
| 4537911 | Palustriella commutata var.commutata | C34 | 1967 | |
| 4537954 | Palustriella commutata var.commutata | C34 | 1968 | |
| 4537818 | Palustriella commutata var.commutata | C34 | 1969 | |
| 4537786 | Palustriella commutata var.commutata | C33 | 1967 | |
| 4248442 | Eucladium verticillatum | C33 | 1967 | |
| 4537680 | Palustriella commutata var.commutata | C13 | 1967 | |
| 4537619 | Palustriella commutata var.commutata | C03 | 1962 | |
| 4248452 | Eucladium verticillatum | C03 | 1962 | |

| | | | | |
|---|---|---|---|---|
| 4537711 | Palustriella commutata var.falcata | C03 | 1969 | |
| 4537522 | Palustriella commutata var.falcata | C02 | 1967 | |
| 4248451 | Eucladium verticillatum | C02 | 1967 | |
| 4531327 | Palustriella commutata var.falcata | B93 | 1962 | |
| 4248450 | Eucladium verticillatum | B93 | 1962 | |
| 4531258 | Palustriella commutata var.falcata | B92 | 1962 | |
| 4531289 | Palustriella commutata var.commutata | B92 | 1968 | |
| 4531189 | Palustriella commutata var.falcata | B91 | 1962 | |
| 4531116 | Palustriella commutata var.falcata | B72 | 1962 | |
| 4248449 | Eucladium verticillatum | B72 | 1962 | |
| 4531044 | Palustriella commutata var.commutata | B70 | 1962 | |
| 4248448 | Eucladium verticillatum | B70 | 1962 | |

# APPENDIX IV

## NOTICE OF NOTIFIABLE ACTIONS
## <u>HABITAT TYPE 4.2</u>

Under STATUTORY INSTRUMENT 94 of 1997, made under the EUROPEAN COMMUNITIES ACT 1972 and in accordance with the obligations inherent in the COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 (the Habitats Directive) on the conservation of the natural habitats and species of wild fauna and flora, all persons must obtain the written consent, (in circumstances prescribed at section A and B below) of the Minister for The Environment and Local Government before performing any of the operations on, or affecting, the following habitats where they occur on lands / waters within the candidate Special Area of Conservation.

Please note that where a landowner has a current approved plan under the Rural Environmental Protection Scheme or any scheme which the Minister considers to be equivalent s/he need only notify the Minister of activities not covered in the plan.

## <u>HABITAT TYPE</u>
## FENS, TRANSITION MIRES, PETRIFYING SPRINGS

**<u>SECTION A</u>**

Please note that the activities listed in *Section A below* are required to be notified to the Minister for The Environment and Local Government and should not be undertaken before consent.

<u>Section A</u>

THE MINISTER FOR THE ENVIRONMENT AND LOCAL GOVERNMENT IS REQUIRED TO BE NOTIFIED IN RELATION TO THE FOLLOWING ACTIVITIES AND SUCH ACTIVITIES SHOULD NOT PROCEED WITHOUT PRIOR CONSENT**:**

grazing of livestock above a sustainable density (as defined in approved farm plans)

grazing by livestock treated within the previous week with a pesticide which leaves persistent residues in the dung

changing of traditional use from hay meadow (to either grazing or silage making), or from grazing to silage cutting

adding lime within 50m of the fen or a water course running into it

adding fertiliser of any sort within 50m or a water course running into it

extracting water for irrigation or other purposes

mowing grass before the 30th June (*Note; if you have been notified that your lands hold breeding corncrakes, or certain rare meadows, special provisions will apply)*

supplementary feeding of stock

operation of boat angling or shore angling business

restocking with fish

reclamation, infilling, ploughing or land drainage within 50m of the fen

reseeding, planting of trees or any other species within 50m of the fen

use of any pesticide or herbicide within 50m of fen

dumping, burning or storing any materials within 50m of the fen
alteration of the banks, bed or flow of watercourses within the fen or running into or out of it

harvesting reed or willow

operation of commercial recreation facilities (e.g. bird watching tours)

introduction (or re-introduction) into the wild of plants or animals of species not currently found in the area any other activity of which notice may be given by the Minister from time to time

**SECTION B**
Please note that the activities listed in *Section B below* may, and in most cases do, require a license or consent from another statutory authority (e.g. the local planning authority, the Minister for the Marine and Natural Resources, or the Minister for Agriculture and Food).

If so, these notifiable actions do not apply.

However, if such activities are not regulated by another statutory authority, the said activities are required to be notified to the Minister for The Environment and Local Government.

SECTION B

(NO REQUIREMENT TO NOTIFY IF ALREADY LICENSED BY ANOTHER MINISTER/BODY)

developing leisure facilities including golf courses, sports pitches, caravan or camping facilities

any activity which might cause pollution of the fen

removal of soil, mud, gravel, sand or minerals

developing roads or car parks

construction of fences, buildings or embankments

afforestation

# APPENDIX V

# GLOSSARY

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CUTAWAY BOG - This term describes areas where peat has been removed systematically by industrial means. Any peat remaining can no longer be considered as economically removable (Irish Peatland Conservation Council).

CUTOVER BOG – An NPWS habitat classification that describes areas of bog which have been previously cut (by hand or by mechanical means), although not down to the underlying mineral soils or bedrock. Remaining peat can still be an economic reserve. Cut-over areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DEHLG - Department of Environment, Heritage and Local Government

DESICCATION - Drying out.

DOMESTIC PURPOSES - Used in relation to the cutting of peat. Peat that is cut for domestic purposes is not for commercial sale and is cut at the rate of one year's supply for a household per year.

DRAINAGE DITCHES - An NPWS habitat classification which refers to water channel systems with moving or stagnant water bodies, artificial in origin. Most ditches are cleared cyclically, although this category also includes ditches that are overgrown with wetland plants.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ECOTOPE - The abiotic environment or habitat of a particular biotic system (Kulcher, 1967; Whittaker et al., 1973). According to work carried out by Kelly (1993) on Clara and Raheenmore raised bogs vegetation can be assigned to five different ecotopes. Sub-central and central ecotopes with Active peat formation (Active Raised Bog habitat) and marginal, sub-marginal and face bank ecotopes with little or no peat formation (Degraded Raised Bog habitat).

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

FENS AND FLUSHES - An NPWS habitat classification. Fens are peatlands fed by calcium rich water, either from groundwater or from inflowing surface water. Flushes are wet areas maintained by the seepage of water down slopes of various gradient, and are usually local features. Both are characterised by an abundance of small sedge forming species-rich mosaics with other species. Orchid species are particularly noticeable in fens and butterworts are more typical of flushes. According to Cross (1990) flushes are areas where nutrient enrichment occurs, usually as a result of more concentrated horizontal water movement. They are particularly common near the bog margin and at the base of low mineral ridges and are characterised by the presence of *Molinia caerulea, Myrica gal*e and often *Sphagnum recurvum*.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT. - Refers to traditional cutting of peat using a slean or spade.

HIGH BOG – This is the area of bog which have not been previously cut and generally its vegetation is characterised by the presence of ericoid and *Cyperaceae* species and an abundant of *Sphagnum* species.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

LAGG - A term used to describe the transition from bog to mineral soil around a raised bog.

LIMESTONE - Sedimentary rock composed predominantly of calcium carbonate, often containing fossils.

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MICROTOPOGRAPHY – This is the small scale variation in surface level within a habitat.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the “health” quantity or quality of a habitat or species.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NGO – Non governmental environmental conservation organisations.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PEAT CUTTING BY HAND. - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

RAISED BOG - An NPWS habitat classification characterised by an elevated dome of peat, the surface of which is isolated from the surrounding ground water table and receiving water solely from precipitation. The peat surface is wet, often with pools and hummock hollow systems and is usually dominated by *Sphagnum* mosses and bushy heather, with Deer-grass, Bog Cottons and other associated species. Raised bogs can be distinguished from blanket bogs by their paucity of grasses which typify blanket bog.

SENSITIVE MARGIN (or Margin with high sensitivity to cutting) - Section of high bog margin that is within 250m of priority habitat (i.e. Active Raised Bog or Bog Woodland).

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPWS is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

TUFA – Hard deposit of calcium bicarbonate (tufa) formed on living and dead plant material in hard-water springs when groundwater rich in calcium carbonate comes to the surface and carbon dioxide is lost from solution to the atmosphere.

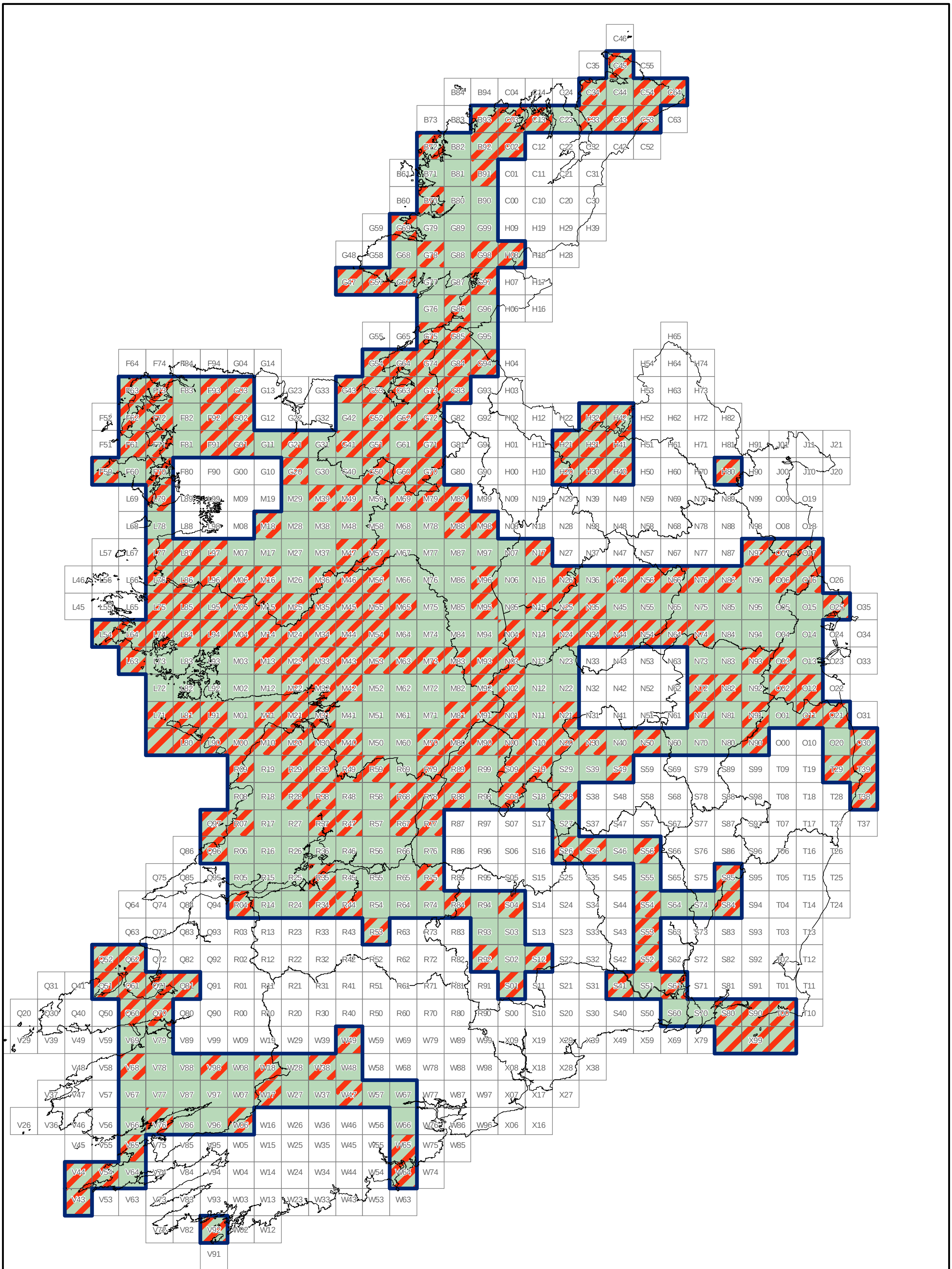
TURBARY – Turbary is the term used to describe the ancient right to cut turf on a particular area of bog. These rights came about with the resettlement of confiscated land or by prescription. Prescription is a legal term meaning that if a person is able to demonstrate that they cut turf without secrecy, without permission and without force continuously for a period of 30 years they have a turbary right. This implies that not all turbary rights will be formally registered.

## 7220 Petrifying Springs with tufa formation (*Cratoneurion*)

| National Level | |
|---|---|
| **Habitat Code** | 7220 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | • Crushell P., 2000. *Irish Fen Inventory - A review of the status of fens in Ireland*, Irish Peatland Conservation Council, Dublin, pp. 100.<br>• Foss, P.J. 2007. National Parks & Wildlife Service Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007. Unpublished report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.<br>• Hammond, R.F. 1984. *The Classification of Irish peats as surveyed by the National Soil Survey of Ireland*. 7th International Peat Congress, Dublin. |
| **Range** | Widespread in Ireland. |
| Surface area | 44,500 km² (445 grid cells selected x 100 km² - area polygon derived from grid cells) see Map 2 |
| Date | 02/2007 Data for habitat distribution and range covers data collection period from surveys of the early 1980's; the NHA surveys of the 1990's to NPWS Fen Study Project 2006. |
| Quality of data | 1 = poor (based on very incomplete data or on expert judgement) |
| Trend | Unknown |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| **Area covered by habitat** | 0.36 km² |
| Distribution map | See map actual present distribution and range attached; NPWS Fen Study database 2007 |
| Surface area | 0.36 km² |
| Date | 02/2007 Data for habitat area covers data collection period from surveys of the early 1980's; the NHA surveys of the 1990's to NPWS Fen Study Project 2006. |
| Method used | 1=only or mostly based on expert opinion |
| Quality of data | 1 = poor (based on very incomplete data or on expert judgement) |
| Trend | Unknown |
| Trend-Period | 1980 - 2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| Justification of % thresholds for trends | There has been an unquantified decline in area since the beginning of the trend period, however this decline is not considered to be significant since the Directive came into force. |
| Main pressures | 140 Overgrazing<br>150 Restructuring agricultural land holding<br>310 Peat Extraction<br>800 Landfill, land reclamation and drying out, general<br>803 Infilling ditches, dykes, ponds, marshes and pits<br>810 Drainage<br>890 Other human induced changes in hydraulic conditions |
| Threats | 140 Overgrazing<br>150 Restructuring agricultural land holding<br>310 Peat Extraction<br>800 Landfill, land reclamation and drying out, general<br>803 Infilling ditches, dykes, ponds, marshes and pits<br>810 Drainage<br>890 Other human induced changes in hydraulic conditions |

| Complementary information | |
|---|---|
| **Favourable reference range** | 44,500 km² (445 grid cells selected x 100 km² - area polygon derived from grid cells) |
| **Favourable reference area** | 0.36 km² |
| **Typical species** | **Vascular plants***: Saxifraga aizoides, Saxifraga hirculus, Pinguicula vulgaris, Carex dioica, Selaginella selaginoides*<br>**Mosses, Liverworts and Lichens***: Palustriella commutata, Palustriella commutata var. falcatum, Cratoneuron filicinum, Eucladium verticillatum, Bryum pseudotriquetrum, Philonotis calcarea, Plagiomnium ellipticum, Tomentypnum nitens*<br>**Dragonflies and Butterflies***:*<br>**Other invertebrates**:<br><br>Further characteristic vascular plants, mosses, lichens and liverworts see Table 5.1.<br><br>Species information from: Ó Críodáin, C. & Doyle, G.J., 1994; 1997; Doyle, G.J. & Ó Críodáin, C., 2003; White, J. & Doyle, G.J., 1982; Foss 2007.<br><br>Methods: all the species above are characteristic of Petrifying springs habitat in Ireland. |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Typical species were assessed as unfavourable/bad using best expert judgement. |
| **Other relevant information** | Restoration initiatives undertaken by: Very limited, NPWS |
| ***Conclusions (assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Favourable (FV) |
| **Specific structures and functions (incl. typical species)** | Unfavourable Bad (U2) |
| **Future prospects** | Unfavourable Bad (U2) |
| **Overall assessment of CS** | Unfavourable Bad (U2) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Petrifying springs with tufa formation (*Cratoneurion*)**

**7220**

- Current Distribution (270 cells)
- Current Range (445 cells)
- Favourable Reference Range (445 cells)
- W48 10km grid cells

Date: October 2007

**7230** **Alkaline Fen**

# CONSERVATION STATUS ASSESSMENT REPORT

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## APPENDICES

## 1. Habitat characteristics in Ireland

Fens, are usually peat-forming wetlands that receive mineral nutrients (magnesium, iron and in particular calcium) from sources other than precipitation: usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement, and are not generally so acidic as bogs. In general they are poor in nitrogen and phosphorus, the latter of which tends to be the limiting nutrient in fen systems. Studies of wetlands in Western Europe frequently show that nutrient enrichment (with nitrogen and particularly phosphorus) leads to changes in species composition, decline in overall plant species diversity, and loss of rare and uncommon species (Doyle & Ó Críodáin 2003, Sheehy Skeffington & O'Connell 1998).

Ecologically, a fen is a mineral rich freshwater environment in which dead but undecayed plant matter has accumulated to the point where most or all of the remaining vegetation is emergent (Rieley & Page 1990).

Fens differ from bogs because they are less acidic and have relatively higher mineral levels. They are therefore able to support a much more diverse plant and animal community.

Some contain a rich selection of higher plants; up to and occasionally more than half Ireland's species of dragonflies, several thousand other insect species, as well as being an important habitat for a range of invertebrates and birds.

Fens, like bogs, provide important benefits in a watershed, including preventing or reducing the risk of floods, improving water quality, and providing habitat for unique plant and animal communities.

Fens often occur in mosaics with other wetland communities such as reed beds, bogs or open water in which case they may be of relatively limited extent. Although fens can be found as discrete habitats in their own right, they may also occur in association with (or within) a range of other habitats including blanket bog, raised bog, turlough, dune slack, machair, wet heathland, wet grassland, woodland, karst areas, lacustrine and riverine habitats and systems.

As fens are an early successional stage in the formation of raised and in some cases blanket bogs, or occurred at the edges of such acid peatlands, they have experienced a natural decline in area as these more acid peatlands developed and eventually buried them (Rieley & Page 1990).

More recently, like most peatland types in Ireland, fens have experienced a decline in range, area, and quality mostly as a result of such activities as peat mining activities, draining for cropland, infilling, and fertiliser pollution and eutrophication.

Alkaline fens in Ireland are classified in the order Caricetalia davallianae (*sensu* Ó Críodáin & Doyle, 1994) within which four associations are recognised in Ireland.

<u>Carici nigrae-Juncetum articulati</u>
Waterlogged habitats in low lying areas in hollows along mesotrophic lake shores, deep drainage channels in blanket bog areas and neglected drainage channels in rough grassland. Also lakes in machair and wet dune hollows (water pH range 5.5-8.3).

<u>Campylio-Caricetum dioicae</u>
Vegetation typical of grazed calcareous flushes, sometimes surrounded by relatively calcifuge vegetation (water pH range 4.6-7.5).

<u>Schoenetum nigricantis</u>
*Schoenus nigricans* dominated base-rich fens and in well established flushes that are ungrazed, where tussock formation is typical (water pH range 5.5-8.1).

<u>Juncetum subnodulosi</u>
*Juncus subnodulosus* dominated calcium-rich fen vegetation (water pH range 5.6-8.5), typical of the contact zone between Cladietum marisci and the Schoenetum nigricantis.

In Ireland Alkaline fens occur in a variety of situations including topogenous fens found in valleys or depressions, valley head fens, within transition mire and tall reed beds, on the landward side of hard water oligotrophic lakeshore communities, calcium rich flush areas in blanket bogs, dune slack areas, fens adjacent to raised and blanket bogs, in turlough sites, depressions in limestone pavement and wet hollows in machair, and spring fed habitats including cliffs, upper ecotones with salt marsh. Fens may also occur as secondary habitats on mined out bog sites which have been excavated to the fen peat layer (Doyle & Ó Críodáin 2003, Foss 2007, Curtis *et al* 2006 *inter alia*).

## 2. Habitat mapping

To-date no potential historic distribution or range map of the occurrence of this habitat has been available in Ireland (Foss 2007). A potential historic distribution and range map for Alkaline fen based on a series of data sets which would indicate the possible location of sites with the habitat in Ireland was produced as a part of the current conservation status assessment of the habitat in Ireland. Information on the historic habitat distribution and range provided by this map was compared with the present habitat range to ensure that an adequate network of sites has been selected to ensure favourable conservation of this habitat in Ireland. Such an exercise was felt to be justified in the absence of any systematic field survey of the habitat to date in Ireland.

The most recent mapping of the fen resource in Ireland was undertaken by Hammond in 1979. This study mapped only deep fen peat (>30cm in depth), and furthermore all fen peat areas were considered to be man modified and no attempt was made to distinguish between the various fen types.

A map of the **potential historic distribution and range** of alkaline fen, based on a 10 km² grid basis was produced by selecting those grid squares in which Alkaline fen is known to be present (based on Foss 2007); or was believed to occur in the past (Hammond 1979; Corine 2000 and Teagasc 2000) (see Map 1). Further information on the specific data sets use to produce the map are listed in Appendix I.

The mapping of the **current habitat distribution and range** of Alkaline fens (see Map 2) is based on National Parks and Wildlife Service (NPWS) study of the extent and conservation status of springs, fens and flushes undertaken in 2006 (NPWS Fen Study 2007, Foss 2007). In the absence of any detailed fen survey in Ireland to-date, this desk study compiled a list of all known fens of conservation value in Ireland based on data held within NPWS, from external NGO and expert sources (see Appendix I & II).

The NPWS Fen Study (Foss 2007) project involved compilation of a list of all known fen sites in Ireland, classification of these according to fen type (using the fen habitats recognised in the EU Habitats Directive), and accurately assessing or estimating the area of fen vegetation present on sites where this was possible. Fen type and area data was obtained from a variety of related wetland studies previously undertaken within NPWS (see Appendix I). In the case of some of these surveys, accurate fen area data were available for the extent of fen vegetation on sites. In other cases only an estimated extent value could be assigned to fen sites.

The Alkaline fen **current habitat distribution and range map** (see Map 2) was produced by selecting the smallest polygon size containing all grid squares, where the habitat was recorded in the NPWS Fen Study database (Foss 2007), or species indicative of the habitat were located, using a minimum number of 90 degree angles. Gaps in the habitat distribution of at least two 10 km² square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range. The map produced should be taken as indicative of the distribution and range of Alkaline fen in Ireland, until such time as a national fen survey is completed. One exception to the mapping criteria used involved the extensive river system SACs where only known sub sites containing fen vegetation were mapped on the 10 km² square grids rather than the entire SAC river system.

The Alkaline fen **favourable reference range** (see Map 3) is considered to be the same as the current habitat range. The FRR is defined as the range of 10 km² grid cells which contain a Alkaline Fen site as recorded in the NPWS Fen Study database (Foss 2007). Gaps in the habitat distribution of at least two 10 km² square grids, as a result of unsuitable ecological conditions for the development of the habitat, were deemed enough as to justify a break in the range.

## 3. Habitat Range

As fens are an early successional stage in the formation of raised and in some cases blanket bogs (eventually being buried under these more acid peatland types), or occurred naturally at the edges of such acid peatlands, they would have been widespread throughout the midlands and west of Ireland in post-glacial times.

The first attempt to map the range of general fen habitats in more recent times undertaken by Hammond (1979) indicates that the habitat type has the greatest concentration of sites occurring in the midlands and westwards into counties Galway, Mayo and Clare (see Table 4.1). Hammond (1979) records no fens in Counties Carlow, Cork, Donegal, Dublin, Monaghan or Wicklow. Subsequent reports show in fact that these counties also contain fen (see Crushell 2000, Foss *et al* 2001, Foss 2007). It is therefore likely that the total range of fen in Ireland recognised in Hammond (1979) is an under representation of the habitat in Ireland. In part, this shortcoming may be related to the fact that Hammond recorded only fen habitats occurring on a deep peat layer (greater than 30 cm).

Nonetheless, Hammond (1979) distribution map of man-modified fen still represents a minimum "best estimate" of the total extent of fen soils and fen habitats in Ireland. One further short coming of the report is that no subdivision is made in Hammond in terms of fen types (i.e. Alkaline fen, *Cladium* fen, Transition mires or Petrifying springs). The digitised version of this fen distribution data produces a **Hammond fen range map** which covers an area of 21,300 km$^2$ (213 grid squares x 100 km$^2$) containing fen, with a significant concentration of grid squares in the midlands and mid-west of Ireland (see Map 4).

A map of the **potential historic distribution and range** of Alkaline fen, based on a 10 km² grid basis and undertaken as part of this assessment project (see section 2 above) indicates that in the distribution and range map, Alkaline fen was considerably more widespread than estimated by Hammond (1979). In the potential historical distribution and range map, Alkaline fen has a range cover of 55,000 km$^2$ (550 grid squares x 100 km$^2$, see Map 1). The range polygon (area polygon derived from grid squares) derived for this habitat cover 68,500 km$^2$ (685 total grid squares x 100 km$^2$).

The historical distribution and range has therefore been found to be double the predicted "fen" range estimated by Hammond (1979). The historical range as defined by this assessment (see Map 1) shows extensions to the range of the habitat in particular along the western and eastern seaboard and south east of Ireland over that plotted using the Hammond data (see Map 4).

The most recent NPWS Fen Study (Foss 2007) undertaken to obtain a information on the distribution and extent of Alkaline fen, *Cladium* fen, Transition mires or Petrifying springs in Ireland, found that Alkaline fens occur in every county throughout Ireland, with increased frequency in the Midlands and West of the country (see Table 4.3 below; and Map 2).

The **current range for Alkaline fen** indicates that the habitat has a range of 42,600 km$^2$ (426 grid squares x 100 km$^2$, see Map 2). The current range polygon (area polygon derived from grid squares) derived for this habitat covers 57,600 km² (576 grid squares x 100 km²).

The current range based on grid cells shows a decline of 23% over the total predicted historical range of the habitat. While an examination of the current range area polygon indicates that the habitat has declined 16% over the historical range area polygon. The range over which the habitat is believed to have declined is shown as blue grid squares on the historical range map for fens (Map 1). Until a detailed field survey of this habitat is completed in Ireland it remains unclear whether this observed decline in the range is the in fact due to loss of sites, or lack of knowledge of the occurrence of sites within these grid squares.

Expert opinion would indicate that the current range of the habitat, based on the known sites listed within the NPWS Fen Study database (Foss 2007), is sufficient to represent the ecological variation of the habitat across its distribution and range in Ireland when compared to the potential historic distribution and range, mapped as part of this conservation status assessment.

It is, however, possible that following a future detailed field based fen survey of Ireland, some additional sites may be discovered within the area formerly believed to contain the habitat, which would increase the number of 10 km² grid cells which contain Alkaline fen. It is unlikely, however, that such new sites will add significantly to the range of the habitat in Ireland.

Based on available data the **Favourable Reference Range** (FRR) (see Map 3) is therefore considered to be the same as the current range for the habitat in Ireland as mapped in this assessment, which should be regarded as a minimum until detailed habitat surveys are completed.

## 3.1. Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relationship between current habitat range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

No specific studies have been undertaken on conservation status of the habitat range in Ireland during the reporting period making any assessment of the annual decline in the habitat extent or range problematic. Thus, although the actual trend cannot be quantified it is considered to be negative based on expert opinion.

An assessment based on current and favourable reference range indicates that the **current range polygon** of the habitat in Ireland (see Map 2), as defined by the list of sites for this habitat held in the NPWS Fen Study database (Foss 2007) covers 57,600 $km^2$ (576 total grid squares x 100 $km^2$).

The **Favourable Reference Range** (FRR) (see Map 3) is considered to be the same as the current range.

- **Current Habitat Range:** Can be considered as the area of the polygon which contains all of the grid cells with the habitat which is 57,600 $km^2$ (576 grid cells x 100$km^2$).
- **Favourable Reference Range** 57,600 $km^2$ (576 grid cells x 100$km^2$) the area of the polygon which contains all of the grid cells with the habitat.

The difference between the current Alkaline fen habitat range and the FRR for this habitat reveals that the current habitat range is the same as the FRR, which is considered to be **Favourable** according to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive).

## 4. Habitat Extent

The first attempt to estimate the original extent of fen habitats in the Republic of Ireland (Hammond 1979) indicated that 92,508 ha of fen occurred. Although Hammond did not differentiate between the different fen types recognised today, it is probable that a significant proportion of this original area of fen was Alkaline fen, with associated areas of Calcareous fen with *Cladium mariscus*, Transition mire and Petrifying springs. Many of these fens were associated with or occurred adjacent to midland raised bogs and in more western blanket bog habitats.

**Table 4.1: The original area (ha) of fen by County in Ireland after Hammond 1979**

| County | Area (ha) |
|---|---|
| Carlow | 7,883 |
| Cavan | 81 |
| Clare | 0 |
| Cork | 0 |
| Donegal | 0 |
| Dublin | 0 |
| Galway | 10,012 |
| Kerry | 5,844 |
| Kildare | 316 |
| Kilkenny | 4,654 |
| Laois | 1,232 |
| Leitrim | 81 |
| Limerick | 16,030 |
| Longford | 5,140 |
| Louth | 352 |
| Mayo | 3,901 |
| Meath | 0 |
| Monaghan | 469 |
| Offaly | 13,901 |
| Roscommon | 4,828 |
| Sligo | 1,279 |
| Tipperary | 4,298 |
| Waterford | 11,026 |
| Westmeath | 0 |
| Wexford | 566 |
| Wicklow | 615 |
| **Total** | **92,508** |

Significant decline in this habitat, due to the activities of human influences, have occurred in Ireland over the last 400 years, a feature noted by Hammond (1979) who included only a “man modified” fen category in his report. In his word “Undisturbed fens are rare and can only be found in a few counties in Ireland. Owing to their small size their representation on the map is not possible, even their continued existence as natural entities is under threat from agriculture and urban pressures”.

The two activities which are most important for the decline of this habitat are drainage activities associated with the related activities of land reclamation and the development of turf extraction schemes on bogs, in particular midland raised bogs (Crushell 2000).

Traditional cutting of bogs for turbary over the last 400 years, and the associated drainage of marginal areas, has had a serious impact on the extent of the raised bogs and their associated fens. Raised bog has declined by an estimated 68% as a result of turbary activity (Hammond 1979, Ryan & Cross 1984, Cross 1989). The mechanisation of peat cutting combined with a grant aid scheme under the Turf Development Act (1981) enabled many small scale extraction programmes to get underway has resulted in further loss of the raised bog and the associated Alkaline fen resource (Fernandez *et al*. 2006).

The most serious impact of mechanisation has been on midland raised bogs and the fens that were associated with these habitats. Mechanical extraction has accounted for a loss of 22% of the raised bog resource in less than 50 years (Cross, 1990), and the drainage works needed to make peat harvesting possible has also resulted in significant loss of Alkaline fen areas associated with the margins of raised bogs.

Subsequent studies undertaken by the Irish Peatland Conservation Council indicated that the intact resource of fen in Ireland has declined significantly since the Hammond study, with just 19,660 ha of intact conservation worthy fen remaining by the year 2000 (Crushell 2000; Foss *et al*. 2001).

Crushell (2000) did not recognise Alkaline fen as a category in his report and provided no specific data relating to this fen habitat type.

**Table 4.2: Conservation worthy fen area (ha) and number of sites recognised by IPCC in 2000 in each Irish County**

| County | Conservation Area (ha) | Number of Sites |
|---|---|---|
| Carlow | 806 | 16 |
| Cavan | 340 | 9 |
| Clare | 90 | 3 |
| Cork | 893 | 13 |
| Donegal | 1,318 | 14 |
| Dublin | 96 | 3 |
| Galway | 2,419 | 34 |
| Kerry | 339 | 8 |
| Kildare | 554 | 11 |
| Kilkenny | 386 | 11 |
| Laois | 843 | 8 |
| Leitrim | 160 | 8 |
| Limerick | 399 | 13 |
| Longford | 572 | 5 |
| Louth | 437 | 19 |
| Mayo | 223 | 10 |
| Meath | 214 | 13 |
| Monaghan | 2,460 | 38 |
| Offaly | 954 | 14 |
| Roscommon | 1,650 | 21 |
| Sligo | 475 | 26 |
| Tipperary | 1,571 | 16 |
| Waterford | 1,161 | 20 |
| Westmeath | 543 | 12 |
| Wexford | 406 | 6 |
| Wicklow | 351 | 16 |
| **Total** | **19,660** | **367** |

The decline is the habitat was also acknowledged by Ó Críodáin in 1995, as part of the SAC designation process, when he estimated that national extent of the Alkaline fen resource remaining in Ireland at just 12,000 ha.

The most recent analysis of conservation worthy sites recognised in Ireland, the NPWS Fen Study (Foss 2007) found that the total area of estimated fen vegetation recorded in the NPWS Fen Study amounted to 22,180 ha within 681 discrete sites (site complex sub-units omitted i.e. sub-sites that occur within existing SAC or NHA). In total the NPWS Fen Study database holds information on 808 sites (which includes 127 sub-site records), where fen habitats are known or believed to occur. This list of sites includes two fen types, poor fen and non-calcareous springs, which were not recorded as part of many of the earlier studies (i.e. Hammond 1979; Foss 2001 *inter alia*).

The extent of Annex 1 fens (i.e. Alkaline fen, *Cladium* fen, Transition mire, and Petrifying spring) which most closely relate to the fen types identified in previous studies, was estimated to cover just 10,298 ha (in a total of 702 sites) or 46% of the total fen area estimated in the NPWS Fen Study (Foss 2007). This is an indication that Annex 1 fens are less widespread in Ireland than estimated by previous workers (Crushell 2000; Foss et al. 2001).

In relation specifically to **Alkaline fen**, a total of 384 sites with this habitat were identified in the Republic of Ireland. Area estimates indicate that 6,840 ha of this habitat occur within the conservation worthy sites recognized in the NPWS Fen Study (Foss 2007), making it the most widespread Annex 1 fen habitat type in Ireland.

**Table 4.3: The extent of Annex 1 fen habitats recognised in Ireland within each county in the NPWS Fen Study (Foss 2007). Area in ha with the number of sites in brackets #.**

| **County** | * Cladium fen 7210 | **Alkaline fen 7230** | Transition Mire 7140 | * Tufa springs 7220 |
|---|---|---|---|---|
| Clare | 303 (15) | 856 (25) | 149 (13) | 7.92 (10) |
| Cavan | 0 (1) | 120 (7) | 0 (1) | 0.1 (3) |
| Carlow | 4 (2) | 4 (1) | | 0.01 (1) |
| Cork | 24 (3) | 501 (17) | 43 (8) | 5.6 (3) |
| Donegal | 21 (5) | 365 (25) | 375 (16) | 1.01 (2) |
| Dublin | | 61 (3) | | 0.1 (2) |
| Galway | 356 (29) | 1,282 (50) | 426 (23) | 7.6 (17) |
| Kildare | 84 (4) | 147 (11) | 2 (3) | 1.3 (8) |
| Kilkenny | 6 (4) | 118 (7) | 3 (2) | 1.9 (7) |
| Kerry | 10 (2) | 183 (9) | 1 (4) | 5.6 (4) |
| Longford | 0 (2) | 156 (7) | 13 (2) | |
| Louth | 3 (2) | 61 (6) | 1 (3) | 0 (1) |
| Leitrim | | 164 (6) | 59 (11) | 0.3 (2) |
| Laois | 10 (2) | 158 (10) | 0.1 (2) | 1.12 (5) |
| Limerick | 127 (13) | 436 (14) | 19 (3) | 0.16 (2) |
| Meath | 36 (4) | 81 (16) | 13 (3) | 0.12 (5) |
| Monaghan | 6 (3) | 9 (4) | 126 (14) | 0.1 (1) |
| Mayo | 249 (16) | 566 (34) | 548 (22) | 1.91 (10) |
| Offaly | 14 (5) | 1,955 (38) | 25 (7) | 2.67 (10) |
| Roscommon | 41 (5) | 386 (23) | 2 (3) | 1.01 (4) |
| Sligo | 0 (1) | 261 (20) | 13 (11) | 2.54 (11) |
| Tipperary | 163 (7) | 1,080 (19) | 16 (6) | 6.13 (7) |
| Westmeath | 11 (11) | 316 (56) | 95 (14) | 1.31 (8) |
| Wicklow | 60 (3) | 110 (8) | 30 (2) | 6.52 (9) |
| Wexford | 0 (2) | 63 (9) | 6 (1) | 0.11 (2) |
| Waterford | 0 (1) | 207 (11) | 4 (6) | 0.01 (1) |

* The data presented in this table includes a limited number of sites which cross one or more county boundaries. In such cases the area data and site is duplicated for the occurrence of the site in each of the respective counties in which it occurs.

As 90 of these Alkaline fen sites remain to be surveyed, and estimates of the area of Alkaline fen habitat on these sites are outstanding, it is likely that the final extent of the habitat resource may increase by as much as 2,070 ha (where average fen habitat per site is estimated to be approximately 23 ha based on data from the NPWS Fen Study, Foss 2007) to as much as 8,910 ha.

These data also indicate that the Alkaline fen habitat is less abundant than previously thought, and that the 6,840 ha represent just 7.4% of the resource of 92,508 ha of fen originally recognized by Hammond (1979).

In the light of the missing data on extent referred to above, expert opinion would indicate that the current area of the habitat, based on the known sites listed within the NPWS Fen Study database (Foss

2007), is insufficient to represent the ecological variation of the habitat across its distribution and range in Ireland.

Additional habitat areas will be discovered as part a future detailed field based fen survey of Ireland, which would increase the known extent of Alkaline fen. The present extent of 6,840 ha of the habitat in Ireland should therefore be regarded as a minimum area until detailed surveys are completed. This qualification concerning extent of the habitat should also be applied to the **Favourable Reference Area** (FRA).

Based on available data the **Favourable Reference Area** (FRA) (see Map 3) is therefore considered to be the same as the current known area of the habitat in Ireland, which should be regarded as a minimum until detailed habitat surveys are completed.

### 4.1. Conservation Status of Habitat Extent

No specific studies have been undertaken on the conservation status of the habitat extent in Ireland. The IPCC fen study of Crushell (2000) lists 10 fen sites with a total site area of 190 ha that had "undergone complete habitat loss since their conservation value was recognised" during the 1990's. A further 47 fen sites with a total site area of 2,463 ha, out of a total of 342 sites recognised in the IPCC study, were reported to have been "damaged since their conservation value was recognised". This represents some 14% of the sites listed in this study. A further 86 sites are listed by Crushell as being threatened by a variety of activities including drainage, agricultural reclamation, afforestation, infilling, turbary *inter alia* (25% of the sites listed by the IPCC).

It is unclear, from the Crushell study, whether the annual incremental decline in habitat area exceeds the 1% per annum threshold set as unfavourably bad by the assessment criteria for this specific habitat.

Analysis of the sites held in the NPWS Fen Study database (Foss 2007), showed that of the 808 sites listed 448 sites (55% of the total) had been affected by damaging operations or were threatened by such activities. In total 377 sites had experienced serious or very serious damage as defined by the NHA standard data forms (data mainly compiled in the 1993-1995 period), representing 47 % of all fen sites in the NPWS Fen Study database (Foss 2007). A further 311 sites were threatened by such activities which represents 39% of the listed sites. Of the sites assessed for damaging activities and threats within the NPWS Fen Study database, only 86 sites (11% of the total) showed no damaging activity, while 83 sites (10% of the total) were considered to have no threats.

Specifically for Alkaline fen, the results of the NPWS Fen Study (Foss 2007) showed that, 172 sites with a habitat area of 2,238 ha (33%) have been damaged by human activities, while 160 sites with a habitat area of 1,792 ha (26%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 2,660 ha or 39% of the presently recorded Alkaline fen resource. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum area estimate.

Again it is unclear, from this study, whether the annual incremental decline in habitat area exceeds the 1% per annum threshold set as unfavourably bad by the assessment criteria for this specific habitat.

The NPWS Fen Study found that the best estimate of the **current habitat area** in Ireland (based on known and predicted area information), as defined by the list of sites for this habitat listed in the NPWS Fen Study database (Foss 2007) covers an area of 68.4 $km^2$ (6,840 ha) in a total of 384 sites.

The **Favourable Reference Area (FRA)** is considered to be the area of this habitat in all sites listed in the NPWS Fen Study (Foss 2007) database, and is the same as the current area.

According to the to the General Evaluation Matrix (Annex E Explanatory notes Article 17 Habitat Directive) the area covered by the habitat type within the range is **Favourable**.

- **Area covered by the habitat:** 68.40 $km^2$. **Should be regarded as a minimum until detailed surveys completed and could increase to as much as 89.00** $km^2$**.**
- **Favourable Reference Area:** 68.40 $km^2$. **Should be regarded as a minimum until detailed surveys completed.**

## 5. Structures and Functions

### 5.1. Habitat Structures and Functions

Satisfactory data on habitat quality, and habitat change trends are lacking for this habitat in Ireland.

The IPCC fen study of Crushell (2000) referred to in section 4.1 above, showed that 10 fen sites with a total site area of 190 ha that had "undergone complete habitat loss since their conservation value was recognised " during the 1990's. A further 47 fen sites with a total site area of 2,463 ha, out of a total of 342 sites recognised in the IPCC study, were reported to have been "damaged since their conservation value was recognised". This represents some 14% of the sites listed in this study. A further 86 sites are listed by Crushell as being threatened by a variety of activities including drainage, agricultural reclamation, afforestation, infilling, turbary *inter alia.* (25% of the sites listed by the IPCC).

Analysis of the sites held in the NPWS Fen Study database (Foss 2007) showed for Alkaline fen, 172 sites with a habitat area of 2,238 ha (33%) have been damaged by human activities, while 160 sites with a habitat area of 1,792 ha (26%) are threatened by human activities. The total area affected by various threats and pressures was estimated at 2,660 ha or 39% of the Alkaline fen resource. As damage and threat assessment for only 71% of sites listed in the NPWS Fen Study database was undertaken, this figure should be regarded as a minimum area estimate.

The damage caused to fen habitats and reported by Crushell (2000) and noted during the NPWS Fen Study (Foss 2007) has presumably been coupled with a decline in habitat quality (i.e. structure and functions).

It is likely that the number of sites for the habitat which have experienced damage in the past from a variety of negative factors (i.e. burning, peat extraction, dumping, infilling, over grazing) or suffered alteration in hydrological conditions (i.e. local drainage, arterial drainage, water abstraction etc.) or are threatened by these and other activities, is in fact much higher than indicated by these two studies. However, without a national survey to record such damage and threats no more specific assessment of conservation status can be undertaken at present.

Although, the overall extent of the habitat may remain unchanged in some cases, adverse changes in some of the above attributes would indicate deterioration in overall habitat structure and function.

### 5.1.1. Conservation Status of Habitat Structures and Functions

Satisfactory data on habitat quality, and habitat change or species trends are lacking. Based on available information and expert opinion it is likely that more than 33% of the area of the habitat in Ireland is unfavourable conserved as regards its specific structures and functions (including typical species). Conservation status of habitat structures and functions is therefore regarded as unknown but likely to be **Unfavourable Bad**.

## 5.2. Typical Species

Alkaline fens typically contain a suite of vascular plants, and are particularly characterised by the presence of small sedges, a rich herbaceous flora and usually a prominent "brown moss" carpet.

According to the 2003 version of the Interpretation Manual the characteristic plant communities and species of Alkaline fen habitat (7230) are as follows:

Calciphile small sedges and other Cyperaceae usually dominate the mire communities, which belong to the *Caricion davallianae*, characterised by a usually prominent "brown moss" carpet formed by *Campylium stellatum*, *Drepanocladus cossonii*, *D. revolvens*, *Palustriella commutata*, *Calliergonella cuspidata*, *Ctenidium molluscum*, *Fissidens adianthoides*, *Bryum pseudotriquetrum* and others, a grass like growth of *Schoenus nigricans, S. ferrugineus, Eriophorum latifolium*, *Carex davalliana*, *C. flava*, *C. viridula ssp. brachyrrhyncha*, *C. hostiana*, *C. panicea*, *Juncus subnodulosus*, *Scirpus cespitosus*, *Eleocharis quinqueflora*, and a very rich herbaceous flora including *Tofieldia calyculata*, *Dactylorhiza incarnata*, *D. traunsteineri*, *D. traunsteinerioides*, *D. russowii*, *D. majalis* ssp. brevifolia, *D. cruenta*, *Liparis loeselii*, *Herminium monorchis*, *Epipactis palustris*, *Pinguicula vulgaris*, *Pedicularis sceptrum - carolinum*, *Primula farinosa*, *Swertia perennis*.

Wet grasslands (*Molinietalia caerulaea*, e.g. Juncetum subnodulosi & Cirsietum rivularis, 37), tall sedge beds (Magnocaricion, 53.2), reed formations (Phragmition, 53.1), fen sedge beds (Cladietum mariscae, 53.3), may form part of the fen system, with communities related to transition mires (54.5, 54.6) and amphibious or aquatic vegetation (22.3, 22.4) or spring communities (54.1) developing in depressions. The sub-units below, which can, alone or in combination, and together with codes selected from the categories just mentioned, describe the composition of the fen, are understood to include the mire communities sensu stricto (Caricion davallianae), their transition to the Molinion, and assemblages that, although they may be phytosociologically referable to alkaline Molinion associations, contain a large representation of the Caricion davallianae species listed, in addition to being integrated in the fen system; this somewhat parallels the definition of an integrated class Molinio - Caricetalia davallianae in Rameau et al., 1989. Outside of rich fen systems, fen communities can occur as small areas in dune slack systems (16.3), in transition mires (54.5), in wet grasslands (37), on tufa cones (54.121) and in a few other situations. The codes below can be used, in conjunction with the relevant principal code, to signal their presence. Rich fens are exceptionally endowed with spectacular, specialised, strictly restricted species. They are among the habitats that have undergone the most serious decline. They are essentially extinct in several regions and gravely endangered in most.

While CORINE defines the species present in Rich fens Caricion davallianae (54.2) vegetation as: Calciphile small sedges and other Cyperaceae usually dominate the mire communities, which belong to the Caricion davallianae, characterised by usually prominent "brown moss" carpet formed by *Campylium stellatum, Drepanocladus cossonii, D. revolvens, Palustriella commutata, Ctenidium molluscum, Fissidens adianthoides, Bryum pseudotriquetrum* and others. With a grass like growth of *Schoenus nigricans, Eriophorum latifolium, Carex flava, C. viridula ssp. brachyrrhyncha, C. hostiana, C. panicea, Juncus subnodulosus* inter alia.

Table 3.1 shows characteristic species for the habitat as defined by the Habitats Directive; phytosociological association character and prominent species; characteristic species for the habitat in general in Ireland as well species considered to be indicators of good site quality or typical species as defined by the Directive (Ó Críodáin, C. *pers. comm.*).

**Table 5.1 List of typical species of Alkaline fen habitat in Ireland**

| Species | Characteristic species in the Habitats Directive Interpretation Manual (2003) | Association Character & prominent (PR) species on Alkaline fen (Ó Críodáin, C. & Doyle, G.J., 1994; Doyle, G.J. & Ó Críodáin, C., 2003) | Typical or good site quality indicator species (Ó Críodáin, C. *pers. comm*.) | Characteristic Irish Alkaline fen species |
|---|---|---|---|---|
| *Anagallis tenella* | | PR | | Yes |
| *Aneura pinguis* | | | | Yes |
| *Bryum pseudotriquetrum* | Yes | | Yes | Yes |
| *Calliergonella cuspidata* | | PR | | Yes |
| *Campylium stellatum* | Yes | PR | Yes | Yes |
| *Carex dioica* | | Character | Yes | Yes |
| *Carex echinata* | | PR | | Yes |
| *Carex hostiana* | Yes | Character | | Yes |
| *Carex nigra* | | Character | | Yes |
| *Carex panicea* | Yes | PR | | Yes |
| *Carex pulicaris* | | PR | Yes | Yes |
| *Carex viridula ssp. brachyrrhyncha* | Yes | PR | | Yes |
| *Carex viridula ssp. oedocarpa* | | Character | Yes | Yes |
| *Carex viridula ssp. brachyrrhyncha* | | Character | Yes | Yes |
| *Cirsium dissectum* | | PR | | Yes |
| *Ctenidium molluscum* | Yes | | Yes | Yes |
| *Dactylorhiza incarnata* | Yes | | | Yes |
| *Dactylorhiza traunsteineri* | Yes | | Yes | Yes |
| *Drepanocladus cossonii* | Yes | | | Yes |
| *Drepanocladus revolvens* | Yes | | Yes | Yes |
| *Eleocharis multicaulis* | | PR | | Yes |
| *Eleocharis quinqueflora* | Yes | Character | Yes | Yes |
| *Epipactis palustris* | Yes | | Yes | Yes |
| *Eriophorum latifolium* | Yes | | Yes | Yes |
| *Fissidens adianthoides* | Yes | | Yes | Yes |
| *Galium palustre* | | PR | | Yes |
| *Hydrocotyle vulgaris* | | Character | | Yes |
| *Juncus articulatus* | | Character | | Yes |
| *Juncus bulbosus* | | PR | | Yes |
| *Juncus subnodulosus* | Yes | Character | Yes | Yes |
| *Mentha aquatica* | | PR | | Yes |
| *Molinia caerulea* | | PR | | Yes |
| *Palustriella commutata* | Yes | | Yes | Yes |
| *Parnassia palustris* | | | Yes | Yes |
| *Pinguicula vulgaris* | Yes | | Yes | Yes |
| *Ranunculus flammula* | | Character | | Yes |
| *Schoenus nigricans* | Yes | Character | Yes | Yes |
| *Scorpidium scorpioides* | | PR | Yes | Yes |
| *Selaginella selaginoides* | | PR | Yes | Yes |
| *Succisa pratensis* | | PR | | Yes |

The final list includes species that are characteristic of the habitat expanded to include those species indicative of good habitat quality, which might be included in future surveys of the habitat. An over representation of a single species does always indicate good habitat quality.

This list is slightly different from that in the Interpretation Manual of the Habitats Directive, as certain species are included in the Interpretation Manual as characteristic of the habitat but do not occur on Irish site. The list also reflects recent changes in species nomenclature.

### 5.2.1. Conservation Status of Habitat Typical Species

No specific studies have been undertaken on conservation status of habitat typical species in Ireland.

Nonetheless, the assessment of the habitat quality (i.e. Structure and Functions, see above) is partially based on changes in habitat extent and can be used to assess the conservation status of Typical Species. The definition of a habitat is based on the presence and dominance of certain typical species, with particular emphasis on sedges and brown mosses. Thus, a decline in habitat quality (estimated at 39% of the area of this habitat damaged and threatened in Ireland) is likely to have resulted in a decline in the presence of Typical Species. The conservation status of habitat structures and functions is regarded as **Unknown** for this habitat.

As habitat quality and typical species are so interdependent, it can be suggested that an **Unknown** but likely to be **Unfavourable Bad** conservation status can also be inferred for Typical Species.

## 6. Impacts and Threats

A variety of impacts and threats are recognised which have resulted in the historic decline and loss in quality and functions of the habitat in Ireland to the levels we see today, and continue to threaten the habitat. Peat or turf cutting, arterial drainage, local drainage and agricultural reclamation are reported as being the most significant activities affecting the conservation status of Alkaline fens (Foss *et al*. 2001, Hammond 1979, Crushell 2000, Curtis *et al* 2006).

In more recent times a series of additional factors have also damaged sites of conservation value (Foss *et al*. 2001, Crushell 2000). These impacting activities include drainage associated with reclamation for agriculture or general land “improvement”, infilling of sites with building waste, dumping of household refuse, afforestation, water pollution and urban expansion (Foss *et al*. 2001, Crushell 2000, Curtis & McGough 1981, Curtis et al 2006). Crushell (2000) list some 46 fen sites with a total site area of 2,463 ha that have been damaged by these activities, while 86 fen sites are listed as being threatened by these activities.

These activities were found to seriously disrupt the hydrological conditions needed to maintain these habitats, leading to desiccation of the fen and loss of the characteristic micro-topographical features and eventually change in flora and fauna (Foss *et al*. 2001). These activities have resulted in at least a 79% decline in the extent of fens (Foss *et al*. 2001) with only 21% remaining in a conservation worthy condition.

Of the remaining sites, 80% are reported to be small in size (less than 100ha) making their future management particularly susceptible to external environmental changes (Foss *et al*. 2001). While in the most recent NPWS Fen Study (Foss 2007) of the 384 Alkaline fens identified in Ireland, almost 44% (169 sites) had a total site area smaller than 50 ha.

A review of damaging activities and threats reported on sites from 1993 to-date was also undertaken as part of this conservation assessment. Data on activities affecting or likely to affect sites were collated against individual sites from various sources.

These included:

- Recent site surveys undertaken by NPWS where damage to fens was reported
- Damage reported to fen sites in the IPCC Fen Study (Crushell 2000)
- Damage assessment section of the NHA standard data forms held by NPWS created as part of the NHA surveys of the mid to late 1990’s. Only serious or very serious damage, as reported

on the NHA data forms, and likely to affect the fen habitats on sites was recorded in the NPWS Fen Study database (Foss 2007)

- Site Inspection Reporting (SIR) programme. Reporting under SIR is carried out on a three yearly cycle that began in 1998 (i.e. 1998-2000; 2001-2003; 2004-2006). The Research Branch Monitoring Section (NPWS) developed the SIR programme to be used as a monitoring tool. Local NPWS staff log the following info: activities occurring on the site and their effects on the site's integrity, follow-up actions including all outcomes such as prosecutions, notifiable actions and positive management undertaken and site patrolling frequency and purpose.

Analysis showed that of the 808 sites listed in the NPWS Fen Study database 448 sites (55% of the total) had been affected by damaging operations or were threatened by such activities. In total 377 sites had experienced serious or very serious damage as defined by the NHA standard data forms, representing 47 % of all fen sites in the NPWS Fen Study database (Foss 2007). A further 311 sites were threatened by such activities which represents 39% of the listed sites.

For Alkaline fen, 172 listed sites with a habitat area of 2,238 ha (33% of the national resource) have been damaged by human activities, while 160 sites with a habitat area of 1,792 ha (26%) are threatened by human activities. The total area affected by various threats and pressures has been estimated at 2,660 ha which represents 39% of the known Alkaline fen resource.

## 6.1. Agriculture & Land Reclamation

Crushell (2000) reported that the most serious impact on fens has been for their reclamation for agricultural land. The process involves drainage, fertilisation, reclamation and the removal of peat. The fact that alkaline fens (and associated areas of calcareous species rich *Cladium* fen, Petrifying springs and Transition mires) are most commonly found over limestone and are indicative of fertile land has resulted in many areas with such communities being drained and utilised for agriculture (O Críodáin & Doyle 1997). Drainage is undertaken to dry out the actual fen habitat surface, or the agricultural land or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural.

From the mid 1800's to the present day the total area of and drained under the various Acts and Schemes amounted to more than 2 million hectares, or some 30% of the total land area in Ireland (Anonymous 1999). Much of this work was carried out under the following: the 1945 Arterial Drainage Act, the Land Project of 1949, the Farm Modernisation Scheme 1974-1985, and the Western Drainage Package 1979-1988. These schemes are likely to have had a serious impact on many fen systems, a fact that is supported by evidence from the Arterial drainage act which resulted in drainage works being carried out on 38 catchments in Ireland, affecting some 262,800 ha of land. Since the mid 1980's there has been a substantial decline in grant aided drainage schemes.

Land reclamation has also been grant aided under the now suspended Farm Improvement Programme and the Programme for Western Development. Between 1981 and 1990 more than 25,000 approvals for intensive lowland reclamation works were made and provided with Euro 25 million in grant aid.

### Agriculture & Land Reclamation Trend

No specific studies have been undertaken on agriculture and land reclamation trends of the habitat in Ireland.

Although larger grant aided schemes have now ceased, small scale drainage and improvements works often carried out on agricultural land surrounding the fen habitat continue to damage these sensitive wetland systems.

## 6.2. Drainage

Drainage is conducted to interfere with the aquifer, dry out the actual fen habitat surface, or the agricultural or peatland often found adjacent to fens, and is the principal technique used to facilitate land reclamation for agricultural purposes and the cutting of turf.

These drainage activities seriously disrupt the hydrological conditions needed to maintain these water dependent habitats, leading to desiccation of the fen and loss of the characteristic micro-topographical features and eventually change in flora and fauna, through the loss of fen character species and/or the invasion of species that thrive in drier conditions (Foss *et al*. 2001).

The blocking of drains is considered as an essential tool for the recovery and improvement of the habitat which has been affected by this activity.

## Drainage Trend

No specific studies have been undertaken on drainage trends of the habitat in Ireland

Although, according to the findings of numerous surveys conducted on sites with this habitat, drainage operations are a recurring feature that continues to threaten the integrity of sites or to lead to their degradation. The ban on the insertion of new drains on protected high bog areas (i.e. raised bogs) should have positive implications for associated fens in such locations.

## 6.3. Turf cutting

Although turf cutting has its most significant affect on the acid bogs from which the turf is cut, drainage works associated with this activity may adversely affect many low lying areas, where fen communities occur. In addition, with more modern forms of mechanised peat extraction (see below), the peat must be spread over dry marginal land beside the bog to allow it to dry, a feature which necessitates improved drainage on these marginal areas.

Turf cutting, which in the past mainly consisted of hand cutting, became mechanised since the 1980's and was stimulated by the introduction of the Turf Development Act in 1981. The mechanisation of peat extraction by private producers allowed the exploitation of small bogs by small commercial companies and co-operatives. This has been accompanied by intensive drainage of the high bog, which was practically non-existent on the smaller bogs up to 1981.

Therefore, in the last two decades, medium and small size bogs have been increasingly severely impacted by mechanised turf cutting. In the view of the IPCC (Foss *et al*. 2001), the widespread use of machinery has in recent years greatly accelerated the process of decline in peatland resource, particularly Lowland Raised Bogs. They consider that, more peat is now being harvested over a wider area of bog and on a semi-commercial basis since the decline of hand cutting. This has in many cases altered the scale of cutting from the traditional domestic small scale level to much more intensive semi-industrial scale extraction.

## Turf Cutting Trend

The mechanisation of peat extraction has increased the amount of peat extracted from active turf plots and thus the negative effects of this activity. Mechanisation has correlated with a reduction in manual extraction.

Following the publication of the list of SAC raised bog sites in 1997, there was prolonged and strenuous objection from turf cutters. The objectors especially concerned about loss of property rights, loss of future fuel supplies and loss of a way of life in the summer months. The then Minister, Síle de Valera T.D., addressed the objections of bog owners by allowing them cut for domestic use for 10 years, up to and including 2008, at which stage all cutting would have to cease. When the NHAs were designated in 2004, a similar 10-year derogation was put in place, allowing cutting until 2014.

The Department of Environment, Heritage and Local Government (DEHLG) has introduced two voluntary turf cutting cessation schemes since 1999 to buy out turbary rights in NHAs and SACs. The schemes, which were relatively successful in dealing with obvious commercial activity (i.e. moss peat developments), were less successful in dealing with small scale, semi-commercial to commercial fuel peat operations and have had almost negligible impact on domestic cutting. The schemes do not appear to have significantly reduced the numbers of cutters and thus the negative effects of cutting on raised bog priority habitats (Fernandez *et al*. 2006). Thus, unless a more restrictive approach (i.e. mandatory cessation of cutting coupled by compensation packages) is taken, turf cutting is likely to continue at current levels or even increase with increasing fuel prices.

## 6.4. Afforestation

Forestry, which mainly consists of coniferous plantations, is found either on the raised or blanket bog or on the cutover area adjacent to these bog types bog. Surface drainage is always associated with forestry plantations and has similar negative effects to that carried out to facilitate peat cutting and land reclamation. However, other impacts such as shading of vegetation and compression of the peat caused by heavy machinery are related to afforestation.

Egan (1999) mentioned that in 1987, Coillte initiated a major afforestation programme on cutaway bogland and up to 1998 over 4,000 ha were planted.

### Afforestation Trend

EU grant aid for private forestry, which is administered by the Forest Service of the Department of Agriculture and Food, is now withheld for designated peatlands. Indeed, according to the Forestry Service biodiversity strategy, areas designated as SAC or SPA are not considered for afforestation grants. NHAs may also be excluded if the proposed development is incompatible with their protection (McAree, 2002). On the other hand, all grant-aided development in Ireland must also conform to the Forest Service Forest biodiversity guidelines which set out measures to protect existing habitats and wildlife and to maximise the biodiversity of forest.

Coillte Teoranta, one of the major owners of peatland in the country, has ceased planting conifers on intact peatlands on its ownership, principally on economic grounds. It has also made strong commitments to the implementation of the Helsinki Process on Sustainable Forest Management and as part of their Nature Conservation Program. Coillte has initiated *Blanket Bog & Raised Bog Restoration Projects* that will result in the felling of coniferous plantations and drain blocking on some of their peatland sites.

The threat from afforestation on SAC & NHA designated sites therefore appears to be declining particularly. The current trend for un-designated sites is unknown.

## 6.5. Other Impacting Activities

Impacting activities such as over grazing by cattle and sheep, associated poaching by grazing animals, reduction in grazing leading to scrub invasion, burning, dumping of domestic waste, landfill dumping, fertilisation, water pollution, communication routes, cultivation, mowing/cutting, modification of inland water structures, sand and gravel extraction are among the impacting activities that have been reported on sites with the habitat (Foss 2007; see Table 6.1).

Specifically they may occur within and around locations for this habitat. These activities are considered to have negative impact on the habitat where they occur or where they affect the aquifer.

With the exception of damage caused by grazing, landfill and the possible effects of water pollution which are widely reported from fen sites, the activities listed above are in general less widespread than the impacting activities of land reclamation, drainage, peat cutting, and afforestation discussed earlier.

Although significant changes in water chemistry, caused by water pollution has been cited (Curtis *et al* 2006) as a factor affecting site vulnerability, studies are lacking on the physio-chemical requirements of the habitat in Ireland. Buffering capacity is considered to be high for the habitat (due to nature of the organic peat substrate), but not accurately known. Phosphorus is the limiting nutrient to growth in most fen (Doyle & Ó Críodáin 2003) and elevated levels lead to the vigorous growth of grasses over other species, resulting in the loss of fen species. The role of increased nitrogen levels in the species composition of the habitat is unclear.

**Table 6.1: Severity of impacting activities recorded on Alkaline fen sites recognised in the NPWS Fen Study (Foss 2007)**

| Main Pressure - Past and present | Level of Impact |
|---|---|
| 143 Overgrazing by cattle | Significant |
| 141 Abandonment of pastoral systems | Minor |
| 150 Restructuring of agricultural land holding | Significant |
| 152 Removal of scrub | Moderate |
| 160 General Forestry management | Moderate |
| 161 Forestry planting | Significant |
| 180 Burning | Moderate |
| 230 Hunting | Minor |
| 300 Sand gravel extraction | Minor |
| 301 Quarries | Minor |
| 310 Peat Extraction | Significant |
| 311 Hand-cutting of peat | Significant |
| 312 Mechanical removal of peat | Significant |
| 400 Urbanised areas, human habitation | Moderate |
| 421 Disposal of household waste | Moderate |
| 502 Communication networks routes, auto routes | Minor |
| 700 Pollution | Moderate |
| 701 Water Pollution | Moderate/Significant |
| 790 Other pollution or human impacts | Minor |
| 800 Landfill, land reclamation and drying out, general | Significant |
| 803 Infilling ditches, dykes, ponds, marshes and pits | Significant |
| 810 Drainage, local and arterial schemes | Significant |
| 890 Other human induced changes in hydraulic conditions | Moderate |
| 950 Biocenotic evolution | Minor |
| 951 Accumulation of organic material | Minor |
| 954 Invasion by a species | Moderate |

## 7. Future Prospects

### 7.1. Negative Future Prospects

Deterioration of the Alkaline fen hydrology at current rates caused by the main threats of peat cutting, drainage, forestry, land reclamation and associated increased grazing damage and possibly water pollution will continue to affect the viability of the habitat. Other negatively influenecing activities (see Table 6.1 above) may also result in further habitat decline at less significant levels than that caused by the main threats.

No accurate current survey data on damage occurring on the known habitat national resource exists. However, the majority of anecdotal information from recent site specific surveys indicate that the Future Prospects for the habitat is Bad.

Furthermore, climate change predictions of increases in temperatures accompanied by a decrease in summer rainfall would increase the summer moisture deficit of Alkaline fens and potentially affect species composition on sites and might possibly result in a reduction or cessation of peat formation. This would result in further habitat losses, reduction in habitat quality and possible reduction in habitat viability.

## 7.2. Positive Future Prospects

No specific national management programme designed to ensure the favourable conservation status of sites with this habitat have been undertaken in Ireland (Ó Críodáin pers comm.).

Alkaline fen habitats may, however, benefit indirectly from a number of individual management and restoration programmes being carried out in Ireland, though these benefits are likely to be relatively restricted in terms of the overall extent of the habitat resource benefiting from these initiatives. In addition a variety of national measures under various schemes, Directives and survey and research programmes may also benefit sites with this habitat. The various initiatives occurring are outlined below:

**NPWS National Fen Survey of Ireland**

Due to limitations in the current knowledge of the Irish fen resource, in terms of both the fen types identified on many sites to date, and the extent of the habitat type(s) within sites (Foss 2007), the NPWS initiated the National Fen Survey of Ireland in 2007. The first detailed pilot survey is being undertaken in County Monaghan in conjunction with Monaghan County Council.

The aims of the County Monaghan and future fen surveys, will be to survey known and recently reported fen sites in each Irish County, locate further sites of conservation value, characterise the fen habitats present (including EU Annex I fen habitat types) in terms of their floristics, hydrology and water chemistry parameters, estimate the extent of fen habitat(s) present on each site, rate site and habitat quality, record threats and damaging operations and make management priorities and needs recommendations to ensure long term conservation and viability of the key sites identified, and their associated fen habitats.

Results of the National Fen Survey will feed into the respective County Development Plans and the NPWS conservation designation process.

**NPWS Site Research & Restoration Work**

The NPWS has undertaken an on-going research programme at Pollardstown Fen, Co. Kildare on the relationships between the hydrology and the ecology of Petrifying Springs and Alkaline fen habitats on the site. This has yielded valuable information on the extent of the impacts arising from small decreases in the water levels of the supplying aquifer on the fen habitats occurring at the site.

In response NPWS has taken mitigation actions and are developing plans for habitat enhancement to offset potential future impacts. This work is being and will be used to develop national risk assessment and monitoring approaches under both the Water Framework Directive and Habitats Directive for Petrifying Springs and Alkaline Fens.

Curtis *et al*. 2006 indicates that the potential for restoring stands of Alkaline fen is largely untested, and is dependent on the nature and extent of the damage. Restoration trials are at an early stage on Pollardstown Fen, Co. Kildare and Blackditch, Co. Wicklow. These trials intend to improve the areas of all fens community types including Alkaline fen. The major tool being tested is restoration of the original water levels at both sites, appropriate ditch and drain management, with scrub or woodland removal and re-introduction of grazing at the latter site.

In the case of Pollardstown fen, it has been established that the construction of the Kildare Bypass through the Curragh aquifer has contributed to the drying out of areas of alkaline fen on a seepage slope at the fen margin. It is not known whether or not this will be a temporary – as distinct from a permanent – effect. Proposals have been made to offset this effect by planning for the enhancement of alkaline fen habitat in degraded areas elsewhere on the site that are less vulnerable to climatic or anthropogenic-induced desiccation. However, these have not yet been implemented, due to unwillingness on the part of the National Roads Authority – who were responsible for the construction of the road - to provide funds.

### NPWS Raised Bog Restoration Project

On Irish raised bogs NPWS commenced a *Raised Bog Restoration Project* in 1994, which ran up to the end of 1999 and included 10 sites. This project was assisted by the EU Cohesion Fund (Ryan and Streefkerk, 1998). Objectives of the project were the restoration of the bogs hydrology, acquisition of raised bog land, survey of high bog and lagg systems and establishment of a monitoring program. These restoration works consisted of the blocking of drains, mainly on the high bog, and the construction of dams. NPWS again carried out restoration works (i.e. blocking of drains) on three new sites in 2003 and one in 2006. The results of these restoration works are considered positive overall, as there is some expansion and new Active Raised Bog habitat formation occurring (Fernandez *et al.* 2005). These restoration activities may also benefit other wetland habitat types.

### EU Life - Nature Programme

Coillte Teoranta initiated a *Raised Bog Restoration Project* in 2004. This was funded by an EU Life - Nature Programme. This project will be completed in 2008 and forms part of Coillte's Nature Conservation Programme. The project will work towards restoring 571.2 hectares of raised bog habitat on its property in the midland counties. This project area will be managed with nature conservation as the primary management objective into the future. The project also involves the felling of 450ha of plantation forest, felling of naturally regenerated exotic trees on open bog, perimeter protection of vulnerable raised bog sites against fire, blocking of drains after felling and ongoing monitoring of vegetation and water levels on 14 sites (Coillte, 2005 - www.raisedbogrestoration.ie).

Coillte Teoranta initiated a *Blanket Bog Restoration Project* in 2002. This project, jointly funded by Coillte and DG-Environment under the EU LIFE-Nature Programme, is a four-year scheme, the primary aim of which is to achieve restoration of blanket bog habitat within 1212 hectares of land owned by Coillte. The main focus of the project, active blanket bog, is listed as a priority habitat for conservation under Annex 1 of the EU Habitats Directive, and the areas for restoration either lie within, or occur adjacent to, proposed Special Areas of Conservation. A total of 14 blanket bog sites, most of which are located along the western seaboard of Ireland, have been selected for restoration. At most sites, the main restoration measures to be employed are the removal of conifers and the blocking of any existing drains (http://www.irishbogrestorationproject.ie/).

### Cutaway Bog Restoration Projects

A further trend which may facilitate the creation of new secondary Alkaline fen sites, over the long term, is the abandonment of former cutaway peat areas following the extraction of commercial peat reserves. On these sites, the cessation of drainage activities used to keep the areas dry enough to allow peat extraction, results in partial re flooding of areas, where contact with the underlying mineral soils or fossil fen peat allows the regeneration of alkaline fen communities (Egan 1999, Farrell 2006). Within the NPWS Fen Study database, 19 discrete sites, occurring in former Bord na Móna peat works are listed which contain 1,790 ha of regenerating secondary Alkaline fen habitat.

Bord na Móna (Irish Turf Development Bord) initiated a series of cutaway bog restoration projects in the 1990's in County Mayo (Anonymous 2003; Farrell & Doyle 1998; 2003) and in the midlands (Farrell 2006). Cutaway bog is the term used to describe peatland from which the economically recoverable layers of peat have been extracted for commercial or domestic purposes. There will be up to 70,000 ha of these lands emerging as a result of Bord na Móna's present peat production activities. The potential exists to create a future landscape of forestry and open grasslands interspersed with lakes, wetlands and natural corridors for wildlife; a landscape which is both economically productive for its communities and which respects and values areas of wilderness alongside commercial enterprise (http://www.bnm.ie).

### NPWS Site Conservation Designations

One further positive prospect for the habitat in Ireland is that 46% (3,152 ha) of all sites recorded within the NPWS Fen study database (Foss 2007) are within a candidate SAC (cSAC) and an additional 28% (1,921 ha) of sites are within a candidate Natural Heritage Area (cNHA).

In the case of Alkaline fen sites 5,073 ha or 74% of the known habitat area falls within a candidate designated (SAC or NHA) area in Ireland, which should in the long term provide an additional degree of protection for these sites. This optimism must, however, be tempered by the fact that habitat loss in terms of extent and quality are still occurring within candidate SAC and NHA due to human interference (see above).

**NPWS SAC, SPA and NHA Conservation Management Plans**

The NPWS is planning to produce Conservation Management Plans for each SAC, SPA and NHA in Ireland. Each plan will list the wildlife resources of the area, the current human uses, any conflicts between the two, and strategies for retaining the conservation value of sites. The draft plans will be given to a liaison committee and other interested parties for discussion and consultation. The NPWS will then prepare a final version of the conservation plan. Consultation on draft consultation plans has begun. Conservation Plans, once complete, will be reviewed on a 5 year cycle.

Data provided by the Management Planning Services Unit (MPSU) section in NPWS (dated 21 February 2007) indicates that 382 conservation plans are presently planned for wildlife sites in Ireland. In total 274 plans are in preparation, 64 plans are completed an ready to go to consultation, while 44 are in consultation or have gone through this process. Within the NPWS Fen Study database (Foss 2007) of the 808 fen sites listed a total of 219 sites have management plans in preparation, 38 plans are completed an ready to go to consultation, while 40 are in consultation or have gone through this process. Implementation of the recommendations in these plans will provide additional conservation protection to fens within the listed sites.

To provide increased conservation protection under the Habitats Directive to SACs from damaging activities, a series of Notifiable Actions have been drawn up by the Department of the Environment (see Appendix IV) on these areas. A landowner must obtain a written consent before performing and such operations on, or affecting the land or waters within an SAC.

**Rural Environment Protection Scheme**

Rural Environment Protection Scheme (REPS), is a scheme designed to reward farmers for carrying our their farming activities in an environmentally friendly manner and to bring about environmental improvement on existing farms. The objectives of the Scheme are to:

- establish farming practices and production methods which reflect the increasing concern for conservation, landscape protection and wider environmental problems;
- protect wildlife habitats and endangered species of flora and fauna;
- produce quality food in an extensive and environmentally friendly manner.

When properly implemented the scheme can benefit sites with this habitat in Ireland, although the lack of sufficient scientific and management expertise needed at a local level, on sites with the habitat, may be a hindrance to achieving this goal.

**EU Water Framework Directive**

Under the Water Framework Directive (2000/60/E) all inland and coastal waters within defined river basin districts must reach at least good status by 2015 and the Directive further defines how this should be achieved through the establishment of environmental objectives and ecological targets for surface waters. Efforts to protect water dependent habitats, which include Alkaline Fen, Transition Mire, Petrifying Springs and Calcareous Fens with Cladium mariscus are being taken within each River Basin District. This is critical as far as protection of the water supplies for these groundwater dependant systems are concerned.

All SACs and, in future, NHAs in which these fen habitats as a qualifying interests will be listed in the Register of Protected Areas drawn up for each River Basin District.

The Water Framework Directive requires that an integrated monitoring programme be established within each river basin district. These monitoring programmes will in many cases be extensions or modifications of existing programmes and will enable collection of the physical, chemical and biological data necessary to assess the status of surface and groundwater bodies in each river basin district.

Where water quality or supply issues are, or have the potential to, impact adversely on sites, this will have to be dealt with through the Programme of Measures associated with each River Basin District Management Plan.

### 7.3. Overall Habitat Future Prospects

No specific management programmes designed to ensure the favourable conservation status of sites with this habitat have been undertaken in Ireland.

Negative actions such as land reclamation, turf cutting, and drainage continue impacting the habitat: decreasing its extent and degrading its structure and functions. Only limited measures have been introduced to address these damaging activities, which are likely to have increased in severity since the 1990's.

To summarise, the habitat long-term viability is not assured and there are unfavourable prospects for its future. The Future Prospects are therefore deemed to be **Unfavourable Bad**.

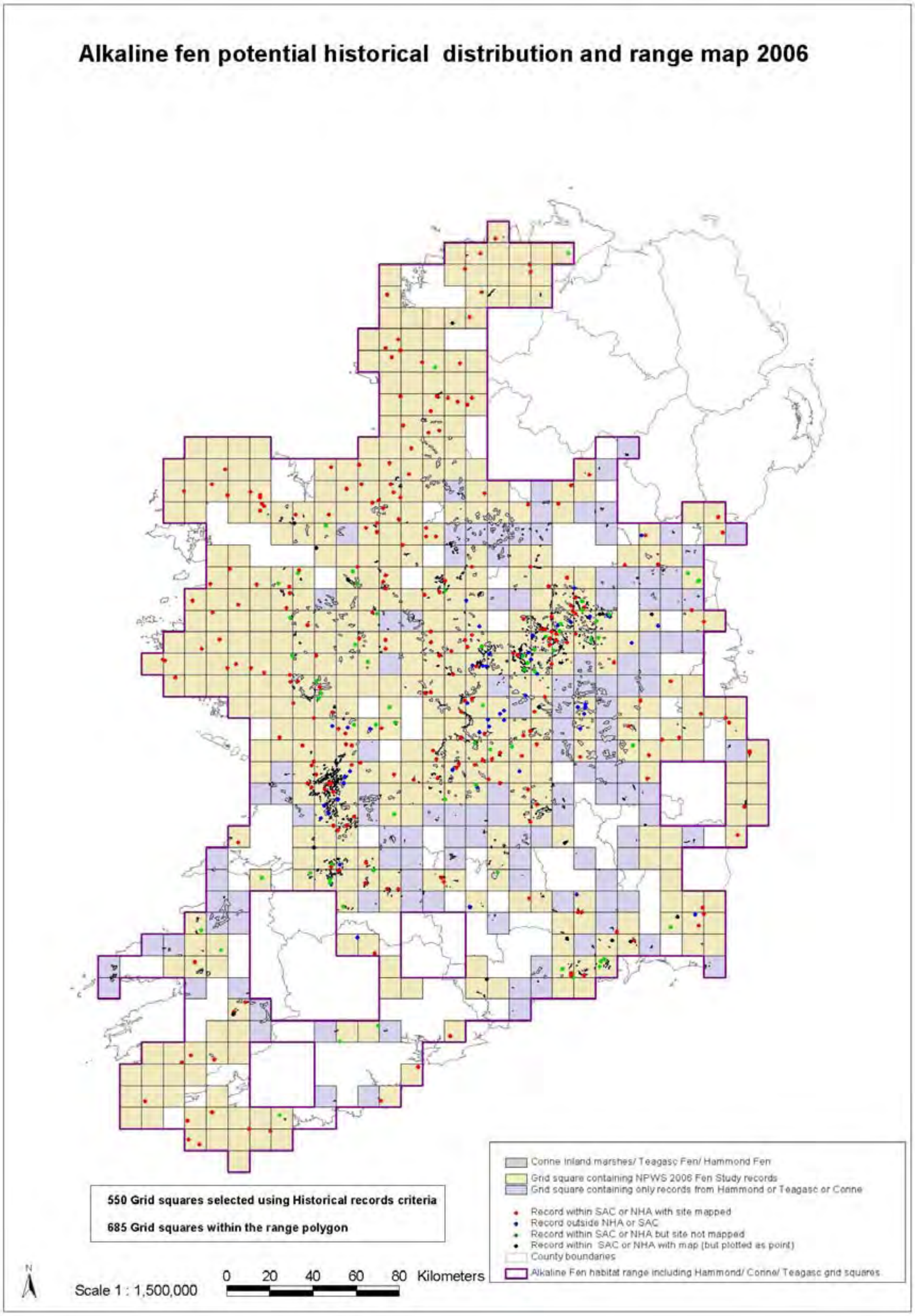
## 8. Overall Assessment of the Habitat Conservation Status

The habitat conservation status of the four main attributes has been assessed as follows:

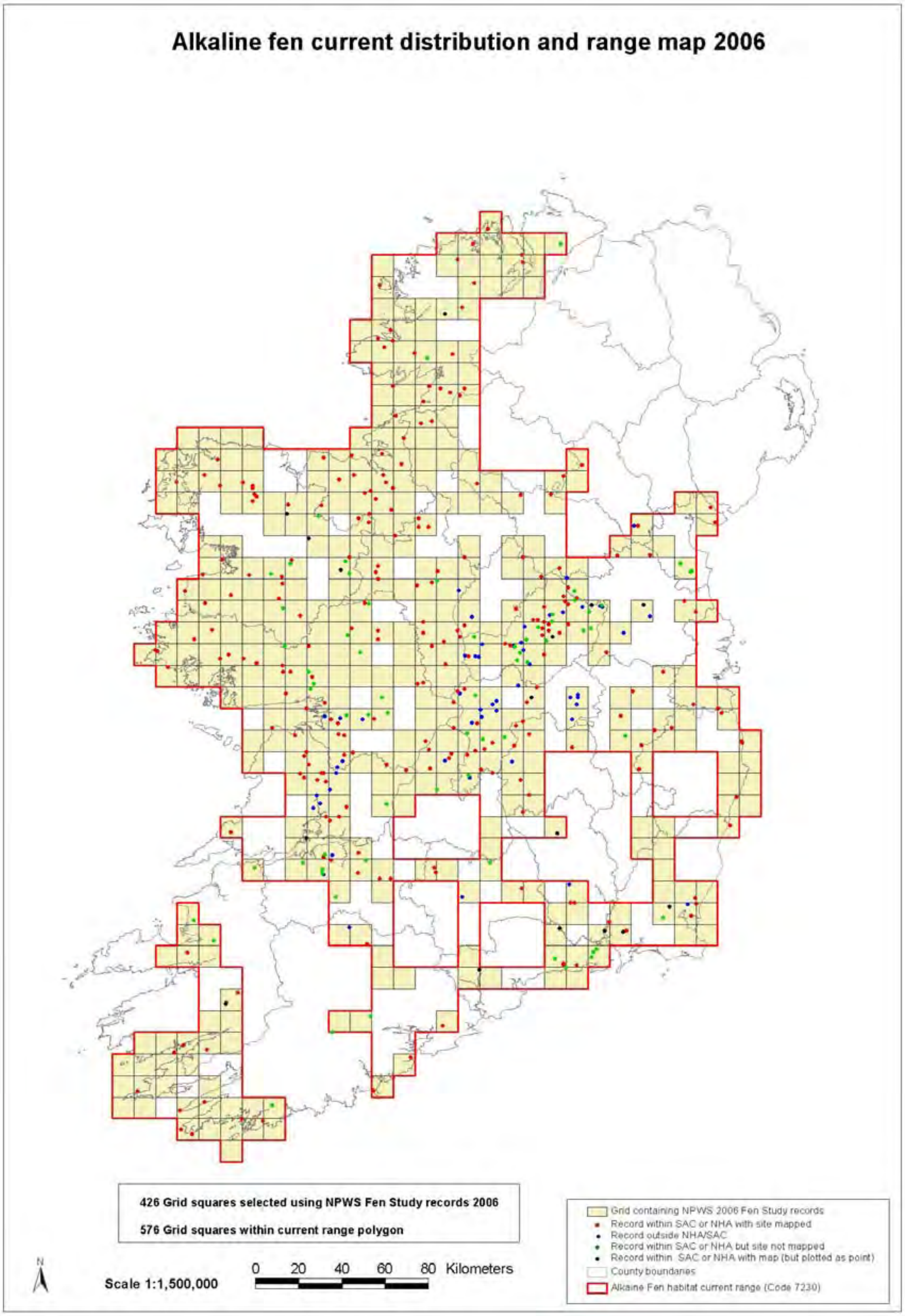
- The **Favourable Reference Range (FRR)** is estimated to be 100% of the current habitat range and thus **Favourable**.
- The **extent of Alkaline fen** habitat has decreased, though exact figures for the decline area not available. The extent of the FRA of the habitat is the same as the current extent and therefore deemed **Favourable**.
- An **Unfavourable Bad** assessment is given to the **habitat structures and functions** as the decline in habitat quality indicates.
- The **habitat's Future Prospects** are overall deemed to be **Unfavourable Bad**. Ongoing deterioration of the hydrological conditions of Alkaline fen at current rates caused by drainage, reclamation, and infilling severely threatens the viability of the habitat. Major positive management actions: land purchase and restoration works are required.

Thus, considering the assessment of the four main habitat's attributes, the overall conservation status for Alkaline fen habitat is **Unfavourable Bad**.

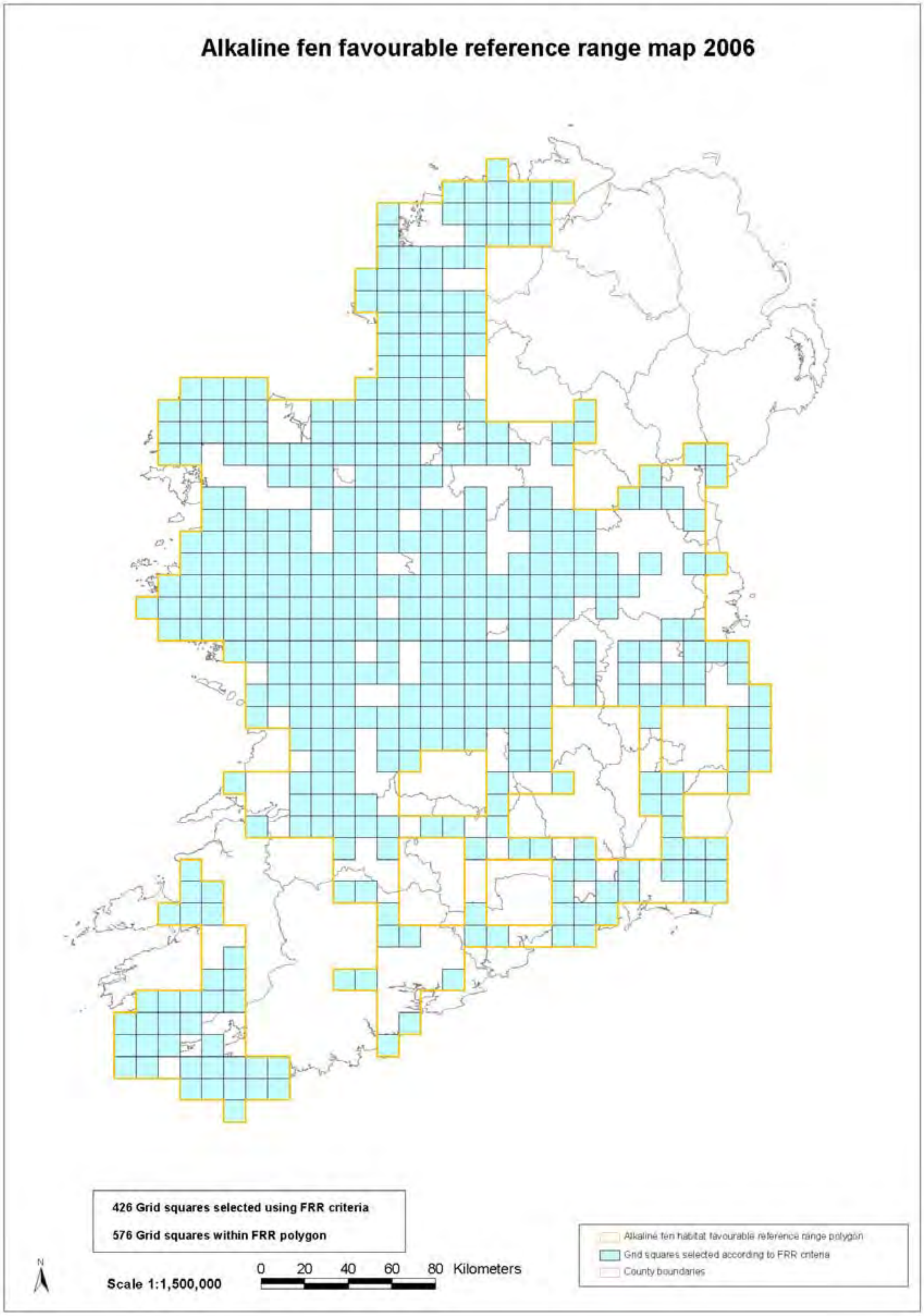
**Map 1: Alkaline fen potential historical habitat distribution and range map**



**Map 2: Alkaline fen current habitat distribution and range map**



**Map 3: Alkaline fen habitat favourable reference range map**

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# APPENDICES

# APPENDIX I

# STUDY OF THE EXENT AND CONSERVATION STATUS OF SPRINGS, FENS AND FLUSHES IN IRELAND

The National Parks and Wildlife Service (NPWS) carried out a *Study of the Extent and Conservation status of Springs, Fens and Flushes in Ireland* (Foss, P.J. 2007) during 2006 with the aim of compiling a comprehensive list of all fen sites in Ireland, classifying these according the EU Habitats Directive fen categories recognised as occurring in Ireland, and assessing the extent of fen vegetation within the sites identified.

No systematic national survey of fens has yet been undertaken in Ireland, in contrast to the situation for raised and blanket bogs. The NPWS Fen study aimed to ascertain our baseline understanding of the fen resource in Ireland.

This study addressed the following research objectives:

- collect and amalgamate data on known fen sites of conservation importance in Ireland from within the NPWS and following consultation with external groups;
- produce a computerised inventory of all sites of known or possible conservation value to include key data on each site, including the specific fen vegetation type(s) present; the known or estimated area of each fen vegetation type; and compile available published and survey information on sites;
- collect data on fen sites without a current conservation designation (outside the NHA and SAC network) but which might be considered for NHA or SAC designation by NPWS following survey and evaluation;
- examine where other sites of conservation interest might be located based on local soil, geological and environmental factors;
- assess the past and present extent of fen habitats in Ireland;
- evaluate each site in terms of its conservation importance, known area information, known survey information, and assign a survey priority to each;
- make recommendations for a future national fen field survey.

The NPWS Fen study focused on 6 fen habitat types of conservation importance (four of which are listed in Annex 1 of the EU Habitats Directive, two of which - denoted with an asterisk - are priority habitats) in Ireland. The Annex 1 fen types investigated during the study include:

7230 Alkaline fens (Fossitt category PF1)

7140 Transition mires and quaking bogs (Fossitt category PF3)

7210 *Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* (Fossitt category PF1)

7220 * Petrifying springs with tufa formation (*Cratoneurion*) (Fossitt category FP1)

A variety of data sources (reports, publications, databases and other habitat inventory lists), groups and individuals were consulted in the compilation of information for the NPWS Fen Study database, over an eight month period in 2006, from both within NPWS and from external sources. The main sources consulted in the compilation of the NPWS Fen Study database are listed below.

The past extent of fens in Ireland (based on Anonymous 1981; Hammond 1979; Foss, P.J., O'Connell C.A. & Crushell P. (eds.), 2001 *inter alia*) is presented in the report. The original area of fens in Ireland is estimated to have been at least 92,508 ha (Hammond 1979). An estimated 19,660 ha of conservation worthy intact fens, occurring in 367 discrete sites were recognised in Ireland by IPCC in 2001 (Foss *et al.* 2001).

The total area of estimated fen vegetation recorded in the NPWS Fen Study amounted to 22,180 ha within 681 discrete sites (site complex sub-units omitted i.e. sub-sites that occur within existing SAC or NHA). In total the NPWS Fen Study database holds information on 808 sites (which includes 127 sub-site records), where fen habitats are known or believed to occur. This list of sites includes those classified as poor fen and non-calcareous springs.

Annex 1 fens (i.e. Alkaline fen, *Cladium* fen, Transition mire, and Petrifying spring) which most closely relate to the fen types identified in previous studies, was estimated to cover 10,298 ha (in a total of 702 discrete sites) or 46% of the total fen area estimated in the present study. This data indicates that Annex 1 fens are less widespread than previously believed (Foss *et al* 2001).

In relation to the fen habitat types classified within the present NPWS Fen Study, the following number of sites and estimated area (ha) of fen vegetation have been recorded:

- 7230 Alkaline fens: 348 discrete sites with a fen area of 6,840 ha
- 7210 *Calcareous fens with *Cladium mariscus:* 102 discrete sites with a fen area of 1,486 ha
- 7140 Transition mires and quaking bogs: 155 discrete sites with a fen area of 1,955 ha
- 7220 * Petrifying springs: 97 discrete sites with a fen area of 36 ha

These fens can be categorised, in terms of their current conservation designation, as follows:

- The number and area (ha) of fens which have been designated for Annex 1 fen habitats under the Habitats Directive: **68 discrete sites with an area of 2,191 ha of designated fen habitat; representing 21% of the total Annex 1 fen resource estimated for Ireland.**

- The number and area (ha) of fen sites with Annex 1 habitats which are within designated Natural Heritage Areas (NHA) or proposed candidate Natural Heritage Areas (cNHA): **281 sites with an area of 2,747 ha; representing 27% of the total estimated Irish fen resource.**

- The number and area (ha) of fen sites with Annex 1 habitats which are located within designated Special Areas of Conservation (SAC) or proposed candidate Special Areas of Conservation (cSAC): **362 sites with an area of 5,681 ha; representing 55% of the total estimated Annex 1 Irish fen resource.**

- The number of Annex 1 fen habitat sites which were "newly" discovered or reported to the NPWS Fen Study and had no conservation designation: **72 sites with an area of 1,947 ha; representing 19% of the total estimated Annex 1 Irish fen resource.**

The NPWS Fen Study also found that it is very probable that sites with conservation worthy fen communities exist outside of the sites which have been identified in the present NPWS Fen Study. Based on the results of the study the following counties were identified as a priority as part of any future NPWS Fen Field Survey: Clare, Galway, Kildare, Leitrim, Limerick, Mayo, Offaly, Roscommon and Westmeath.

The NPWS Fen Study also found that existing knowledge of the fen resource in Ireland is markedly incomplete. Our knowledge in relation to the specific fen type(s) present, is considered wholly lacking or inadequate (confusion over one or more fen types) for 268 (33%) of sites identified in the present NPWS Fen Study database. While knowledge in relation to the extent of fen type(s) present on sites, is considered wholly lacking for 102 sites (13%), and inadequate for a some further 600 sites identified in the NPWS Fen Study database (i.e. 74%, where only estimated data on fen extent is presently available).

These findings make a systematic survey of existing and newly reported sites a high priority for Ireland, if conservation worthy sites are to be identified and the best examples put forward for conservation under the Natural Heritage Area or European Habitats Directive Natura 2000 (SAC) network and provided favourable conservation status.

Data sources used in the compilation of list of site in the NPWS Fen Study database 2007:

- **Habitat Assignment Project (NPWS 2006)**
  This desktop project was undertaken by NPWS and the main aim was classifying sites according to habitats listed in the Annex I of the Habitats Directive (92/43/EEC). Sites were obtained from a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, NGOs shadow lists inter alia.

- **NPWS Enquiries (Sites) Database**
  This is a comprehensive NPWS internal database, which includes data on habitat type and extent, and site designation.

- **CORINE Database – Fen sites**
  This is a NPWS internal database, which includes data on designated CORINE habitat types and extent present within sites listed in the NPWS Enquiries database.

- **IPCC Fen Sites Database**
  The Irish Peatland Conservation Council (IPCC) sites database holding a range of information on sites designated as fens.

- **Conaghan (2000) Blanket bog Database – Fen site list**
  An electronic list of blanket bog sites prepared by Conaghan (2000) for the NPWS which records the occurrence of fen habitats within the mire complexes identified, together with data on their extent.

- **Derwin (2003) Blanket bog Database – Fen site list**
  An electronic list of blanket bog sites prepared by Derwin (2003) for the NPWS which records the occurrence of fen habitats within the mire complexes identified, together with data on their extent.

- **External Expert fen site submissions**
  A number of external submissions were made by expert interests groups and individuals which provided additional sites to the NPWS Fen Study. These included submissions from Bord na Mona, Botanical Society of the British Isles County Recorders, and County Council Heritage/Biodiversity Officers.

# APPENDIX II

# SOURCES OF DATA USED IN THE PRODUCTION OF HABITAT DISTRIBUTION MAPS

The following is a summary of the main sources of information employed to produce the habitat's potential historic distribution and range map, current habitat distribution and range map and the Favourable reference range (FRR) map. These range maps and area extent were used to carry out the habitats conservation status assessment for this habitat:

**Potential Historic distribution and range map**:
To-date no map of the potential historical distribution and range of this habitat in Ireland has been available. It was decided to create a potential historical distribution and range map for Alkaline fen based on a series of data sets which would indicate the possible former location of sites with the habitat in Ireland. Information on the habitat range provided by this map could then be compared with the current distribution and range to ensure that an adequate network of sites has been recognised to ensure favourable conservation of this habitat in Ireland. Such an exercise was felt justified in the absence of a systematic field survey of the habitat to date in Ireland.

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site or species record occurred as a point source was included in the range map.

For the Hammond; Corine and Teagasc data sets, every grid square which contained a digitised boundary element was included within the range map.

The list of the data sets used in the compilation of the potential habitat distribution and range map (for details of the data sources employed see below) included:

- NPWS Fen Study Database - Foss (2007) - Alkaline fen site list (389 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).
- Corine Land Cover Map (2000) - Alkaline fen classified in the following vegetation categories: Inland marshes
- Digitised Peatland Map of Ireland - Hammond (1979) – entire Fen data set
- National Soils and Parent Material Maps - Teagasc (2006)
- Botanical Society of the British Isles 10 km Flora distribution map for: none
- British Bryological Society 10 km bryophyte distribution maps for: none

**Current habitat distribution and range map**:
The present habitat distribution and range is defined as the range of 10 km grid cells which contain an Alkaline fen site as recorded in the NPWS Fen Study database (Foss 2007).

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site/ species record occurred as a point source was included in the range map.

The list of the data sets used in the compilation of the current habitat distribution and range map (for details of the data sources employed see this section, below) included:

- NPWS Fen Study Database - Foss (2007) - Alkaline fen sites listed within NPWS Fens Database (389 discrete sites mapped after larger river and estuarine system SAC adjustment; See Appendix III).

**Favourable reference range map (FRR)**:
The favourable reference range for Alkaline fen habitat is considered to be the same as the current habitat range. The FRR is defined as the range of 10 km grid cells which contain a Alkaline fen site as recorded in the NPWS Fen Study database (Foss 2007).

Mapping Protocol:

For those site locations which occurred within a recognised NHA or SAC for which a digitised site boundary existed, every grid square containing the NHA or SAC site boundary was included within the range map. An exception to this rule was made for the larger river and estuarine system SAC where only point source grid squares for habitat locations were included within the range map (see below).

For site locations which occurred within a recognised NHA or SAC or for newly reported non-NHA or SAC sites, or for species records (mosses or vascular plants) for which no digitised site boundary existed, only the grid square within which the site/ species record occurred as a point source was included in the range map.

The list of the data sets used to map the Favourable reference range (FRR) (for details of the data sources employed see this section, below) included:

- NPWS Fen Study Database - Foss (2007) - Alkaline fen sites listed within NPWS Fens Database (389 discrete sites mapped after larger river and estuarine system SAC site adjustment; See Appendix III).

## Further information on data sources:

### A. NPWS Fen Study Database (2007)

As part of the NPWS **Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007** (see project details in Appendix I above) a specific NPWS Fens Study database was created at the outset of this project to hold data on the fen sites recorded during the study.

In summary the main NPWS Fen Study database held information on site provenance or proposer, site names, county, SAC and NHA codes, national grid reference, site conservation designations, habitat information on the specific fen vegetation type(s) present and the area of each (or an estimate where no accurate area data was available), information on rare species of note, a summary of published reports holding information on the site, and a site evaluation section which ranked each site in terms of its conservation importance, area information, survey information, and survey priority (For a full list of data fields recorded in the NPWS Fen Study database see Foss 2007).

Two secondary relational databases (linked to one together by use of site record number and reference code number), hold a list of fen related reports and publications for Ireland, and a publications / report site records database.

The database was created using the Filemaker Pro 8 database package which runs on both PC and Mac platforms.

This database (NPWSFENSURVEY.fp7 Version 1.3) was used to produce distribution maps, habitat area estimates and site lists for the current and favourable habitat range and conservation assessment for alkaline fen in Ireland.

### B. Corine Land Cover Map (2000) – Map 5

Corine Land Cover (CLC) is a map of the European environmental landscape based on interpretation of satellite images. It provides comparable digital maps of land cover for each country for much of Europe. The CLC 2000 project in Ireland forms part of the update of land cover maps for the whole of Europe, which is being co-ordinated by the EEA (European Environmental Agency) with the co-operation of national competent authorities in contributing states. The Environmental Protection Agency (EPA) is the national competent authority for CLC 2000 data in Ireland. The CLC 2000 database was created by first assessing and correcting the existing CLC 1990 land cover database and images for geometric and thematic content, followed by mapping land cover changes using 2000 satellite imagery and ancillary data. The CORINE project provides a coarse quantification of land cover in Ireland (EPA, 2004).

CLC is based on a simple 3-level hierarchy classification system consisting of 44 land cover classes. The land cover inventory was conducted at a scale of 1:100,000 and the minimum area digitised in the updated version, CORINE 2000 is 25 ha.

Fen land cover from this data set is available for the following subtypes:

Wetlands 4/ Inland wetlands 4.1/ 4.1.1 Inland Marshes

Low-lying land usually flooded in winter and more or less saturated by water all year round.

**Extension :**
Non-forested areas of low-lying land flooded or floodable by fresh, stagnant or circulating water. Covered by a specific low ligneous, semi-ligneous or herbaceous vegetation.

**This heading includes :**
- Fens and transitional bogs without peat deposition or on peaty ground (peat layer is less than 30 cm thick) with specific vegetation composed of reeds, bulrushes, rushes, willows, sedges and tall herbs, sphagnum hummocks, often with alder or willows and other water plants,
- marsh vegetation located in margin zones of raised bogs,
- water-fringe vegetation of reed beds, sedge communities, fen-sedge beds, tall rush swamps, riparian cane formations,
- high floating vegetation,
- inland saline (alkali) marshes (prevailing arheic).

**This heading excludes :**
- humid meadows (water logging of between 10 and 30 cm depth) (class 231),
- rice fields (class 213),
- free water space in wetlands (class 512),
- salt marshes (class 421),
- salt meadows in intertidal zone (class 421),
- Garaat, (classified 211 or 411 according to land cover visible from the satellite image)
- polders with reticulated channels bordered by hydrophitic vegetation (class 2xx),
- humid forests with a crown cover more than 30 % (class 31x),
- Peat bogs (class 412)
- low floating aquatic vegetation (class 512).

(http://www.epa.ie/OurEnvironment/Land/CorineLandCover).

### C. Digitised Peatland Map of Ireland - Hammond (1979) – Map 4

Hammond's *Peatland Map of Ireland* (1979) is the most comprehensive over-view of the distribution of peatlands and fen in Ireland at the end of the 1970s. Hammond mapped the mire subtypes described by Moore (1972).

Hammond's map is based on data from several sources, principally the detailed soil map data from the National Soil Survey carried out by An Foras Talúntais since 1968, these maps covered 10 counties fully and 2 counties partially. Aerial photographs from 1973/74 together with site visits covered the rest of the country. No aerial cover existed however for county Donegal and parts of counties Sligo, Cork, Waterford and Louth. Hammond acknowledges that the these counties were not covered by the same detailed reconnaissance field sheets as the other counties and were mapped principally on the basis of the far cruder 1920 peat map for Ireland. However, Hammond's map is regarded as the only peatland map which has been methodically produced and which specifically targets peatlands and fens.

Although Hammond maps categorised mires (i.e. blanket bog, raised bog and fen) according to the level of disturbance (i.e. man modified, milled peat, moss peat) the current status of those sites considered unmodified is likely to have changed since 1979. Hammond's maps are therefore not reliable for identifying the current site status due to the impact of the Turf Development Act (1981-1995) supported projects and private afforestation grant aids. However, Hammond's map is considered to be the most accurate national map available for indicating the location of fen peat soils.

The Soils Division of Teagasc has now digitised the original Hammond's *Peatland Map of Ireland* (1979). This was used to refine the habitat distribution map produced from other sources by overlaying the Hammond's digital map on it. This provided further validations for those sites already mapped and most importantly identify fen areas in grid squares where they had not been identified by other sources.

### D. National Soils and Parent Material Maps Teagasc (2006) - Map 6

A digital data set of alkaline fen soils identified in Ireland, produced by Teagasc in 2006.

### E. BSBI Flora Atlas (2000)

10 km square distribution maps produced by the Botanical Society of the British Isles, as part of the New Atlas of the British & Irish Flora 2002. For access to the most up-to-date data sets see National Biological Network Gateway website at http://www.searchnbn.net/index_homepage

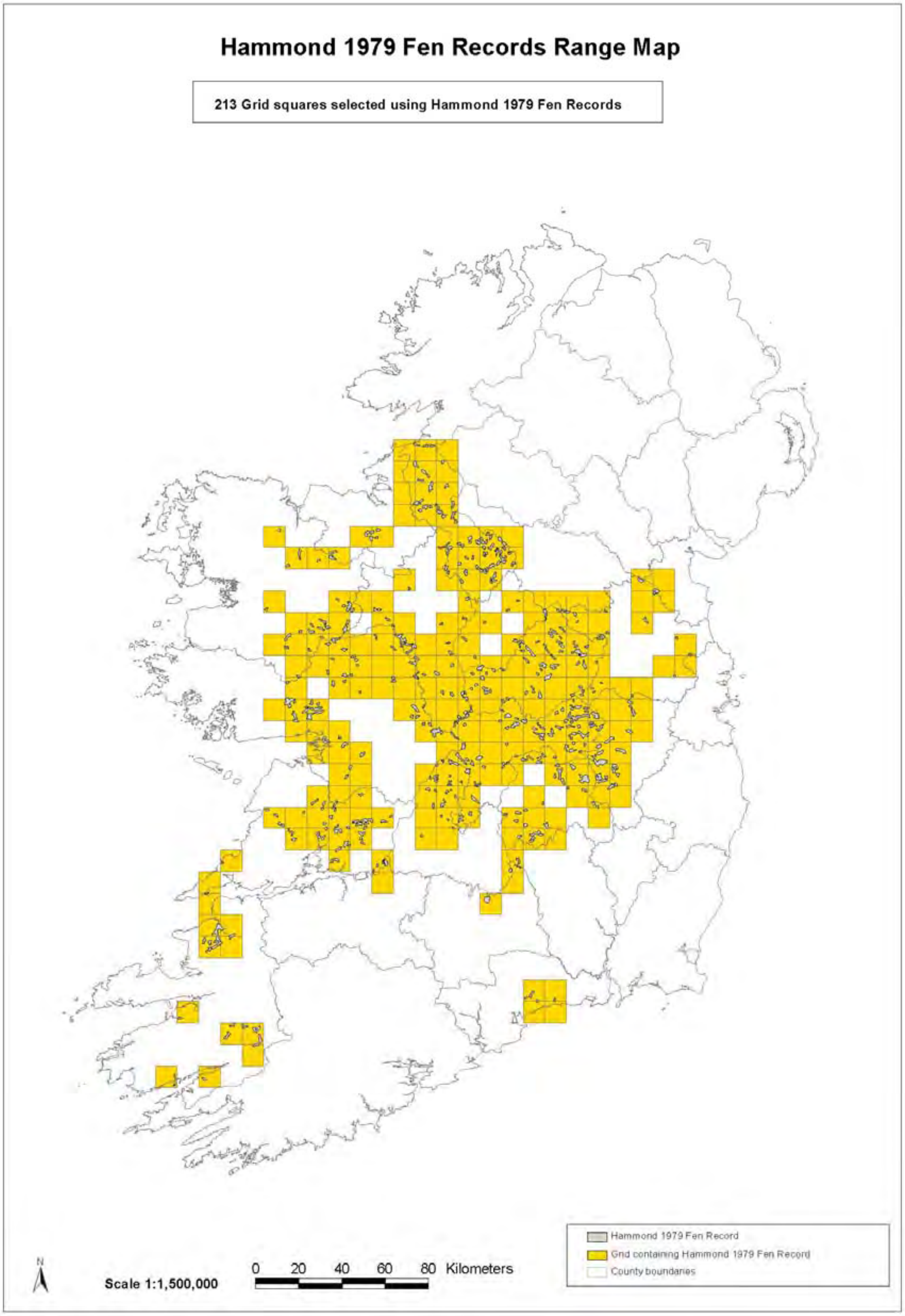
Data sets used in compilation of habitat distribution maps include those for the following species: **None**

### F. Bryophyte Distribution data (2007)

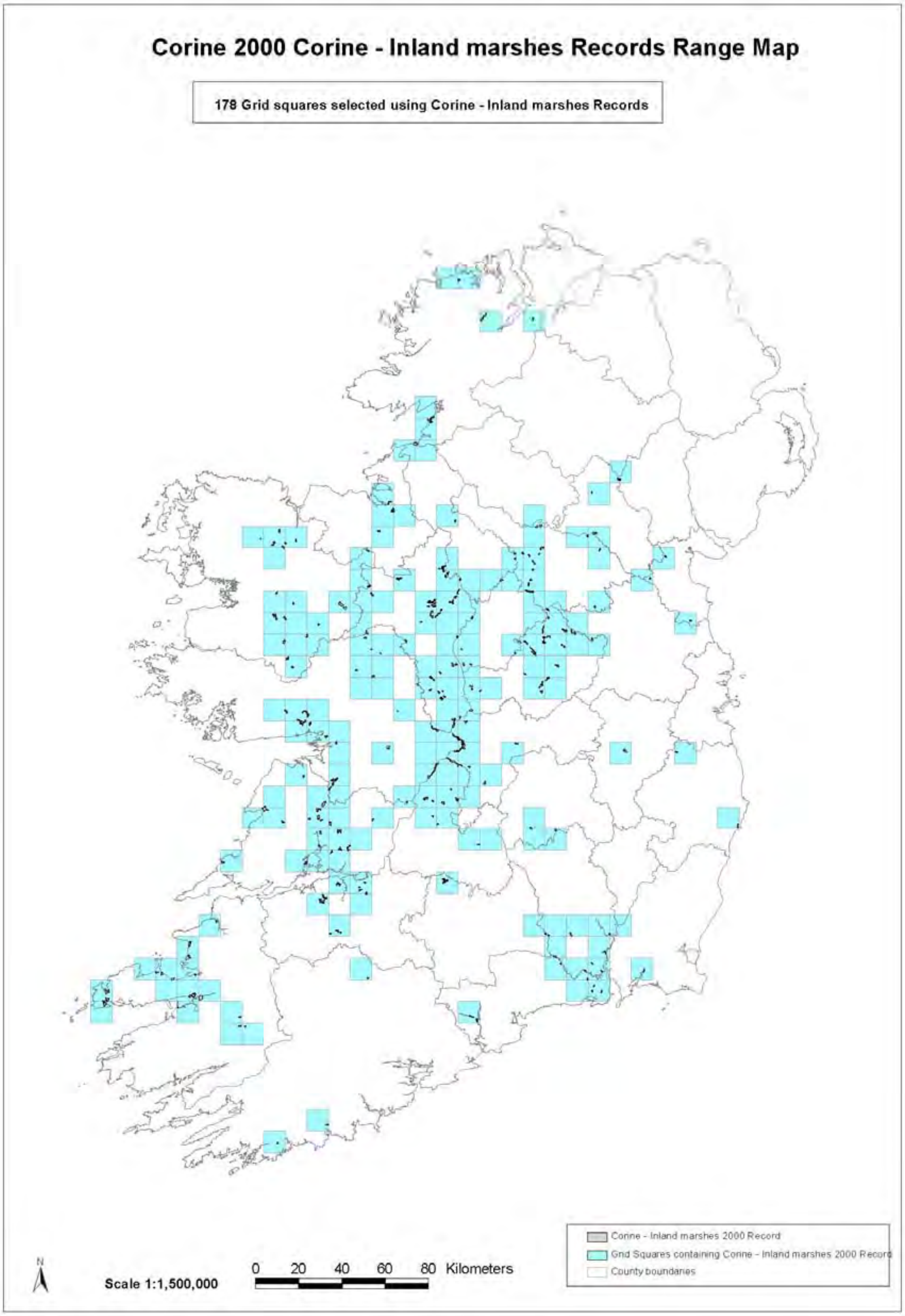
10 km square distribution maps obtained from THE DISTRIBUTION OF BRYOPHYTES IN IRELAND: an annotated review of the occurrence of liverworts and mosses in the Irish vice-counties, based mainly on the records of the British Bryological Society (Holyoak 2003) produced by the British Bryological Society, with additional recent additions provided by N. Lockhart, NPWS (pers. comm.).

Data sets used in compilation of habitat distribution maps include those for the following species: **None**

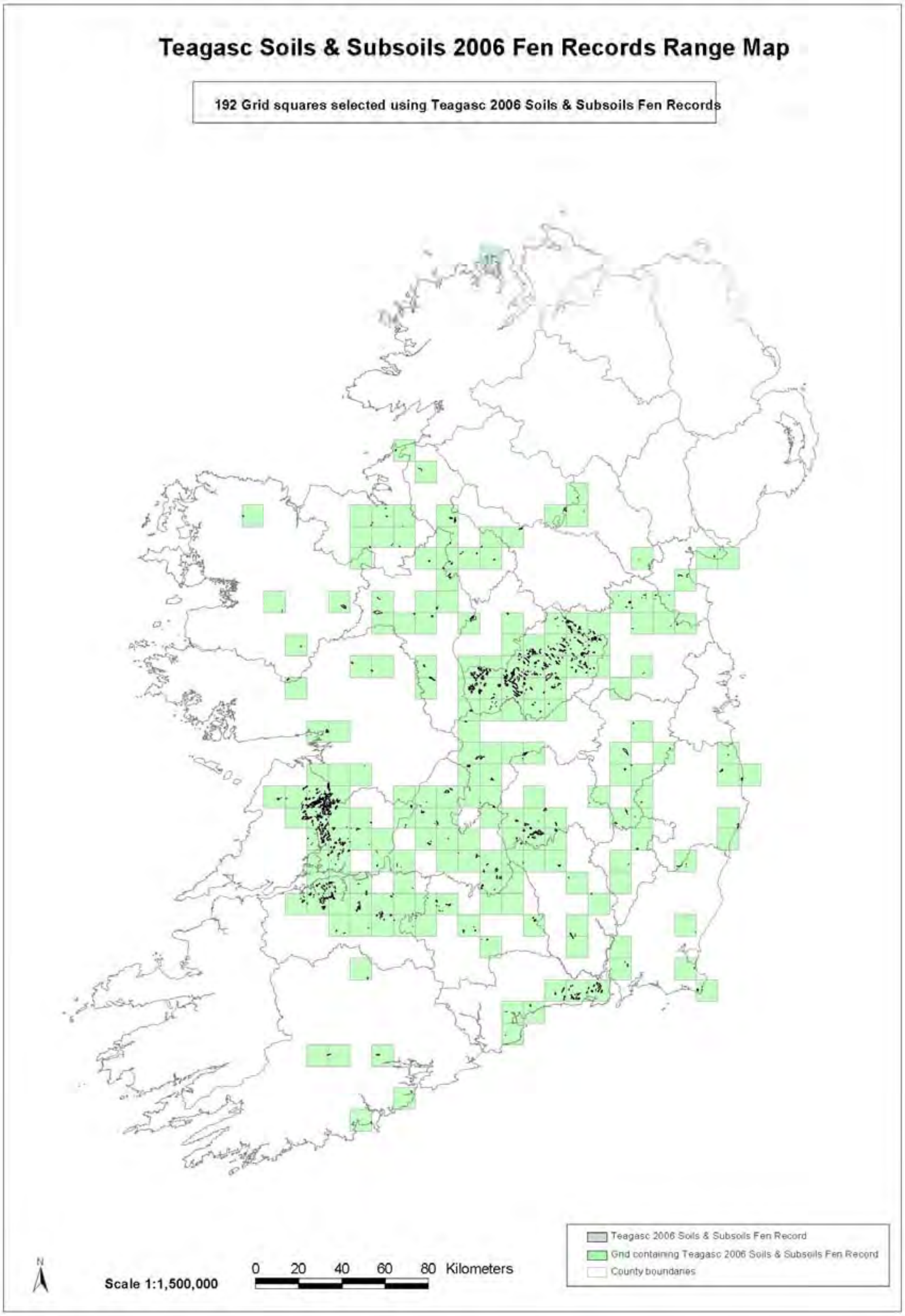
**Map 4: Digitised Peatland Map of Ireland - Hammond (1979)**



**Map 5: Corine Land Cover Map (2000)**



**Map 6: National Soils and Parent Material Maps Teagasc (2006)**



# APPENDIX III

# HABITAT SITE LIST

| Site Code | SAC/NHA Name | New/Subsite Name | Nat Grid E | Nat Grid N |
|---|---|---|---|---|
| F2693 | | ARCHERSTOWN | 257700 | 267000 |
| F2705 | | ARDSALLAGH/GRANGE | 289000 | 262600 |
| F2709 | | ASHFIELD | 228000 | 230500 |
| F752 | | BALLINDEREEN LOU | 138500 | 216300 |
| F758 | | BALLYBEG LOUGH | 133200 | 173900 |
| F786 | | BALLYCON | 255500 | 226500 |
| F2699 | | BALLYKEERAN | 208200 | 244100 |
| F2715 | | BALLYMACAGUE | 225000 | 195500 |
| F749 | | BALLYMACHILL LOUG | 146600 | 195600 |
| F2692 | | BALLYNACARRIGY - | 231000 | 258000 |
| F2688 | | BENALBIT | 233300 | 240500 |
| F2695 | | BISHOPS LOUGH | 248600 | 264500 |
| F775 | | BLACKWATER | 201000 | 227000 |
| F2689 | | BOG LAKE | 203400 | 244500 |
| F779 | | BOORA | 218000 | 219000 |
| F2704 | | BRACKLONEY | 250400 | 280300 |
| F751 | | BUNAHOW LOUGH | 144200 | 192800 |
| F755 | | CARNAVOODAUN TURL | 145700 | 215500 |
| F2713 | | CLOGH | 138000 | 143000 |
| F782 | | CLONGAWNY | 206500 | 213500 |
| F788 | | CLONSAST | 255000 | 222000 |
| F2700 | | CLORAN LOUGHS | 267000 | 267000 |
| F771 | | DAINGEAN BEG | 251500 | 138400 |
| F795 | | DERRAGHAN | 206500 | 262500 |
| F780 | | DERRIES | 216000 | 222000 |
| F787 | | DERRYCRICKET | 255500 | 225000 |
| F789 | | DERRYOUNCE | 253000 | 215000 |
| F760 | | DOON LOUGH | 143700 | 190000 |
| F781 | | DRINAGH | 211000 | 216000 |
| F2714 | | GLENNAMEADE | 142000 | 152000 |
| F2708 | | GORTROE | 202000 | 132500 |
| F756 | | KILBRECKAN LOUGH | 136500 | 176100 |
| F304 | | KILCORAAL FEN | 306300 | 129100 |
| F753 | | KILCREEST (RIVER | 156000 | 215000 |
| F2694 | | KILRUSH LOWER | 265800 | 267400 |
| F2698 | | LALISTOWN | 230300 | 247000 |
| F757 | | LOUGH GIRROGA | 134800 | 179700 |
| F2735 | | LOUGH MAKEEGAN FE | 211400 | 249800 |
| F2696 | | LOUGH PATRICK | 242700 | 263100 |
| F754 | | LOUGHANAWARLA | 150000 | 118500 |
| F794 | | MOUNTDILLON | 200500 | 274500 |
| F785 | | MOUNTLUCAS | 252000 | 225000 |
| F784 | | NOGGUSBOY | 210500 | 219400 |
| F761 | | O'BRIENS BIG LOUG | 141000 | 182500 |
| F2697 | | RATHSKEAGH LOWER | 226000 | 249000 |
| F2703 | | RORISTOWN | 276800 | 254900 |
| F2707 | | RYAN'S CROSS ROAD | 205500 | 188000 |
| F2724 | | TIRAGARVAN | 281500 | 304500 |
| F2687 | | TOGHERSTOWN | 229300 | 250400 |
| F783 | | TURRAUN | 218000 | 223500 |
| F2690 | | TWY LOUGH AND BOG | 209700 | 243800 |
| F2706 | | USKANE | 194000 | 196000 |
| 000011 | LOUGH DERG | | 176000 | 191400 |
| 000011 | LOUGH DERG | LOUGH ALEWNAGHTY | 176000 | 191400 |

| | | | | |
|---|---|---|---|---|
| 000015 | BALLYCAR LOUGH | | 141000 | 168000 |
| 000019 | BALLYOGAN LOUGH | | 137000 | 190000 |
| 000020 | BLACK HEAD-POULSALLAG | | 114000 | 211000 |
| 000032 | DROMORE WOODS AND LOU | | 135000 | 187000 |
| 000038 | INCHICRONAN LOUGH | | 139000 | 186000 |
| 000054 | MONEEN MOUNTAIN | | 124746 | 207500 |
| 000057 | MOYREE RIVER SYSTEM | | 138000 | 190000 |
| 000087 | GARRYLUCAS MARSH | | 161000 | 043000 |
| 000092 | KILCOLMAN BOG | | 158000 | 111000 |
| 000097 | LOUGH HYNE NATURE RES | | 110000 | 029000 |
| 000101 | ROARINGWATER BAY AND | | 100000 | 030000 |
| 000102 | SHEEP'S HEAD | | 071600 | 033700 |
| 000109 | THREE CASTLE HEAD TO | | 072000 | 025000 |
| 000111 | ARAN ISLAND (DONEGAL) | | 164000 | 416000 |
| 000115 | BALLINTRA | | 192000 | 368000 |
| 000138 | DURNESH LOUGH | | 187000 | 369000 |
| 000139 | ERNE ESTUARY/FINNER D | | 184000 | 362000 |
| 000163 | LOUGH ESKE AND ARDNAM | | 197500 | 384000 |
| 000164 | LOUGH NAGREANY DUNES | | 214000 | 442000 |
| 000166 | LOUGH SWILLY INCLUDIN | | 230000 | 426500 |
| 000166 | LOUGH SWILLY INCLUDIN | LOUGH SWILLY (002 | 229700 | 430000 |
| 000173 | MEENTYGRANNAGH BOG | | 202000 | 405800 |
| 000174 | CURRAGHCHASE WOODS | | 141300 | 149500 |
| 000190 | SLIEVE TOOEY/TORMORE | | 163000 | 391000 |
| 000190 | SLIEVE TOOEY/TORMORE | LEAMAGOWRA (157) | 166000 | 387000 |
| 000191 | ST. JOHN'S POINT | | 170000 | 369000 |
| 000197 | WEST OF ARDARA/MAAS R | | 170000 | 390000 |
| 000197 | WEST OF ARDARA/MAAS R | SHESKINMORE LOUGH | 169000 | 395000 |
| 000216 | RIVER SHANNON CALLOWS | | 198000 | 223000 |
| 000222 | SUCK RIVER CALLOWS NH | | 184000 | 232000 |
| 000253 | CREGGANNA MARSH NHA | | 138539 | 222660 |
| 000263 | DRUMBULCAUN BOG | | 151000 | 257000 |
| 000268 | GALWAY BAY COMPLEX | | 130000 | 220000 |
| 000297 | LOUGH CORRIB | | 107000 | 241000 |
| 000297 | LOUGH CORRIB | ADDERGOOLE EAST & | 132600 | 234500 |
| 000297 | LOUGH CORRIB | GORTACHALLA LOUGH | 122500 | 237000 |
| 000299 | LOUGH CUTRA | | 147496 | 198511 |
| 000304 | LOUGH REA | | 161303 | 215251 |
| 000308 | LOUGHATORICK SOUTH BO | | 167000 | 194000 |
| 000326 | SHANKILL WEST BOG | | 163000 | 252000 |
| 000371 | FOUNTAINSTOWN SWAMP | | 178200 | 058500 |
| 000382 | SHEHEREE (ARDAGH) BOG | | 098300 | 088400 |
| 000393 | LIFFEY VALLEY MEANDER | | 291000 | 210000 |
| 000396 | POLLARDSTOWN FEN | | 275495 | 216501 |
| 000404 | HUGGINSTOWN FEN | | 252000 | 130000 |
| 000412 | SLIEVE BLOOM MOUNTAIN | | 226153 | 202685 |
| 000412 | SLIEVE BLOOM MOUNTAIN | GLENLAHAN RIVER V | 233000 | 208000 |
| 000413 | ANNAGHMORE LOUGH FEN | | 230000 | 214000 |
| 000417 | GRANTSTOWN WOOD AND L | | 233000 | 180000 |
| 000428 | LOUGH MELVIN | | 188000 | 353000 |
| 000436 | HERBERTSTOWN FEN | | 169000 | 141000 |
| 000437 | LOUGH GUR | | 164000 | 141000 |
| 000438 | LOUGHMORE COMMON TURL | | 154000 | 153000 |
| 000439 | TORY HILL | | 153911 | 143632 |
| 000440 | LOUGH REE | | 201000 | 253000 |
| 000440 | LOUGH REE | COOSAN LOUGH (LOU | 205000 | 244000 |
| 000440 | LOUGH REE | ST JOHNS WOOD (00 | 200000 | 256000 |
| 000446 | LOUGHS ADERRY AND BAL | | 193000 | 073000 |
| 000453 | CARLINGFORD MOUNTAIN | | 317000 | 313000 |
| 000461 | ARDKILL TURLOUGH | | 127000 | 263000 |

| | | | | |
|---|---|---|---|---|
| 000466 | BELLACORICK IRON FLUS | | 100522 | 324627 |
| 000470 | MULLET/BLACKSOD BAY C | | 070004 | 325002 |
| 000476 | CARROWMORE LAKE COMPL | | 083000 | 328000 |
| 000476 | CARROWMORE LAKE COMPL | LARGAN MORE (517) | 090000 | 323000 |
| 000484 | CROSS LOUGH (KILLADOO | | 073991 | 274317 |
| 000500 | GLENAMOY BOG COMPLEX | | 089000 | 335100 |
| 000532 | OLDHEAD WOOD | | 082000 | 282000 |
| 000552 | CORSTOWN LOUGHS | | 289000 | 291000 |
| 000564 | RIVER LITTLE BROSNA C | | 198000 | 211000 |
| 000571 | CHARLEVILLE WOOD | | 232000 | 223000 |
| 000576 | FIN LOUGH (OFFALY) | | 203000 | 229000 |
| 000583 | ROSCREA BOG | | 216000 | 190000 |
| 000584 | CUILCAGH - ANIERIN UP | | 209000 | 324000 |
| 000585 | SHARAVOGUE BOG | | 204500 | 198500 |
| 000587 | LOUGH GARA | | 171000 | 300000 |
| 000588 | BALLINTURLY TURLOUGH | | 184000 | 260000 |
| 000594 | BRIERFIELD TURLOUGH | | 181000 | 277000 |
| 000596 | CORRIGEENROE MARSH | | 182000 | 308000 |
| 000600 | CLOONCHAMBERS BOG | | 163000 | 280000 |
| 000606 | LOUGH FINGALL COMPLEX | | 141500 | 215000 |
| 000606 | LOUGH FINGALL COMPLEX | LOUGH FINGALL (30 | 141500 | 215000 |
| 000609 | LISDUFF TURLOUGH | | 184000 | 255000 |
| 000610 | LOUGH CROAN TURLOUGH | | 188000 | 249000 |
| 000611 | LOUGH FUNSHINAGH | | 193500 | 251000 |
| 000620 | AUGHRIS HEAD | | 151000 | 337000 |
| 000623 | BEN BULBEN, GLENIFF A | | 175120 | 344920 |
| 000625 | BUNDUFF LOUGH AND MAC | | 171232 | 355293 |
| 000627 | CUMMEEN STRAND/DRUMCL | | 165000 | 338000 |
| 000633 | LOUGH HOE BOG | | 137000 | 314000 |
| 000636 | TEMPLEHOUSE AND CLOON | | 162000 | 317000 |
| 000666 | ISLANDTARSEY FEN | | 255000 | 101000 |
| 000672 | AGHALASTY FEN | | 251000 | 259000 |
| 000673 | BALLYNAFID LAKE AND F | | 240000 | 260000 |
| 000684 | LOUGH DERRAVARAGH NHA | | 240000 | 267000 |
| 000685 | LOUGH ENNELL | | 240000 | 245000 |
| 000686 | LOUGH GLORE | | 249000 | 272000 |
| 000687 | LOUGH IRON | | 235000 | 261000 |
| 000688 | LOUGH OWEL | | 239000 | 257000 |
| 000688 | LOUGH OWEL | BUNBROSNA FEN (00 | 237000 | 261000 |
| 000688 | LOUGH OWEL | SOUTH OF ROYAL CA | 242100 | 256100 |
| 000689 | LOUGH SEWDY | | 222000 | 250000 |
| 000690 | LOUGH SHEEVER FEN/SLE | | 247000 | 255000 |
| 000692 | SCRAGH BOG | | 242000 | 259000 |
| 000699 | BOLEY FEN | | 278000 | 117000 |
| 000708 | SCREEN HILLS | | 310310 | 129332 |
| 000712 | WEXFORD SLOBS AND HAR | | 308000 | 124000 |
| 000713 | BALLYMAN GLEN | | 322000 | 218000 |
| 000729 | BUCKRONEY-BRITTAS DUN | | 329000 | 179000 |
| 000730 | THE MURROUGH | | 331500 | 204000 |
| 000730 | THE MURROUGH | THE MURROUGH WETL | 331368 | 204851 |
| 000731 | POULAPHOUCA RESERVOIR | | 299000 | 211000 |
| 000744 | BALLYKELLY MARSH | | 270000 | 121000 |
| 000747 | BALLYROE FEN AND LAKE | | 309800 | 132200 |
| R000781 | SLANEY RIVER VALLEY | | 298000 | 128000 |
| 000839 | KILKEASY BOG | | 254000 | 130000 |
| 000859 | CLONASLEE ESKERS AND | | 227000 | 212000 |
| 000868 | MANNIN WETLAND | | 229000 | 187000 |
| 000881 | THE GREAT HEATH OF PO | | 253000 | 202000 |
| 000897 | DERRYKEEL MEADOWS | | 216000 | 204000 |
| 000900 | DRUMAKEENAN, EAGLE HI | | 210700 | 191700 |

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|---|---|---|---|---|
| 000909 | LOUGH COURA | | 209000 | 213000 |
| 000910 | LOUGH NANAG ESKER | | 200000 | 228000 |
| 000932 | FIAGH BOG | | 196000 | 197000 |
| 000974 | ANNAGH LOUGH (BALLYCO | | 229000 | 318800 |
| 000984 | LOUGH GARROW AND LOUG | | 243000 | 319000 |
| 000985 | LOUGH KINALE AND DERR | | 238500 | 281000 |
| 000987 | LOUGH SHEELIN | | 247000 | 285000 |
| 000992 | LOUGH GOWNA | | 230000 | 290000 |
| 001008 | DROMOLAND LOUGH | | 139000 | 170000 |
| 001017 | LOUGH CULLAUNYHEEDA | | 148500 | 174500 |
| 001040 | BARLEY COVE TO BALLYR | | 077000 | 023000 |
| 001177 | MEENYBRADDAN BOG | | 180000 | 384500 |
| 001179 | MUCKISH MOUNTAIN | | 200000 | 428000 |
| 001190 | SHEEPHAVEN | | 207000 | 435000 |
| 001202 | BALLYBETAGH BOG | | 320390 | 219986 |
| 001209 | GLENASMOLE VALLEY | | 309000 | 222000 |
| 001271 | GORTNANDARRAGH LIMEST | | 119000 | 240000 |
| 001279 | KILKERRIN TURLOUGH | | 163000 | 256000 |
| 001294 | LOUGH HACKET | | 131000 | 249000 |
| 001312 | ROSS LAKE AND WOODS | | 119278 | 236837 |
| 001342 | CLOONEE AND INCHIQUIN | | 084000 | 062000 |
| 001387 | BALLYNAFAGH LAKE | | 281000 | 228000 |
| 001398 | RYE WATER VALLEY/CART | LOUISA BRIDGE WAR | 295000 | 237000 |
| 001403 | ARROO MOUNTAIN | | 183000 | 352000 |
| 001443 | LOUGH SLAWN | | 203000 | 258500 |
| 001451 | LISCARRAGH MARSH | | 319000 | 306000 |
| 001482 | CLEW BAY COMPLEX | | 091000 | 289000 |
| 001486 | CLOONBOORHY LOUGH | | 119000 | 277700 |
| 001492 | CARROWMORE LOUGH SHOR | | 123000 | 288500 |
| 001518 | KINLOOEY LOUGH | | 103643 | 281685 |
| 001527 | LOUGH ALICK | | 121500 | 314200 |
| 001528 | LOUGH BEG, CARROWMORE | | 118500 | 280800 |
| 001558 | BREAKEY LOUGHS | | 273700 | 290700 |
| 001571 | URLAUR LAKES | | 150000 | 290000 |
| 001573 | BALLYNABARNY FEN | | 268700 | 245900 |
| 001576 | CROMWELL'S BUSH FEN | | 310200 | 264700 |
| 001578 | DULEEK COMMONS | | 304700 | 269800 |
| 001617 | ARDAKILLIN LOUGH | | 188000 | 278300 |
| 001625 | CASTLESAMPSON ESKER | | 194400 | 240300 |
| 001626 | ANNAGHMORE LOUGH (ROS | | 190690 | 283708 |
| 001631 | DRUM BRIDGE (LOUGH KE | | 182000 | 304000 |
| 001636 | FIN LOUGH (ROSCOMMON) | | 186500 | 304000 |
| 001642 | LOUGH BODERG AND LOUG | | 203000 | 290000 |
| 001644 | LOUGH GLINN | | 163000 | 286000 |
| 001665 | EASKY RIVER | | 138000 | 336000 |
| 001669 | KNOCKALONGY AND KNOCK | | 152000 | 328000 |
| 001677 | MOYLOUGH TURLOUGH | | 154000 | 308000 |
| 001683 | LISKEENAN FEN | | 197000 | 199000 |
| 001687 | GLEN LOUGH | | 227000 | 266000 |
| 001689 | ANNESTOWN STREAM | | 250000 | 100000 |
| 001695 | CASTLECRADDOCK BOG | | 249000 | 102000 |
| 001705 | LISSAVIRON BOG | | 249000 | 101000 |
| 001731 | WALSHESTOWN FEN (SLAN | | 239000 | 254000 |
| 001742 | KILPATRICK SANDHILLS | | 326000 | 165800 |
| 001764 | LOWTOWN FEN | | 284000 | 192000 |
| 001772 | DUNLAVIN MARSHES | | 285000 | 203000 |
| 001774 | LOUGH CARRA/MASK COMP | | 117410 | 270991 |
| 001775 | MURPHY'S BRIDGE ESKER | | 236600 | 229800 |
| 001779 | BALLINASLOE ESKER | | 181500 | 231500 |
| 001786 | KILROOSKY LOUGH CLUST | | 249000 | 327500 |

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|---|---|---|---|---|
| 001814 | LOUGH NANEAGH | | 251000 | 276000 |
| 001837 | MULLAGLASSAN LOUGH | | 257300 | 332700 |
| 001846 | BALLYNEILL MARSH | | 190000 | 144000 |
| 001847 | PHILIPSTON MARSH | | 189001 | 146002 |
| 001858 | GALMOY FEN | | 230000 | 172000 |
| 001898 | UNSHIN RIVER | | 170000 | 322000 |
| 001899 | CLOONAKILLINA LOUGH | | 159000 | 306200 |
| 001900 | MEHARTH LOUGH | | 157000 | 319700 |
| 001901 | QUARRYFIELD WEST TURL | | 159100 | 310000 |
| 001902 | SLIEVEWARD BOG | | 165600 | 328000 |
| 001904 | KNOCKMULLIN FEN | | 166900 | 324500 |
| 001905 | FEENAGH AND BUNNAMUCK | | 169200 | 312000 |
| 001907 | FIN AND RISKEEN LOUGH | | 159800 | 320600 |
| 001922 | BELLACORRICK BOG COMP | | 105000 | 323000 |
| 001922 | BELLACORRICK BOG COMP | BRACKLOON (498) | 107000 | 318000 |
| 001922 | BELLACORRICK BOG COMP | CLOONOORAGH (498) | 106000 | 319000 |
| 001922 | BELLACORRICK BOG COMP | FORMOYLE (498) | 105000 | 322000 |
| 001922 | BELLACORRICK BOG COMP | OWENBOY BOG NNR ( | 105000 | 316000 |
| 001926 | EAST BURREN COMPLEX | | 130000 | 200000 |
| 001926 | EAST BURREN COMPLEX | CARRAN TURLOUGH 0 | 129000 | 198000 |
| 001926 | EAST BURREN COMPLEX | INCHIQUIN LAKE (0 | 127000 | 189800 |
| 001926 | EAST BURREN COMPLEX | KNOCKAUNROE TURLO | 131000 | 194000 |
| 001926 | EAST BURREN COMPLEX | LOUGH ATEDAUN (00 | 129000 | 188000 |
| 001932 | MWEELREA/SHEEFFRY/ERR | | 083045 | 268737 |
| 001932 | MWEELREA/SHEEFFRY/ERR | DERRYAUN (488) | 095000 | 272500 |
| 001976 | LOUGH GILL | | 174000 | 333000 |
| 001980 | LIZZY SMYTH'S BOG | | 229500 | 136500 |
| 001986 | GARINISH POINT | | 051900 | 042800 |
| 001992 | TAMUR BOG | | 203000 | 368000 |
| 001992 | TAMUR BOG | BELALT SOUTH (117 | 201000 | 365000 |
| 002006 | OX MOUNTAIN BOGS | | 145000 | 326000 |
| 002008 | MAUMTURK MOUNTAINS | | 086327 | 256421 |
| 002031 | THE TWELVE BENS/GARRA | | 078000 | 252000 |
| 002034 | CONNEMARA BOG COMPLEX | | 090000 | 243000 |
| 002034 | CONNEMARA BOG COMPLEX | BUNSCANNIFF (236) | 094000 | 245000 |
| 002034 | CONNEMARA BOG COMPLEX | LEAM (293) | 101000 | 243000 |
| 002054 | ROSROE LOUGH | | 145000 | 170000 |
| 002074 | SLYNE HEAD PENINSULA | | 061272 | 246552 |
| 002074 | SLYNE HEAD PENINSULA | MANNIN BAY COMPLE | 060000 | 247000 |
| 002077 | NAFARTY FEN | | 283300 | 304500 |
| R002103 | ROYAL CANAL | | 244000 | 253000 |
| R002104 | GRAND CANAL | | 234000 | 225000 |
| 002120 | LOUGH BANE AND LOUGH | | 255000 | 271200 |
| 002121 | LOUGH LENE | | 251000 | 268200 |
| 002121 | LOUGH LENE | WINDTOWN | 249600 | 269600 |
| 002129 | MURVEY MACHAIR | | 066000 | 239000 |
| R002137 | LOWER RIVER SUIR | | 247000 | 118000 |
| 002147 | LISDUFF FEN | | 208200 | 200500 |
| 002158 | KENMARE RIVER | | 068905 | 060701 |
| R002162 | RIVER BARROW AND RIVE | | 268000 | 117000 |
| R002162 | RIVER BARROW AND RIVE | ARDALOO FEN 00082 | 246000 | 162000 |
| R002162 | RIVER BARROW AND RIVE | KILNASEER FEN | 276500 | 116500 |
| 002164 | LOUGH GOLAGH AND BREE | | 196500 | 366200 |
| R002170 | BLACKWATER RIVER (COR | | 210000 | 099000 |
| 002176 | LEANNAN RIVER | | 207500 | 417100 |
| 002181 | DRUMMIN WOOD | | 151500 | 199500 |
| 002185 | SLIEVE MISH MOUNTAINS | | 075000 | 107000 |
| 002187 | DRONGAWN LOUGH | | 073100 | 064000 |
| 002189 | FARRANAMANAGH LOUGH | | 083000 | 037800 |
| 002211 | COMMONS OF CARNEY | | 187300 | 192200 |

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|---|---|---|---|---|
| 002236 | ISLAND FEN | | 212300 | 201100 |
| 002241 | LOUGH DERG, NORTH-EAS | | 186592 | 200932 |
| 002241 | LOUGH DERG, NORTH-EAS | SLEVOIR BAY AND G | 185000 | 205000 |
| 002244 | ARDRAHAN GRASSLAND | | 144647 | 213018 |
| 002279 | ASKEATON FEN COMPLEX | | 137989 | 151391 |
| 002279 | ASKEATON FEN COMPLEX | GORTEENNAMROCK (0 | 138000 | 151000 |
| 002293 | CARROWBAUN, NEWHALL A | | 147482 | 207476 |
| 002295 | BALLINDUFF TURLOUGH | | 144922 | 208030 |
| 002296 | WILLIAMSTOWN TURLOUGH | | 157078 | 268681 |
| R002298 | RIVER MOY | | 131045 | 298734 |
| R002298 | RIVER MOY | LOUGH CONN AND LO | 121000 | 310000 |
| R002298 | RIVER MOY | MANNIN AND ISLAND | 146000 | 284000 |
| R002299 | RIVER BOYNE & RIVER B | | 286083 | 268000 |
| R002299 | RIVER BOYNE & RIVER B | LOUGH SHESK (556) | 262000 | 268000 |
| R002301 | RIVER FINN | | 194200 | 402800 |
| R002301 | RIVER FINN | FINTOWN FEN | 194200 | 402800 |
| 002313 | BALLYMORE (DUNEEL) FE | | 224333 | 249135 |
| 002338 | DRUMALOUGH BOG | | 162000 | 283000 |
| 002343 | TULLAHER LOUGH & BOG | | 095000 | 162500 |
| 002364 | MOYCULLEN BOGS NHA | | 120500 | 227000 |
| 002459 | EANY MORE GORGE | | 186000 | 382000 |
| 002461 | CROCKAHENNY | | 247500 | 435000 |
| 002472 | T BAN | | 254000 | 274200 |
| 002473 | BOULTRY FEN | | 205000 | 189000 |
| 002477 | KILRUANE WETLAND | | 190500 | 182500 |
| 002490 | CLONLYON GLEBE FEN | | 208100 | 226000 |
| 002496 | KILPATRICK BRIDGE FEN | | 241000 | 251300 |
| 002499 | DOONARD UPPER FEN | | 106000 | 146000 |
| 002523 | SUNCROFT FEN | | 277500 | 207400 |
| 002550 | MOIN FEN | | 077800 | 121800 |
| 002561 | LOUGHAPOLLBOY LAKE | | 159000 | 268400 |
| 002563 | CROSS/BALLINPHUILL BO | | 165000 | 225000 |
| 002564 | BALLINDOOLY LOUGH AND | | 132000 | 229000 |
| 002572 | BALLINAHISTLE (BALLYD | | 167600 | 217900 |
| 002576 | RATHESCAR WOOD | | 303000 | 287000 |
| 002579 | CAPPAGH GRASSLAND, KI | | 148000 | 288000 |
| 002585 | COOLEY LOUGH | | 113500 | 282300 |
| 002586 | WATERLOO FEN | | 159700 | 077600 |
| 002588 | BALLYCURRIN FEN | | 120000 | 249000 |
| 002590 | CARTON-POLLAPHUCA | | 149000 | 254000 |
| 002591 | HORSELEAP CROSS | | 155000 | 246000 |
| 002592 | LOUGH AFOOR | | 131000 | 237000 |
| 002593 | POLLNAGARRAGH POOLS | | 148500 | 216800 |
| 002595 | CARTONSTOWN LOUGH | | 307600 | 283300 |
| 002596 | DRUMSHALBON LOUGH | | 308200 | 283600 |
| 002598 | BALLYADAM FEN | | 137500 | 145200 |
| 002601 | BALLYNEALE FEN | | 143600 | 132700 |
| 002602 | DOOHYLE LOUGH FEN | | 137500 | 143500 |
| 002603 | ELLAHA FEN | | 128400 | 148400 |
| 002604 | FRIARSTOWN FEN | | 157500 | 149500 |
| 002606 | MORNANE LOUGH | | 138400 | 152300 |
| 002619 | KNOCKLEHARD LAKE | | 119100 | 266300 |
| 002620 | LOUGH CAHEER | | 150000 | 282400 |
| 002621 | CLONDALLOW FEN | | 204500 | 208500 |
| 002622 | KILLAUN BOG | | 211500 | 205600 |
| 002624 | CLOONFINLOUGH | | 190500 | 279000 |
| 002634 | LOUGH NASKEA | | 135500 | 309000 |
| 002635 | BALLYGUNNER BOG | | 264200 | 108400 |
| 002636 | CASTLETOWN FEN | | 262000 | 104900 |
| 002639 | KILCARAGH FEN | | 262700 | 107200 |

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|---|---|---|---|---|
| 002642 | MONROE FEN | | 237300 | 257600 |
| 002643 | MOUNT DALTON LOUGH | | 231800 | 251700 |
| 002647 | GARRYSALLAGH FEN | | 243600 | 260400 |
| 002648 | MONINTON FEN | | 244000 | 263400 |
| 002649 | BALNAVINE FEN | | 254200 | 270000 |
| 002650 | CLONAGH LAKE | | 260800 | 264800 |
| 002651 | KILLUA CASTLE FEN | | 266700 | 267800 |
| 002652 | LISCLOGHER BOG | | 261700 | 257200 |
| 002653 | CLONYRINA FEN AND GRA | | 228700 | 245600 |
| 002654 | LISNAGREE FEN | | 227400 | 242300 |
| 002655 | RATHSKEAGH FEN | | 226500 | 248700 |
| 002656 | BALLYNACLIFFY FEN | | 207700 | 253200 |
| 002657 | DROMORE FEN | | 232200 | 241600 |
| 002658 | INNISCARRA LAKE (CARR | | 142000 | 070200 |
| 002660 | CORBETSTOWN FEN | | 258200 | 256000 |
| 002681 | BALLIN LOUGH | | 245000 | 104000 |
| 002684 | BAWN FEN | | 167000 | 175700 |
| 002696 | BEALAGRELLAGH WETLAND | | 087000 | 112500 |
| 002700 | COOLTEEN WETLAND | | 295000 | 123200 |
| 002712 | PIGEONSTOWN SPRINGS | | 221590 | 206760 |
| 002722 | CLOON BOG | | 133500 | 231500 |
| 002725 | KILNACLASHA | | 114200 | 036300 |
| 002729 | WEST OF GRALLAGHMORE | | 214900 | 148500 |
| 002738 | MANULLA LAKES | | 122500 | 287000 |
| 002739 | CLOONOO EAST | | 158500 | 217000 |
| 001934 | | Cabragh wetlands NHA | | |
| 000402 | | Fiddown Island NHA | | |
| 000781 | | Slaney Valley NHA | | |
| 000420 | | Goul River Marsh | | |
| 000519 | | Lough Conn & Cullen NHA | | |
| 002048 | | Fergus Estuary NHA | | |
| 000667 | | Lismore woods NHA | | |
| 001794 | | Blackwater valley (Kilcummer) | | |
| 001561 | | Awbeg valley (Castletownroche) | | |
| F99999 | | Newfoundland bog | 092700 | 083000 |

# APPENDIX IV

**NOTICE OF NOTIFIABLE ACTIONS**
**HABITAT TYPE 4.2**

Under STATUTORY INSTRUMENT 94 of 1997, made under the EUROPEAN COMMUNITIES ACT 1972 and in accordance with the obligations inherent in the COUNCIL DIRECTIVE 92/43/EEC of 21 May 1992 (the Habitats Directive) on the conservation of the natural habitats and species of wild fauna and flora, all persons must obtain the written consent, (in circumstances prescribed at section A and B below) of the Minister for The Environment and Local Government before performing any of the operations on, or affecting, the following habitats where they occur on lands / waters within the candidate Special Area of Conservation.

Please note that where a landowner has a current approved plan under the Rural Environmental Protection Scheme or any scheme which the Minister considers to be equivalent s/he need only notify the Minister of activities not covered in the plan.

**HABITAT TYPE**
**FENS, TRANSITION MIRES, PETRIFYING SPRINGS**

**SECTION A**
Please note that the activities listed in *Section A below* are required to be notified to the Minister for The Environment and Local Government and should not be undertaken before consent.

Section A
THE MINISTER FOR THE ENVIRONMENT AND LOCAL GOVERNMENT IS REQUIRED TO BE NOTIFIED IN RELATION TO THE FOLLOWING ACTIVITIES AND SUCH ACTIVITIES SHOULD NOT PROCEED WITHOUT PRIOR CONSENT:

grazing of livestock above a sustainable density (as defined in approved farm plans)

grazing by livestock treated within the previous week with a pesticide which leaves persistent residues in the dung

changing of traditional use from hay meadow (to either grazing or silage making), or from grazing to silage cutting

adding lime within 50m of the fen or a water course running into it

adding fertiliser of any sort within 50m or a water course running into it

extracting water for irrigation or other purposes

mowing grass before the 30th June (*Note; if you have been notified that your lands hold breeding corncrakes, or certain rare meadows, special provisions will apply)*

supplementary feeding of stock

operation of boat angling or shore angling business

restocking with fish

reclamation, infilling, ploughing or land drainage within 50m of the fen

reseeding, planting of trees or any other species within 50m of the fen

use of any pesticide or herbicide within 50m of fen

dumping, burning or storing any materials within 50m of the fen

alteration of the banks, bed or flow of watercourses within the fen or running into or out of it

harvesting reed or willow

operation of commercial recreation facilities (e.g. bird watching tours)

introduction (or re-introduction) into the wild of plants or animals of species not currently found in the area any other activity of which notice may be given by the Minister from time to time

**SECTION B**

Please note that the activities listed in *Section B below* may, and in most cases do, require a license or consent from another statutory authority (e.g. the local planning authority, the Minister for the Marine and Natural Resources, or the Minister for Agriculture and Food).

If so, these notifiable actions do not apply.

However, if such activities are not regulated by another statutory authority, the said activities are required to be notified to the Minister for The Environment and Local Government.

SECTION B

(NO REQUIREMENT TO NOTIFY IF ALREADY LICENSED BY ANOTHER MINISTER/BODY)

developing leisure facilities including golf courses, sports pitches, caravan or camping facilities

any activity which might cause pollution of the fen

removal of soil, mud, gravel, sand or minerals

developing roads or car parks

construction of fences, buildings or embankments

afforestation

# APPENDIX V

# GLOSSARY

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CUTAWAY BOG - This term describes areas where peat has been removed systematically by industrial means. Any peat remaining can no longer be considered as economically removable (Irish Peatland Conservation Council).

CUTOVER BOG – An NPWS habitat classification that describes areas of bog which have been previously cut (by hand or by mechanical means), although not down to the underlying mineral soils or bedrock. Remaining peat can still be an economic reserve. Cut-over areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DEHLG - Department of Environment, Heritage and Local Government

DESICCATION - Drying out.

DOMESTIC PURPOSES - Used in relation to the cutting of peat. Peat that is cut for domestic purposes is not for commercial sale and is cut at the rate of one year's supply for a household per year.

DRAINAGE DITCHES - An NPWS habitat classification which refers to water channel systems with moving or stagnant water bodies, artificial in origin. Most ditches are cleared cyclically, although this category also includes ditches that are overgrown with wetland plants.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ECOTOPE - The abiotic environment or habitat of a particular biotic system (Kulcher, 1967; Whittaker et al., 1973). According to work carried out by Kelly (1993) on Clara and Raheenmore raised bogs vegetation can be assigned to five different ecotopes. Sub-central and central ecotopes with Active peat formation (Active Raised Bog habitat) and marginal, sub-marginal and facebank ecotopes with little or no peat formation (Degraded Raised Bog habitat).

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

FENS AND FLUSHES - An NPWS habitat classification. Fens are peatlands fed by calcium rich water, either from groundwater or from inflowing surface water. Flushes are wet areas maintained by the seepage of water down slopes of various gradient, and are usually local features. Both are

characterised by an abundance of small sedge forming species-rich mosaics with other species. Orchid species are particularly noticeable in fens and butterworts are more typical of flushes. According to Cross (1990) flushes are areas where nutrient enrichment occurs, usually as a result of more concentrated horizontal water movement. They are particularly common near the bog margin and at the base of low mineral ridges and are characterised by the presence of *Molinia caerulea, Myrica gal*e and often *Sphagnum recurvum*.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT. - Refers to traditional cutting of peat using a slean or spade.

HIGH BOG – This is the area of bog which have not been previously cut and generally its vegetation is characterised by the presence of ericoid and *Cyperaceae* species and an abundant of *Sphagnum* species.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

LAGG - A term used to describe the transition from bog to mineral soil around a raised bog.

LIMESTONE - Sedimentary rock composed predominantly of calcium carbonate, often containing fossils.

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MICROTOPOGRAPHY – This is the small scale variation in surface level within a habitat.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NGO – Non governmental environmental conservation organisations.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PEAT CUTTING BY HAND. - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

RAISED BOG - An NPWS habitat classification characterised by an elevated dome of peat, the surface of which is isolated from the surrounding ground water table and receiving water solely from precipitation. The peat surface is wet, often with pools and hummock hollow systems and is usually dominated by *Sphagnum* mosses and bushy heather, with Deer-grass, Bog Cottons and other associated species. Raised bogs can be distinguished from blanket bogs by their paucity of grasses which typify blanket bog.

SENSITIVE MARGIN (or Margin with high sensitivity to cutting) - Section of high bog margin that is within 250m of priority habitat (i.e. Active Raised Bog or Bog Woodland).

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPWS is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

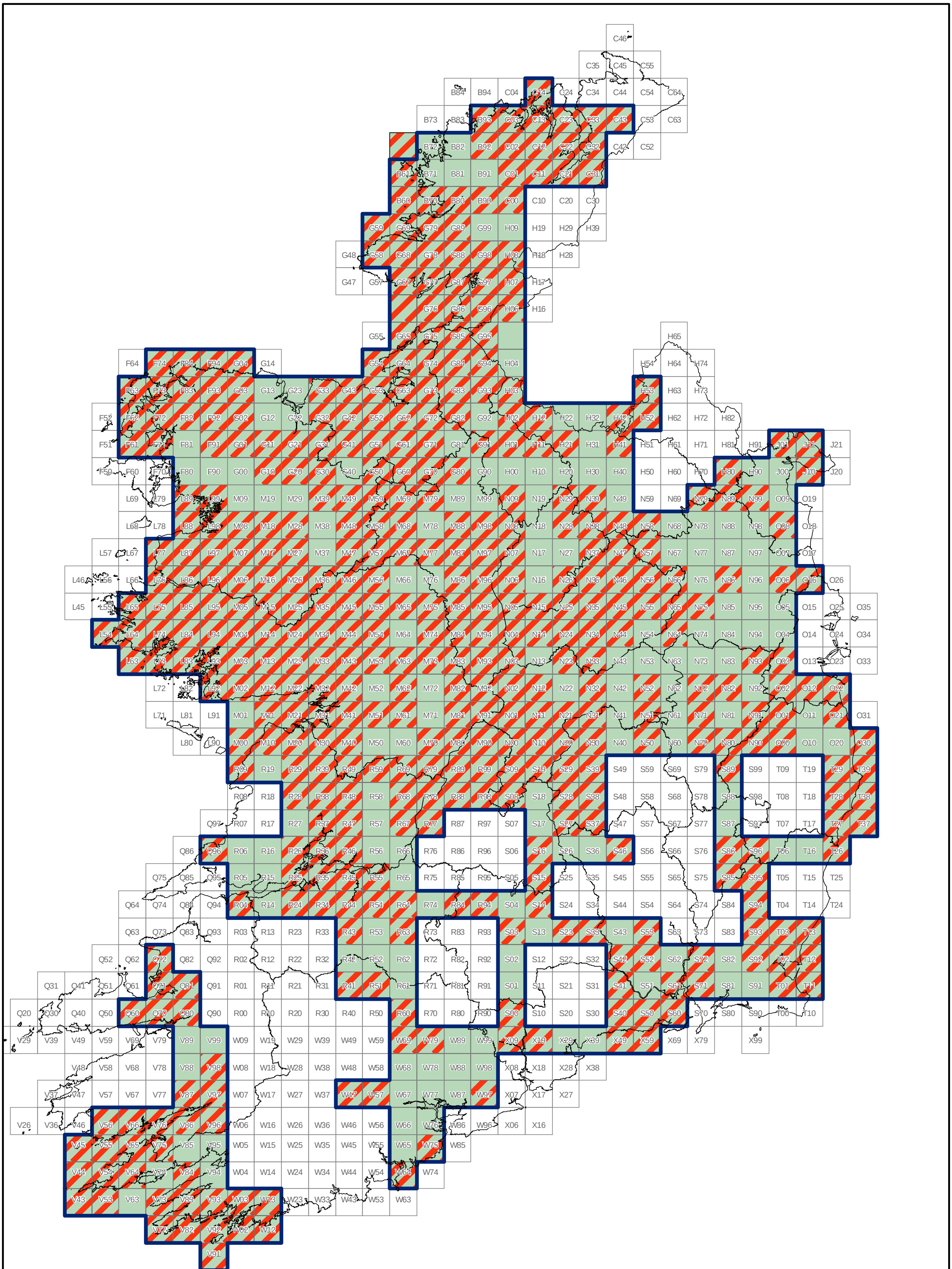
TURBARY – Turbary is the term used to describe the ancient right to cut turf on a particular area of bog. These rights came about with the resettlement of confiscated land or by prescription. Prescription is a legal term meaning that if a person is able to demonstrate that they cut turf without secrecy, without permission and without force continuously for a period of 30 years they have a turbary right. This implies that not all turbary rights will be formally registered.

## **7230** Alkaline Fen

| National Level | |
|---|---|
| **Habitat Code** | 7230 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | • Crushell P., 2000. *Irish Fen Inventory - A review of the status of fens in Ireland*, Irish Peatland Conservation Council, Dublin, pp. 100.<br>• Foss, P.J. 2007. National Parks & Wildlife Service Study of the Extent and Conservation Status of Springs, Fens and Flushes in Ireland 2007. Unpublished report for the National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.<br>• Hammond R.F., 1979, The Peatlands of Ireland, Soil survey Bulletin No 35, An Foras Talúntais, Dublin. |
| **Range** | Throughout Ireland, most commonly in west and Midlands. See Map 2 attached |
| Surface area | 57,600 km² (576 grid cells selected x 100 km² - area polygon derived from grid cells) see Map 2 |
| Date | 02/2007 Data for habitat distribution and range covers data collection period from surveys of the early 1980's; the NHA surveys of the 1990's to NPWS Fen Study Project 2006. |
| Quality of data | 2 = moderate (based on partial data with some extrapolation) |
| Trend | Decreasing |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| **Area covered by habitat** | 68.4 km$^2$ |
| Distribution map | See map actual present distribution and range attached; NPWS Fen Study database 2007 |
| Surface area | 68.4 km$^2$ |
| Date | 02/2007 Data for habitat area covers data collection period from surveys of the early 1980's; the NHA surveys of the 1990's to NPWS Fen Study Project 2006. |
| Method used | 3 = ground based survey |
| Quality of data | 1 = poor (based on very incomplete data or on expert judgement) |
| Trend | - = decreasing |
| Trend-Period | 1980 - 2006 |
| Reasons for reported trend | 3 = direct human influence (restoration, deterioration, destruction) |
| Justification of % thresholds for trends | There has been an unquantified decline in area since the beginning of the trend period, however this decline is not considered to be significant since the Directive came into force. |
| Main pressures | 140 Overgrazing<br>150 Restructuring agricultural land holding<br>161 Forestry Planting<br>310 Peat Extraction<br>311 Hand-cutting of peat<br>312 Mechanical removal of peat<br>701 Water pollution<br>800 Landfill, land reclamation and drying out, general<br>803 Infilling ditches, dykes, ponds, marshes and pits<br>810 Drainage |
| Threats | 140 Overgrazing<br>150 Restructuring agricultural land holding<br>310 Peat Extraction<br>312 Mechanical removal of peat<br>701 Water pollution<br>800 Landfill, land reclamation and drying out, general<br>803 Infilling ditches, dykes, ponds, marshes and pits |

| | |
|---|---|
| | 810 Drainage<br>890 Other human induced changes in hydraulic conditions |
| ***Complementary information*** | |
| **Favourable reference range** | 57,600 km² (576 grid cells x 100 km²) See Map 3 attached |
| **Favourable reference area** | 68.4 km² |
| **Typical species** | **Vascular plants***: Schoenus nigricans, Eriophorum latifolium, Carex dioica, C. viridula ssp. brachyrrhyncha, C. pulicaris, C. viridula ssp. oedocarpa, Juncus subnodulosus, Eleocharis quinqueflora, Dactylorhiza traunsteineri, Selaginella selaginoides, Epipactis palustris, Parnassia palustris, Pinguicula vulgaris*<br>**Mosses, Liverworts and Lichens***: Scorpidium scorpioides, Campylium stellatum, Drepanocladus revolvens, Palustriella commutata, Ctenidium molluscum, Fissidens adianthoides, Bryum pseudotriquetrum*<br><br>Species information based on: Ó Críodáin, C. & Doyle, G.J., 1994; 1997; Doyle, G.J. & Ó Críodáin, C., 2003; White, J. & Doyle, G.J., 1982; Foss 2007.<br><br>Further characteristic vascular plants, mosses, lichens and liverworts see Table 5.1.<br><br>**Other species:**<br>**Dragonflies and Butterflies***: Euphydryas aurinia*<br>**Other invertebrates**: *Vertigo geyeri*, *V. angustior, V. moulinsiana*<br>**Vertebrates**: *Lutra lutra*<br><br>Methods: all the species above are characteristic of Alkaline fen habitat in Ireland. |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Typical species were assessed as unfavourable/bad using best expert judgement. |
| **Other relevant information** | Restoration initiatives undertaken : Very limited; NPWS |
| ***Conclusions<br>(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Favourable (FV) |
| **Specific structures and functions (incl. typical species)** | Unfavourable Bad (U2) - ongoing deterioration of the condition of Alkaline fen habitats at current rates caused by drainage, land reclamation, peat cutting, forestry etc. threatens the structures and functions of the habitat as well as habitat quality indicator and typical species. |
| **Future prospects** | Unfavourable Bad (U2) - ongoing deterioration of Alkaline fen habitats at current rates caused by drainage, land reclamation, peat cutting, forestry etc. threatens the future prospects for the habitat. |
| **Overall assessment of CS** | Unfavourable Bad (U2) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

# Alkaline fens

## 7230

- Current Distribution (426 cells)
- Current Range (576 cells)
- Favourable Reference Range (576 cells)
- W48 10km grid cells

Date: October 2007

# 8110 SILICEOUS SCREE OF THE MONTANE TO SNOW LEVELS

# CONSERVATION STATUS ASSESSMENT REPORT

## Table of Contents

# 8110 SILICEOUS SCREE OF THE MONTANE TO SNOW LEVELS

# CONSERVATION STATUS ASSESSMENT REPORT

## *1 HABITAT CHARACTERISTICS IN IRELAND*

### 1.1 Definition of Siliceous scree of the montane to snow levels in Ireland

A definition of Siliceous scree of the montane to snow levels (hereafter referred to as siliceous scree) cannot be made without first reference to the term 'montane', which is also understood as 'alpine' in Ireland. In the historical literature, the convention in Ireland has been to apply the term 'alpine' to those areas of habitat above 350-450 metres (1,200 – 1,500 ft) in altitude. However, the easy application of this label is very difficult as areas of 'alpine' vegetation may occur much lower than this, and the occurrence of this habitat is ultimately dependent on a number of factors principally geographical location, aspect, levels of exposure and not least, biogeographical history. In general, an alpine zone on Irish mountains occurs within the altitudinal range above but, moving northwards and westwards, it is met with at increasingly lower levels.

From a vegetation point of view, assemblages of alpine plants of screes are confined to areas of scree located at the foot of the more or less vertical, bare, north-east facing cliffs or areas of outcropping rock on slopes, which had their origins during the last glacial periods. It is widely considered that the alpine species occupying these areas are relictual in nature and represent the last vestiges of the arctic/tundra floristic component that was widespread in Ireland during the Pleistocene period.

There has been little published on the vegetation of Irish mountains, even though some systematic work was carried out on them during the 1970s. However, White and Doyle (1982) recognized 7 associations within 4 Classes, which probably encompass the range of variation found within the alpine cliff communities. Some further details on the affinities of the alpine vegetation of Mount Brandon and Slieve League were presented by Curtis (1993).

**Table 1** presents a list of Associations indicative of scree and rocky slopes which are specifically alpine in nature and which correspond to the Annex I habitats. Siliceous scree is mainly included in the Class 'Pioneer communities of scree', but it should be noted that there is often overlap between the other scree and rocky Annex I habitats, which include:

- 8120 Calcareous and calcshist screes of the montane to alpine levels
- 8210 Calcareous rocky slopes with chasmophytic vegetation
- 8220 Siliceous rocky slopes with chasmophytic vegetation

and that these habitats above often occur as part of a mosaic of vegetation, which can include alpine heath, upland grasslands, wet heath and dry heath. Consequently, it is considered that the term 'alpine' only be applied to those categories listed in, which the diagnostic species, appropriate to each is present. It should be noted that there is some doubt as to the exact nature of some of the categories as a systematic phytosociological survey of Irish alpine vegetation has not yet been carried out.

**Table 1. Table of plant associations found on alpine cliffs in Ireland based on White & Doyle (1982) and Curtis (1993).**

| Class | Association | Diagnostic species |
|---|---|---|
| Pioneer communities of scree[1] | *Cryptogrammetum*<br><br>*Oxyrietum digynae* | *Cryptogramma crispa.*<br><br>*Oxyria digyna.* |
| Wall fern -*Asplenietea-rupestria* | *Polysticho-Asplenietum viridis* | *Polystichum lonchitis, Asplenium viride.* |
| Spring vegetation - *Montio-Cardaminetea* | *Philonotido fontanae-Saxifragetum stellaris*<br><br>*Saxifrago-Chrysosplenietum oppositifolii*<br><br>*Saxifragetum aizoidis* | *Saxifraga stellaris, Montia fontana ssp fontana, Dicranella palustris, Philonotis fontana, Scapania uliginosa.*<br><br>*Chrysosplenium oppositifolium, Saxifraga stellaris.*<br><br>*Saxifraga aizoides, S. oppositifolia, Alchemilla glabra, Selaginella selaginoides.* |
| Arctic-alpine grass heaths | *Breutelio-Seslerietum*[2] | *Arenaria ciliata, Saxifraga aizoides, Silene acaulis, Euphrasia salisburgensis, Breutelia chrysocoma, Sesleria albicans.* |

*Notes:*

1. The nature of the Pioneer communities of screes is fragmentary and so the status of this Class in Ireland is still uncertain.
2. White and Doyle assign the *Breutelia-Seslerietum* to the Class of Arctic-Alpine grass heaths when it is actually an association found on wet cliffs on the Ben Bulben massif.

For most habitats listed in the Interpretation Manual of the Habitats Directive, there is a direct correspondence between its name and an Association of vegetation, which has been formally recognized by phytosociologists. However, for the Habitat Directive categories of alpine cliff habitats there is no direct equivalence between the habitat title and a specific Association of vegetation. Instead, there has been a broad, generic approach to the classification of alpine categories within the Interpretation Manual and consequently the formal assignation of areas of alpine habitat to these is not easily accomplished.

In some cases, individual Associations appear to be restricted to certain Interpretation Manual categories e.g. the *Cryptogrammetum* to siliceous scree and the *Polysticho-Asplenietum viridis* to Calcareous rocky slopes. However, the majority of Associations can occur in 2 or 3 Interpretation Manual categories viz. *Saxifragetum aizoidis* and *Breutelia-Seslerietum* in both Calcareous scree slopes and Calcareous rocky slopes, whilst the *Philonotido fontanae-Saxifragetum stellaris* may be included within both of the Chasmophytic categories of Calcareous and Siliceous slopes. The consequences of this are that the accommodation of Irish alpine habitats, species and vegetation within the categories of the Interpretation Manual is not easily accomplished and it must be recognized, that on the ground, there is a great deal of overlap between Habitats Directive categories.
However, for the purposes of the Habitats Directive, alpine cliff and scree habitats in Ireland are considered to belong to four categories:

The alpine cliff and scree communities are accommodated within:

- **(8110) Siliceous scree of the montane to snow levels**

- **(8120) Calcareous and calcshist screes of the montane to alpine levels**
- **(8210) Calcareous rocky slopes with chasmophytic vegetation**
- **(8220) Siliceous rocky slopes with chasmophytic vegetation**

**Siliceous scree** is applied to areas of open rocky habitat consisting of eroded material of siliceous origin on steep slopes, usually of boulders but sometimes of smaller fragments. These slopes are unstable and liable to slippage. Elements of alpine heath may occur where there is sufficient cover. A diagnostic species of this category is *Cryptogramma crispa*, which is rare in Ireland and the number of sites listed for this habitat is consequently small. It is probable that the two associations listed in **Table 1** for Pioneer communities of scree can be included here.

Though the four categories used to accommodate alpine scree and rocky vegetation in Ireland, for the purposes of the Habitats Directive, are appropriate for the designation of Special Areas for Conservation, they cannot be considered comprehensive for the purposes of defining alpine cliff and scree habitats and their vegetation. For the purposes of confirming the occurrence of and identifying montane areas where alpine screes and rocky habitats are found the conspectus of Associations given in Table 1 should be used. However, a preliminary assignation of the associations of alpine vegetation to the appropriate Habitats Directive categories is presented in Table 2. It is stressed that this is approximate and the production of a definitive account must await a thorough field investigation of the nature of Irish alpine vegetation.

**Table 2. NATURA 2000 alpine cliff and scree habitat categories and the likely plant associations based on White and Doyle (1982), which they contain.**

| NATURA 2000 Habitat title | Probable identity of plant association (White and Doyle (1982)) |
|---|---|
| **Siliceous scree** | *Cryptogrammetum;*<br>*Oxyrietum digynae;*<br>*Lycopodio-alpini-Rhacomitrietum lanuginosi* |
| **Calcareous scree** | *Saxifragetum aizoidis;*<br>*Breutelio-Seslerietum* |
| **Chasmophytic vegetation: Calcareous** | *Polysticho-Asplenietum viridis;*<br>*Philonotido fontanae-Saxifragetum stellaris;*<br>*Saxifragetum aizoidis;*<br>*Breutelia-Seslerietum;*<br>*Arctostaphylo-Dryadetum;*<br>*Lycopodio-alpini-Rhacomitrietum lanuginosi* |
| **Chasmophytic vegetation: Siliceous** | *Philonotido fontanae-Saxifragetum stellaris;*<br>*Saxifrago-Chrysosplenietum oppositifoli;*<br>*Herberto-Polytrichetum alpini;*<br>*Lycopodio-alpini-Rhacomitrium lanuginosi* |

It can be seen from **Table 2** that some alpine associations occur in more than one habitat and in reality their expression is a function of the rock type on, which they occur, the altitude, aspect, substrate size and degree of slope. In general, the greatest diversity of species occurs within the Calcareous scree/ Calcareous Chasmophytic habitats on the limestone mountains of the north-west with a lesser degree of diversity found within the Calcareous Chasmophytic habitat found on mountains of other rock types. The least diversity is found within the Siliceous Chasmophytic habitat except in areas where the bryophyte communities are very well represented.

## 1.2 List of alpine and siliceous scree plant species in Ireland

The listing of plant species occurring in alpine areas in Ireland is made possible for the vascular plants by the availability of lists from papers prepared by 19th century botanists, principally H.C. Hart who was the first to systematically examine the major mountain ranges in Ireland and who provided altitudinal data along with species occurrences. This has been added to over the 20th century by the discovery of further sites for alpine plants and it can be concluded that the species complements of Irish mountains is reasonably well known for the ferns and flowering plants. However, for the cryptogams, this is not the case and only certain well-botanised sites such as Ben Bulben (Site Code: 000623) and the Macgillicuddy's Reeks (Site Code: 000365) are well documented. However, the systematic survey of many Irish counties for bryophytes is ongoing and will eventually result in a comprehensive overview of the alpine mosses and liverworts.

Defining an alpine plant in Ireland is often made difficult as what may be alpine here may not be elsewhere in Europe and this is confounded by the behaviour of some lowland species, which occur on mountain tops and cliffs and act as alpine elements. For example, sea pink, *Armeria maritima* is found on the summit of Carrauntoohill at 1,034 m whilst on alpine cliffs a form of the common scurvy grass, *Cochlearia officinalis* a common coastal species, is sometimes found. A further illustration of the ecologically fickle nature of many Irish plants is crowberry, *Empetrum nigrum*, usually a species of high mountains but in County Mayo, it occurs at sea level.

The list of true alpines in Ireland is small, that is species, which never descend lower than 350m or away from cliff habitats and these are the true post-Pleistocene relicts, which can be considered as **Obligate Alpines** due to their virtual confinement to vertical, north-east facing cliffs or on exposed mountain ridges and summits. There conditions are severe enough to inhibit competition from coarser species and inaccessible enough to prevent grazing by animals. These may be joined here by what may be termed **Facultative Alpines**, which are species found in other habitats, not necessarily montane, but, which are also commonly associated with alpine locations.

**Table 3** lists the siliceous scree species, which are found at high altitude in Ireland. It excludes species, which are very widespread and found across a range of habitats from sea level to mountain tops.

**Table 3: List of species found on siliceous scree in Ireland.**

| Scientific Name | Obligate or Facultative Alpine Species |
|---|---|
| *Cryptogramma crispa* | Obligate |
| *Oxyria digyna* | Obligate |
| *Polygonum viviparum* | Obligate |
| *Salix herbacea* | Obligate |
| *Vaccinium vitis-idaea* | Obligate |
| *Agrostis canina* | Facultative |
| *Agrostis capillaris* | Facultative |
| *Arctostaphylos uva-ursi* | Facultative |
| *Antennaria dioica* | Facultative |
| *Calluna vulgaris* | Facultative |
| *Daboecia cantabrica* | Facultative |
| *Empetrum nigrum* | Facultative |
| *Erica cinerea* | Facultative |

| Scientific Name | Obligate or Facultative Alpine Species |
|---|---|
| *Hymenophyllum tunbrigense* | Facultative |
| *Hymenophyllum wilsonii* | Facultative |
| *Juniperus communis* | Facultative |
| *Vaccinium myrtillus* | Facultative |
| *Barbilophozia floerkii* | |
| *Campylopus paradoxus* | |
| *Cladonia furcata* | |
| *Cladonia impexa* | |
| *Cladonia squamosa* | |
| *Cladonia uncialis* | |
| *Dicranum majus* | |
| *Dicranum scoparium* | |
| *Eurhynchium praelongum* | |
| *Hypnum cupressiforme* | |
| *Isopterygium elegans* | |
| *Lophozia ventricosa* | |
| *Mnium hornum* | |
| *Oedipodium griffithianum* | |
| *Plagiothecium undulatum* | |
| *Pleurozium schreberi* | |
| *Pogonatum urnigerum* | |
| *Polytrichum alpinum* | |
| *Polytrichum formosum* | |
| *Pseudotaxiphyllum elegans* | |
| *Ptilidium ciliare* | |
| *Racomitrium* spp. | |
| *Rhytidiadelphus loreus* | |

## 2 *HABITAT MAPPING*

There has been no recent inventory or mapping of the national siliceous scree resource in Ireland. For the purposes of this survey, an extensive literature review of both published and unpublished material was undertaken (**Appendices 1** and **2**). Records documenting the occurrence of the species recorded from siliceous scree slopes (as listed in **Table 3**) were collated in an *MS Access* **Uplands Habitats Database**. This database contains records of the obligate and facultative species of the five Annex I upland habitats (4060, 8110, 8120, 8210, 820) in Ireland and was designed specifically for the purposes of this report.

The **Upland Habitats Database** of this project, currently holds c.4,500 records of indicator species of all Annex I upland habitats (i.e. 4060, 8110, 8120, 8210 and 8220) which have been gleaned from a variety of sources (both published and unpublished as documented in **Appendices 1** and **2** respectively). Given the antiquity of the bulk of the data (c.1700 of the records date from the 1800s to the 1950s) and the lack of accurate geographical references (only c.1500 records have grid references of varying accuracy (see below and **Appendix 3** for further information) the GIS application of much of the collated data is limited. The bulk of records will not be illustrated in **Figures 1 to 3** due to their lack of grid references.

The database contains information on the following:

- Species Name
- Designated Site Code (NATURA 2000 sites (SACs) or Natural Heritage Areas (NHAs))
- Description of the location of the species
- Altitudinal information (either in feet (‘) or metres (m) depending on the antiquity of the record)
- Grid Reference (if provided) – these were assigned an accuracy rating
- Source of data (published or unpublished reference)
- Date of record
- List of associated species (if present)
- Indication of whether the description indicated a single species record, an assemblage of species or a description of habitat cover*
- Any information on substrate or underlying geology

*Given the variability of data sources, records of indicator species have been described either as an assemblage of species, a single species location or as an indication of habitat cover, depending on the quality and source of the data. For example a historical record by Corry (1884), which only contained details of a particular species at a certain altitude on Ben Whisken (Site Code: 000623) was entered as a single plant species location, whereas a description of several arctic-alpine species on a cliff above a corrie lake on Mount Brandon (Site Code: 000375) by Stelfox (1951) was entered as a species assemblage. Where there was a good description of an area of alpine heath (such as that given by Conaghan et. al. (1994) in the NHA Site Card for the Twelve Bens (Site Code: 002031)) this was entered as habitat cover.

Data for all of the above fields in the database was not necessarily contained in the original publication/source for each record and based on the description of the locations given, an appropriate SAC Site Code was assigned to each record using the Discovery and 6” Mapping on Arc View 3.2.

**GIS**

GIS data sources, which are related to ecological factors that determine the occurrence of siliceous scree, were used to produce the indicative natural range and potential distribution maps shown on **Figures 1** and **2**. These include:

- Contour lines >350m elevation. Ordnance Survey (1995) – 1:50,000 Discovery Series, 10m contour interval,
- A Digital Terrain Modelling package (2007) generated polygons, which were used to identify areas of potential siliceous scree slope based on the following criteria:
    - elevation above 350m,
    - upland areas above 350m with a slope > 40º,
    - north and north-east facing slopes with a slope > 40º.

The areas which were identified were further refined to exclude the mountain ranges which are formed of limestones.

Investigation of the polygons created by the DTM indicated that not all slopes, which potentially contain siliceous scree, had been accurately identified (e.g. the north prison of Lugnaquilla within Wicklow Mountains SAC (Site Code: 002122) was not shown) and this was thought to be due to the use of the slope criteria. The use of this data thus has some limitations.

Although the use of recent (2000) digital aerial photographs of Ireland, which were ortho-rectified, was investigated, it became apparent that it was not possible to use these remotely to identify areas of siliceous scree. This is because it is not possible to distinguish it accurately from scree in mosaics of vegetation of wet heath, dry heath, rocky habitats and upland grassland.

## 2.1 Habitat Range

Siliceous scree slopes which support the habitat are largely restricted to those areas of north and north-east facing slopes (>40º) above 350-450 metres (c.1,200 – 1,500ft) in height and can be found within siliceous mountain ranges. However, siliceous screes do occur with other aspects. The occurrence of this habitat is ultimately dependent on a number of factors, principally geographical location, aspect, levels of exposure, nature of the solid geology, local erosional features and fluvio-glacial history. The actual range of siliceous scree slopes habitat as defined in the Habitats Directive Interpretation Manual is unknown in Ireland.

In general a siliceous (alpine) scree zone on Irish mountains occurs within the altitudinal range above but as you move northwards and westwards, it occurs at increasingly lower levels. From an alpine vegetation point of view, siliceous scree is usually confined to the north and north-east facing slopes of the mountains and may be found at the base of north and north-east facing cliffs, though screes can occur with other aspects. Siliceous scree is quite localised in upland areas in a few selected parts of Ireland.

**Figure 1** shows that siliceous scree thus potentially occurs in most of the mountain ranges in Ireland with the exception of the limestone mountains. These are located mainly in the north-west in Counties Donegal and Cavan, in the west (Counties Leitrim, Mayo and Galway) and south-west (Counties Kerry and Cork). Apart from these areas, there is a more localised distribution in uplands in the south (Co. Tipperary, Co. Limerick and Waterford), the north-east (Co. Louth) and eastern part (Co. Wicklow) of the country. There is an absence of siliceous scree in the midlands of Ireland due to the lowland character of the landscape. This habitat thus has a naturally discontinuous range in Ireland as it is restricted by altitude.

**Figure 1** shows how the natural range of siliceous scree in Ireland has been mapped. This map is based on a variety of different data sources.

- Firstly the locations, of north and north-east facing slopes (> 40º) in siliceous upland areas (>350m in elevation) were plotted on a $10km^2$ basis (purple squares).
- Due to the limitations of the DTM in accurately identifying all slopes which potentially contain siliceous scree (as described above), the locations of all sites for which this scree is a qualifying interest were also plotted on a $10km^2$ basis as well as sites where the habitat may potentially be present (pink squares) – note that this included sites which are below 350m in elevation such as Carlingford Mountain (000453) (see **Appendix 3**).
- The potential range of the habitat was also extended by the addition of several of the sites for *Cryptogramma crispa*, which occur below these elevation criteria and these are shown on a 10km basis (light blue squares). This principally relates to the record for Co. Cavan which is recorded from Bruse Hill pNHA (Site Code: 000002). However this species was last seen in 1938 so it is questionable as to whether or not it should be included within the range. However the record for Carlingford Mountain (Site Code: 000453) in Co. Louth also occurs at elevations below 350m and might therefore not otherwise be displayed in the natural range of the habitat.
- Finally sites were identified as potentially containing siliceous scree on the basis of the occurrence of true obligate species for the habitat. No extra squares were added on this criteria. Sites with only obligates but not the correct slopes were not included within the range as these obligates are found in other alpine habitats.

This habitat thus has a naturally discontinuous range in Ireland, as it is restricted by altitude and by the location of siliceous geology.

**It must be stated, however, that although areas of siliceous scree may occur in these mountain ranges they may not conform to the Habitats Directive definition, as this will depend on the species complement present. In the absence of a dedicated field survey, which will confirm the occurrence of those indicator species this figure should be very much viewed as an over-estimation. To determine a range based solely on the <u>known</u> locations of *Cryptogramma crispa* would indicate a range as low as $500km^2$ (5 grid cells selected x 100 $km^2$). Whilst *Cryptogramma crispa* may be a true indicator of siliceous scree habitats on Continental Europe this does not hold true for Ireland where it has been documented on exposed slabs of siliceous rock (Wicklow Mountains SAC (Site Code: 002122) (Dr Curtis, pers. obs.) and on Bruse Hill, Co. Cavan at 260m. Further investigation of the ecological nature of this species in an Irish context is highly desirable.**

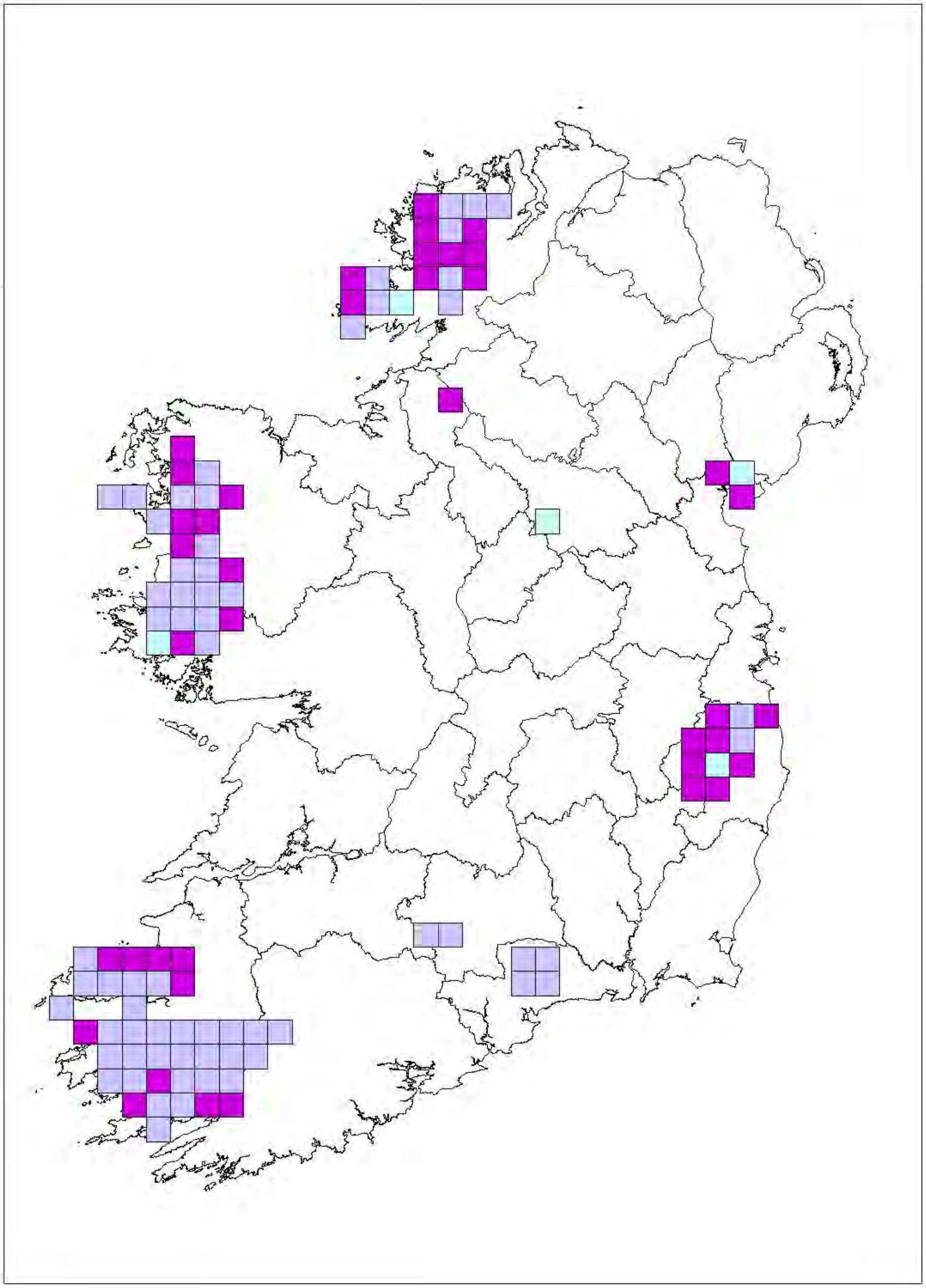


**Figure 1. Map showing the range and favourable reference range of siliceous scree in Ireland on a 10km² basis, which shows squares that contain north and north-east facing slopes (> 40°) in upland areas >350m in elevation on a siliceous rock type (purple squares), squares which contain cSAC sites for which siliceous scree is a qualifying interest as well as sites where the habitat may potentially be present (pink squares), (see Appendix 3). The 10km² historical distribution of *Cryptogramma crispa* is also shown (blue squares). This map is presented at a scale of 1 : 2,000,000.**

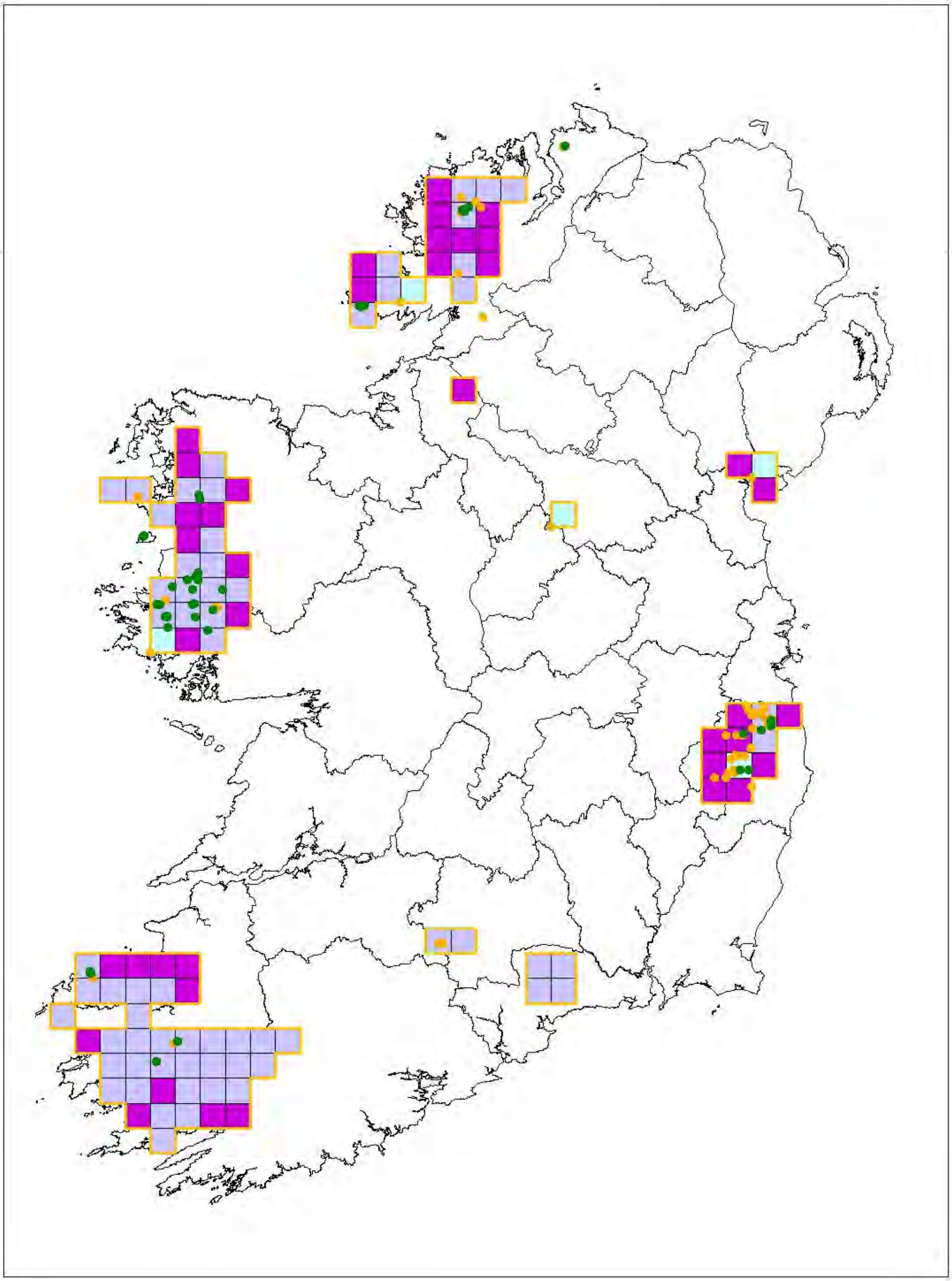


**Figure 1b. Range and Favourable Reference Range for siliceous scree in Ireland, which is based on the historic natural range of the habitat. Locations of single occurrences of the 5 obligate species are shown in orange and assemblages of these obligate species in green.**

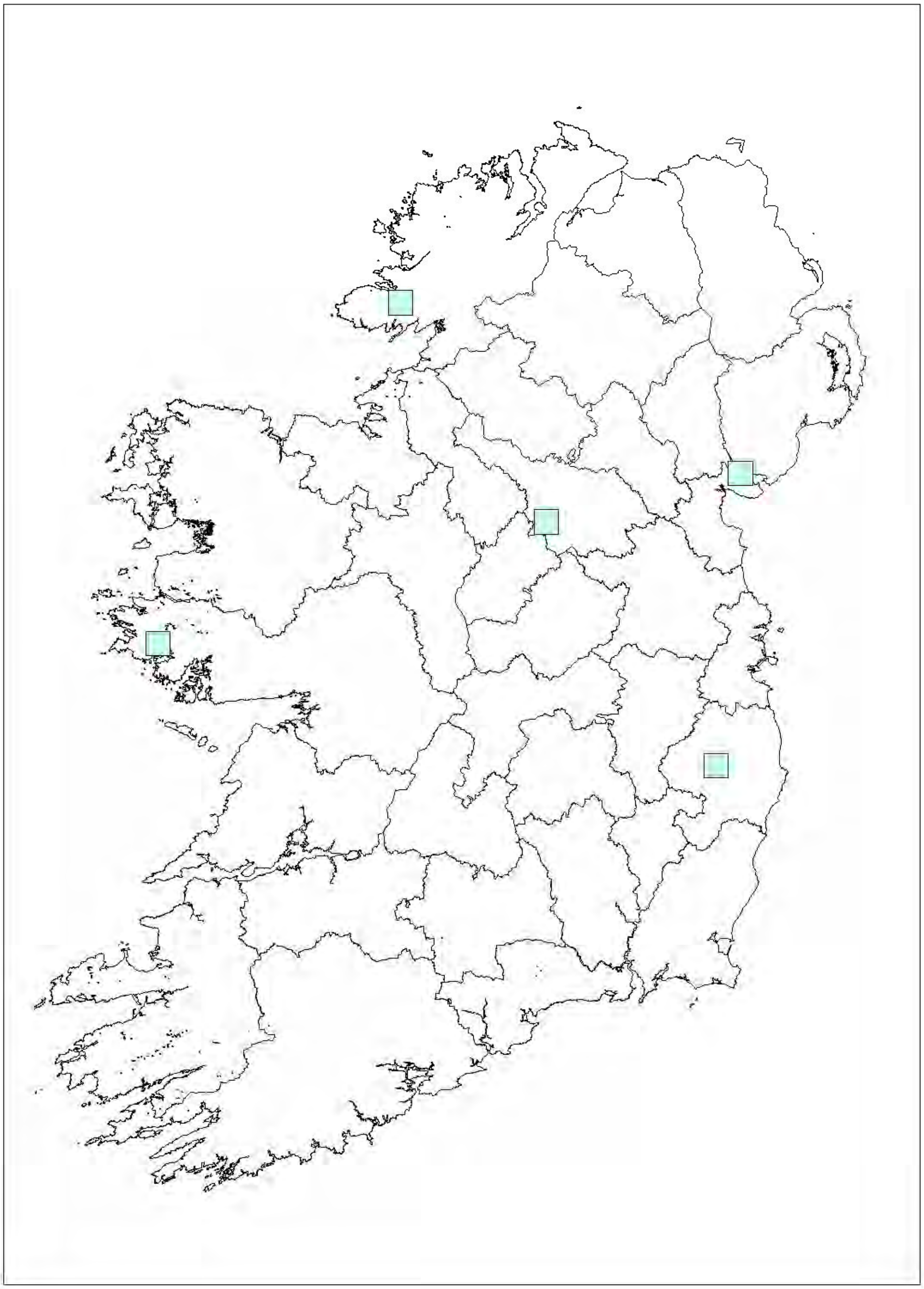


**Figure 2. Map showing the potential distribution of siliceous scree in Ireland based on the locations of north and north-east facing slopes** (> 40º) **(shown in black) at elevations >350m and records of *Cryptogramma crispa* on a 10km² basis (blue squares). Note that at the scale of 1 : 2,000,000 many of the areas of slopes are not visible.**

Both **Figures 1** and **2** were produced using the GIS sources described above coupled with the data collated in the database.

## 2.2 Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between current habitat range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

An assessment based on the historical range of siliceous scree indicates that the natural range polygon of the habitat in Ireland (see **Figure 1**), as defined by locations > 350 m with north and north-east facing slopes > $40^0$; sites for which siliceous scree is a qualifying interest; sites where there is potential for the habitat to occur (**Appendix 3**) and the documented records of true alpine indicator species collated in the project database (**Figure 3 and Appendix 3**), potentially covers 10,900 $km^2$ (109 grid cells selected x 100 $km^2$) **(See Figure 1)**. However, this range may be as low as 500$km^2$ (5 grid cells selected x 100 $km^2$) based solely on the <u>known</u> locations of *Cryptogramma crispa* in Ireland **(**See **Figures 1, 2** and **3)**. No specific studies have been undertaken on the conservation status of the habitat range in Ireland during the reporting period making any assessment of the extent or annual decline or otherwise in the habitat range problematic.

In general, the conservation status of the habitat range is deemed **Favourable** as the physical conditions for the presence of siliceous scree slopes are still present and the natural range of the habitat is thus likely to remain unchanged.

The Favourable Reference Range (FRR) is considered the same as the current range.

**Habitat Range Area:** Can be considered as the area of the polygon, which contains all of the grid cells, which contain the habitat, which are defined by the location of potential locations for the habitat and by documented records of indicator species collated in the project database. This potentially covers 10,900 $km^2$ (109 grid cells selected x 100 $km^2$).

**Favourable Reference Range**: This is considered the same as the Habitat Range Area and as described above, i.e. 10,900 $km^2$ (109 grid cells selected x 100 $km^2$)

## 2.3 Habitat Extent

***Slopes***

It is not possible to quantify the extent of siliceous scree in Ireland, as there has been no systematic mapping of this habitat. The distribution of the habitat as shown on **Figure 2** is based on the location of north and north-east facing slopes (with a slope >$40^o$) above 350m in elevation in the siliceous mountain ranges where siliceous scree slopes could be expected. By using the DTM generated polygons for north and north-east facing slopes above 350 m in elevation with a slope > $40^o$ it is possible to produce a very inaccurate estimate of the potential area of siliceous scree slope in Ireland. This figure has inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria as described above, whereby areas where siliceous rocky slope is known to occur may not be depicted. These areas are also likely to contain other habitats such as calcareous and siliceous rocky slope, alpine heath or dry and wet heath.

The area of north and north-east facing slopes above 350m in elevation with a slope > $40^o$ as defined using the DTM in areas of siliceous geology is approximately 1,141 ha or 11.41 $km^2$. Note that this figure does not include potential alpine siliceous scree habitat in areas below 350m such as Carlingford Mountain or sites in the west, in Kerry and Donegal.

***Species***

The literature review and consultations with experts on siliceous scree has indicated that whilst the presence of indicative obligate arctic-alpine species within known sites is reasonably well documented for certain documented mountain ranges, this information cannot be used to determine the precise extent of the habitat either within a site or on a previously undesignated mountain range. In the absence of a national survey, the best attempt that could be made to determine extent was to utilise the rare, threatened and scarce plant data, which gives accurate point locations of obligate arctic-alpine species coupled with altitudinal information to indicate likely areas of siliceous scree.

The principal sources of recent information pertaining to the location and distribution of siliceous scree species, which included grid references* include:

- National Parks & Wildlife Rare, Threatened and Scarce Plant Databases,
- Rare, Threatened and Scarce Plant County Survey Reports,
- County Floras – many of the locations of indicator species were manually assigned to either a $10km^2$ or $1km^2$ grid based on the descriptions of locations detailed in these publications,
- National Rare and Threatened Bryophyte Surveys,
- Published papers with records of indicator species, which were assigned to either a $10km^2$ or $1km^2$ grid square,
- Unpublished field records of one of the principal authors of this report (Dr. Curtis) and other NPWS staff,

*These data sources provided data in a wide variety of levels of mapped accuracy, which ranged from an accuracy of:

- 1m or 10m (recent county rare or threatened plant/bryophyte surveys),
- 100m (unpublished field records),
- $1km^2$ square grids (County flora records),
- $10km^2$ square grids (older publications or historical records of rare or threatened plant species).

These records were thus assigned an accuracy rating (relative to the nearest metre) in the database and were then plotted in Arc View 3.2 using an appropriate visual scale. This data was used coupled with other criteria listed below to indicate the likely extent of the habitat.

The key species used to try to determine an indicative extent of **siliceous scree** in Ireland are the 'true alpine' species for the habitat listed in **Table 3** as follows:

- *Cryptogramma crispa**
- *Oxyria digyna*
- *Polygonum viviparum*

- *Salix herbacea*
- *Vaccinium vitis-idaea*

*This is the only true alpine species that is unique to this habitat.

Records for these species are available at an accuracy of a 10km square, a 1 km square, at 100m and at 1m and a map of the indicative extent of siliceous scree is presented in **Figure 3**. These points are colour coded to indicate whether they are either single obligate alpine species records (orange points), or species assemblage records (green points). Note that there are two records which occur outside the range of the habitat as shown in **Figure 1** and **1b** and **3** – these are single records of *Salix herbacea* from Bulbin Mountain (Site Code: 000120) and *Vaccinium vitis-idaea* from Dunragh Loughs/Pettigo Plateau (Site Code: 001125), which in their own right do not indicate siliceous scree.

Note that there is overlap between these species (with the exception of *Cryptogramma crispa*) and the true alpines of other upland habitats such as 8120, 8210, 8220 and 4060. Where these occur on Limestone Mountains these records have been ignored, as they would otherwise skew the data.

The data relating to extent based on the DTM can be further refined with the known locations of *Cryptogramma crispa.*

The data collated by the Botanical Society of the British Isles was not used for the following reasons:

- typically the mountain summits were not surveyed during the Atlas 2000,
- the data, which are presented, is available only on a 10km basis and at that scale does not indicate 'effort 'i.e. whether a plant was no longer recorded from a location, or that, the location was not surveyed,
- the Atlas data are not fully accurate for the Irish context (many of the records were incorrectly gridded, while others were assigned to the wrong year classes. This was despite detailed corrections from NPWS, which were not corrected).

Further details on the processes and datasets which should be used in mapping siliceous scree in Ireland are presented in **Appendix 3**.

To produce a map showing anything other than an indicative extent is rendered difficult because the available information relating to the occurrence of this habitat is based on plant species location rather than habitat extent. The areas of siliceous scree are often located within a mosaic of other habitats including heaths, grassland and exposed rock, and so it is difficult to assume a minimum area where the alpine plant species occur. In addition large areas of upland habitats in Ireland remain unsurveyed.

The **accurate** mapping of the extent of siliceous scree of the montane to snow levels (8110) as defined in the Habitats Directive Interpretation Manual has not been possible.

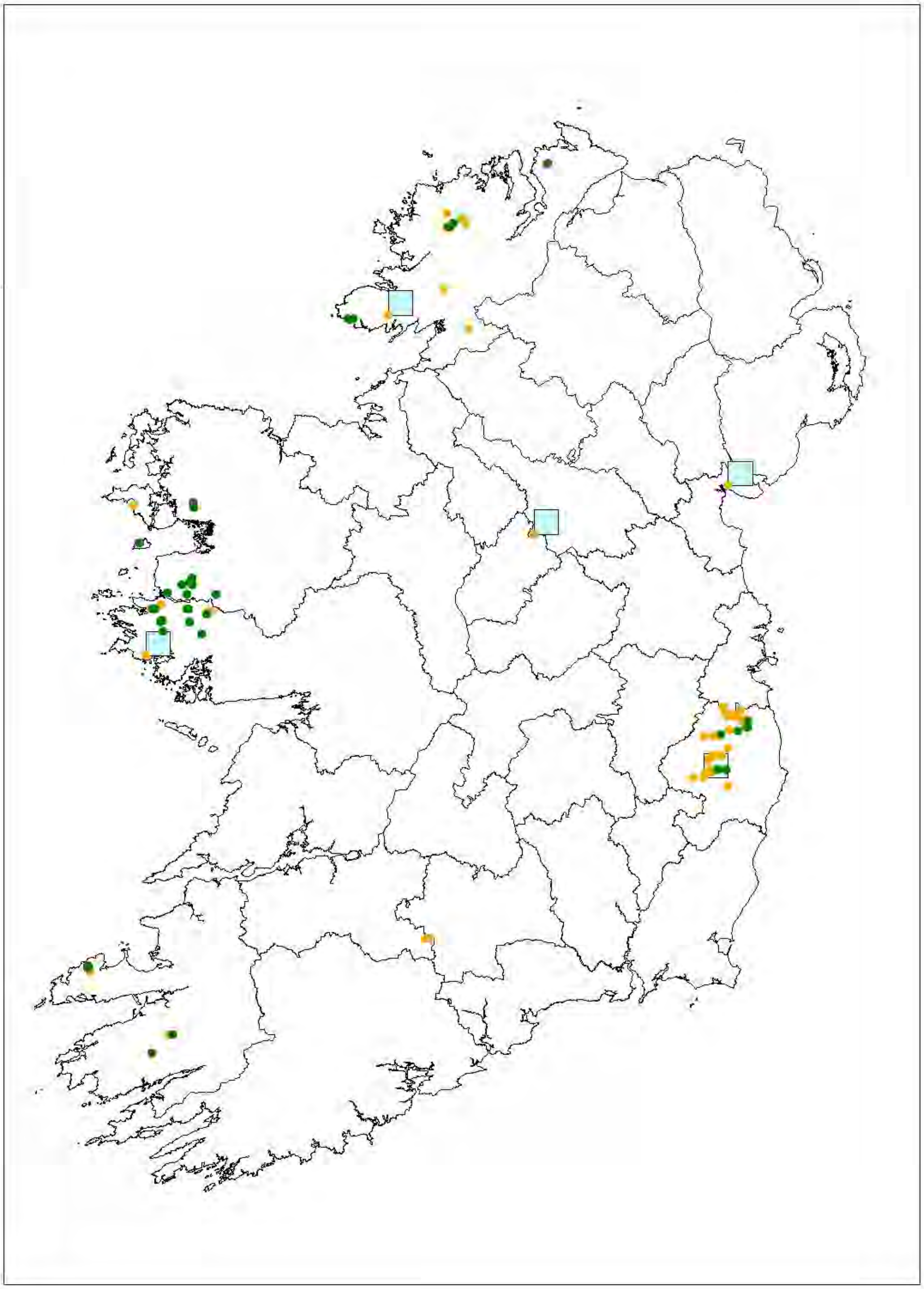


**Figure 3. Map showing the indicative extent of siliceous scree in Ireland based on the distribution of the five obligate alpine species for the habitat (114 records). These have an accuracy of 100m and are colour coded to indicate whether they are either single obligate alpine species records (shown as orange points (57 records)), or species assemblage records (shown as green points (57 records)). This map is shown at a scale of 1 : 2,000,000. Records for *Cryptogramma crispa* are shown on a 10km² basis (light blue squares).**

Given the following, the area was calculated as **Unknown:**

- the area of 1,141 ha may on the one hand be an under-estimate of the relevant slopes as not all are picked up by DTM
- that the same area may be an under-estimate as the habitat has been recorded below 350 m
- that time did not allow for an examination of locations of steep ground/cliffs against geology and aerial photographs
- the lack of any systematic survey of this habitat in the recent or distant past

**A decision was taken by NPWS to calculate/estimate a best expert judgement** on the area based on the DTM figures. The CORINE data base was consulted in an effort to calculate the area of bare rocks as defined by CORINE. However, bare rocks of e.g. Wicklow or Hungry Hill did not show up, and similarly for other areas, possibly because CORINE mapped at the scale of 25 ha.

The area of siliceous scree slopes was estimated by NPWS as outlined on **Table 4.**

**Table 4 Estimation of area of Siliceous Scree Habitat in Ireland**

| | |
|---|---|
| Area covered by DTM on north and north-east facing slopes > $40^0$ > 350 m for siliceous geology – under estimate | 11.41 $km^2$ |
| NPWS assumes that circa 20% of the siliceous geology throughout the country (11.41 $km^2$) supports calcareous or metamorphosed strata, therefore 80% can be said to be siliceous and potentially. suited to supporting the habitat. | 9.128 $km^2$ |
| Of the estimated 9.128 $km^{2,}$ NPWS assumes that 60% is vegetated so 40% possibly consists of bare scree and rocky habitat. | 3.6512 $km^2$ |
| Of this estimation, NPWS further assumes that bare rocky ground is greater in area than scree in ratio 60:40 | 1.46 $km^2$ |
| As the entire DTM may be an underestimate and as siliceous slopes below 350 m have been recorded as supporting the habitat and as *Cryptogramma* sites have to be taken into account. increase this figure to 1.5 $km^2$ | 1.5 $km^2$ |

This best expert judgement figure can be improved upon following a dedicated survey.

## 2.4 Conservation Status of Habitat Extent

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the extent of a habitat can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat extent in the reporting period (a decrease in habitat extent greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between current habitat extent and the Favourable Reference Area (FRA) (if current habitat extent is 10% below FRA the habitat extent is considered Unfavourable Bad).

As mentioned previously the current extent of the habitat is **Unknown though a best expert judgement is provided**. The significance of the land use and activities on the extent of this habitat are not clearly understood due to lack of survey data. Any over-grazing impacting activities in so remote a habitat are deemed to be less significant than similar impacts on the wet heath and blanket bogs of the uplands. However, overgrazing by sheep is known to have damaged extensive areas of upland habitats.

The Commonage Framework Plan did not isolate upland exposed rocky slopes or screes as a habitat type within the survey and it is therefore not possible to use any of the data from this survey in accurately identifying the level of grazing damage to siliceous scree. A gross measure of the levels of grazing damage to those sites, which contain siliceous scree that are located within areas of commonage indicates that approximately 73% of the land has some levels of damage. Given the high levels of damage to other habitats in these commonage areas the impact of grazing is likely to have negatively impacted on siliceous scree. Overgrazing is known to have had a deleterious effect on this habitat in certain sites such as Derryclare Mountain in Connemara, Co. Galway (Site Code: 002031), Mount Brandon in Co. Kerry (Site Code: 000375) and parts of the Macgillicuddy's Reeks in Kerry (Site Code: 000365) (Dr Curtis pers. obs.).

The loss of the intrinsic suite of species may have led to a reduction in the area of the habitat. Mining and tourism related activities are also deemed to be threats to the alpine habitats. It is recognised that all of these impacting activities may play a role in damaging the habitat. As it is not known whether there has been a loss in habitat area or not, but it is known that there are damaging impacts which may have impacted on the area, a ranking of **Unfavourable-Inadequate** scoring is given.

**Area covered by the habitat:** The accurate extent of siliceous scree habitat in Ireland is **Unknown. However an estimate of 1.5 km²** has been calculated.
**Favourable Reference Area:** Though the area is calculated using best expert judgement, it is nonetheless felt that, in this instance, there has been a decline in area within the reporting period (1950s to 2006) due to impacting activities. Loss of habitat equates with loss of specific species and not the loss of actual rock. The extent of the loss is unknown but is not considered to be > 10%. Favourable Reference Area is considered to be **Unfavourable Inadequate** as it is perceived to be > the current estimated area.

The conservation status of the habitat extent is deemed **UnFavourable-Inadequate** and the trend is negative due to impacting activities. Favourable Reference Area is considered to be **Unfavourable Inadequate** as it is perceived to be > the current estimated area. The period for this trend is 1950s to the present. Further survey with more accurate information before the next reporting cycle may indicate a more Favourable Assessment.

# 3 STRUCTURES AND FUNCTIONS

## 3.1 Structures and Functions of the Habitat

Satisfactory data on habitat quality and habitat change trends are lacking for this habitat in Ireland.

An increase in the intensity of impacting activities on the habitat has occurred since the 1950's in Ireland. This increase has been due mainly to the overstocking of sheep in the uplands, which results in slippage, erosion, loss of species and loss of habitat. The Commonage Framework Plan did not isolate upland exposed rocky slopes as a habitat type within the survey and it is therefore not possible to use any of the data from this survey in accurately identifying the level of grazing damage to siliceous scree slopes. A gross measure of the levels of grazing damage to those sites, which contain siliceous rocky slope that are located within areas of commonage indicates that approximately 73% of the land has some levels of damage. Given the high levels of damage to other habitats in these commonage areas, the impact of grazing and trampling is likely to have negatively impacted on siliceous scree slopes.

A secondary impact is due to an increase in leisure activities in the uplands notably hill walking, mountaineering, rock climbing and para-gliding. Hill walking and rock climbing may cause trampling and erosion of the rocky and scree slopes habitat and ultimately loss of the species that characterise this Annex I habitat. Quarrying poses another threat. However, due to the economics involved in such activities in such remote upland areas, it does not pose a significant threat.

### 3.1.1 Conservation Status of Structures and Functions of the Habitat

The variation in the conservation status of the structure and functions of siliceous scree slopes cannot be quantified. Overgrazing has altered the quality of the habitat in the Mweelrea/Sheefry/Erriff Complex (Site Code: 001932) and The Twelve Bens (Site Code: 002031). The leisure activities detailed above may have altered the quality of the habitat in localised areas (notably on sites, which are popular hill walking and mountaineering areas such as The Twelve Bens and the pilgrimage trail on Croaghpatrick Mountain (NHA 00483) and that of the Wicklow Mountains (002122) very close to a large urban centre.

Due to the lack of information, the conservation status of structure and functions of the habitat is **Unknown** though the trend is negative due to the pressures described above. However according to NPWS, given that the habitat structure is intact in many of the more remote areas and given that damage by grazing is not deemed to be as severe on rocky habitats as it is on blanket bog and wet heath, an assessment **of Unfavourable Inadequate** is appropriate.

## 3.2 Typical Species

Siliceous scree is characterised by some species, which are truly alpine in nature and occur in this habitat due to their altitudinal requirements (True alpine species). As described above four of these species are common to other **Annex I** upland habitats including:

- (4060) Alpine and Boreal Heath
- (8120) Calcareous and calcshist screes of the montane to alpine levels

- (8210) Calcareous rocky slopes with chasmophytic vegetation
- (8220) Siliceous rocky slopes with chasmophytic vegetation

Siliceous scree also contains a number of other species, which may be found in other associated habitats and at lower elevations (these are termed Facultative species). These have been listed in **Table 3.**

#### 3.2.1 Conservation Status of Habitat Typical Species

An accurate assessment of the conditions of typical siliceous scree slope habitat species cannot be carried out in the absence of a specific field monitoring program. However, the assessment of the condition of the structures and functions of the habitat based on impacting activities and the influence of these activities on the typical species of the habitats will let us ascertain the conservation status of the latter. Furthermore, a decline in the habitat's structure and functions as mentioned previously already indicates a decline in the species typical of the habitat. The conservation status of habitat structures and functions is thus regarded as **Unfavourable Inadequate** for this habitat. As habitat quality and typical species are so interdependent, it can be suggested that an **Unknown** status would be appropriate but an **Unfavourable Inadequate** conservation status can also be inferred for Typical Species.

## 4 IMPACTS AND THREATS

The main damages influencing the siliceous scree slope habitat in Ireland based on best expert opinion are as follows:

**Table 4. Damaging activities affecting siliceous scree, main ecological effects and future trends.**

| Damage type (EU Code) | Main ecological effects | Likely future trends of damage |
|---|---|---|
| **Outdoor recreation (501, 530, 610, 622, 624, 720)** | Erosion of habitat and loss of species. | Future incidence uncertain. Risk greatest in popular walking areas or close to urban areas, e.g. Ben Bulben. |
| **Overgrazing (142)** | Where very severe, complete removal of indicator species occurs with very poor prospects for recovery. | Intensity set to decline when destocking recommendations are implemented. |
| **Mining and extraction (390)** | Removal of siliceous scree and loss of species and habitats associated with it. | Increasing level of quarrying due to increased demand for rock materials for construction or the cement industry. |
| **Air Pollution (702)** | Acidification. | Potential loss of ion exchange and subsequent loss of species. At a pH, lower than 3 most species are unlikely to survive. |

### 4.1 Overgrazing

Overgrazing by sheep is one of the damaging activities affecting siliceous scree slopes and this has been observed in several locations such as Derryclare Mountain in Connemara, Co. Galway (Site Code: 002031), Mount Brandon in Co. Kerry (Site Code: 000375) and parts of the Macgillicuddy's Reeks in Kerry (Site Code: 000365) (Dr Curtis pers. obs.), but no quantitative data is available on this impact.

A revised and subsequently amended Rural Environment Protection Scheme (REPS) was introduced in May 1999. As a result, degraded commonage areas were assessed and managed according to a specific management tool – "The Commonage Framework Plan (CFP)" surveyed and assessed the condition of most commonage areas in the Republic of Ireland. In order to facilitate the restoration of these areas the Plan recommends a destocking level for each commonage or site surveyed. Within the scheme, damage is assessed according to a 6 point scale ranging from U (undamaged) to S* (very severely damaged) and each point on this scale has an associated destocking level. In addition to mapping the extent and severity of grazing damage within commonages, the habitats occurring within these areas was also indicated but unfortunately upland rocky habitats and screes were not identified. However, as detailed in section 3.2 above approximately 73% of the lands, which contain siliceous scree slopes that are located within commonage areas have some levels of damage.

**Overgrazing Trend**

Stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (FAPRI-Ireland Partnership 2003). However, this could potentially result in sites being abandoned, which may, in the case of scree, lead to habitat loss through vegetation encroachment. The Rural Environment Protection Scheme (REPS) and National Farm Plan Scheme also aim to address a reduction in over-grazing levels. The implementation of these three schemes should reduce damage on siliceous screes caused by farming activities. To date the results of the implementation of measures recommended by these schemes is unknown. Thus, it cannot be stated that the threat to siliceous scree slopes from intensive overgrazing or under-grazing is declining.

## 4.2 Quarries

Quarries are a known historical threat to siliceous scree slopes as documented by the location of the quarry on the lower slopes of Muckish Mountain (001179), Co. Donegal.

### Quarrying Trend

The future trends for quarrying are unknown but if the current economic growth continues in Ireland, there may be increasing pressures on siliceous scree slope sites for material for the cement and building industries. However, planning control of quarrying has improved greatly with regard to opening of new quarries and re-opening of old works since the introduction of regulations under Section 261 of the Planning and Development Act 2000.

## 4.3 Outdoor Recreation

Trackway erosion of upland habitats such as alpine heath, wet heath, dry heath, screes and rocky slopes, caused by tourist use of popular walking routes has been highlighted as a problem in Ireland since the beginning of the 1990s. Problems with erosion of upland habitats are for example associated with The Wicklow Way (002122) walking route and along popular routes int eh Connemara National Park but the impact of these routes on areas of scree is unknown. Tracks are clearly visible in some areas of siliceous scree such as on Croaghpatrick Mountain (NHA 000483) and Errigal Mountain in Donegal (002047) The increase in popularity of hill walking in Ireland in recent years is likely to result in more pressure on sensitive upland habitats such as siliceous scree. The ease and speed of access to the most remote areas of our mountain ranges has increased with the arrival of ATVs and scrambler bikes.

### Outdoor Recreation Trend

Trackway erosion is considered an increasing threat to siliceous rocky slopes. There is a similar increase in the threat to siliceous scree slopes as a result of increased ownership of ATV's and Four Wheel Drive vehicles and accessibility to upland areas. Hill walking continues to increase as a popular recreation in Ireland and our mountains are actively promoted to visiting walkers.

## 4.4 Site Inspection Form results

Regional NPWS Management is responsible for patrolling designated sites and enforcing relevant legislation (e.g. Habitats Directive 92/43 EEC or the Wildlife Act). NPWS Conservation Rangers are required to summarise information collected on the integrity of sites within their areas during the course of their duties. They are given the responsibility for reporting the information required under the Site Inspection Reporting (SIR) programme. Reporting is carried out on a three yearly cycle that began in 1998.

There are no reported activities in the period 1998 – 2003.

# 5. *FUTURE PROSPECTS*

## 5.1 Negative Future Prospects

Siliceous scree slopes have undergone a negative impact in the last fifty years principally as a result of overgrazing and leisure activities. Whilst over-grazing is an impact which can be resolved through management agreements with landowners (see Positive Future Prospects below) other impacts such as acidification and damage from walkers and increased recreational access to the mountains resulting in trampling has also become an increasing problem, which is less easily managed.

## 5.2 Positive Future Prospects

**Single Farm Payment (SFP)**
As already noted, stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (SFP) (FAPRI-Ireland Partnership 2003). As long as the market value of hill sheep remains low, there is little incentive for farmers to maintain large flocks in the uplands.

Payment under the SFP requires the farmer to keep lands in "Good Agricultural and Environmental Condition"

**The Rural Environment Protection Scheme (REPS)**
REPS is an EU funded scheme for environmentally sensitive farming, introduced in 1994, which includes incentives to reduce stocking densities within proposed NHAs, SACs and on those land designated as degraded (overgrazed) by the Department of Agriculture, Food and Forestry.

The positive impact of this scheme for siliceous scree conservation is dependent on several factors such as the uptake of REPS by farmers with large flock numbers in overgrazed areas. A reduction on the stocking density as a result of the implementation of the Commonage Framework Plan recommendations should reduce the impact associated with sheep grazing on areas of rocky slopes.

**National Farm Plan Scheme (NFPS)**
The NPWS launched a new 5 year National Farm Plan Scheme (NFPS) in February 2006 for landowners who are not in REPS but with designated areas (SACs, SPAs) and commonage. This follows on from the requirements of the EU Natural Regulations and the Wildlife (Amendment) Act, 2000. The scheme allows the Department to pay farmers and landowners for losses incurred through restrictions caused by the designation of lands as a SAC or a SPA or to pay for certain actions, which are of benefit to nature and are agreed in a Farm Plan.

In the particular case of siliceous scree slopes and other upland habitats, the NFPS provides the following recommendations:

- Stocking density rates must be set down by a planner.
- The location of feeding points to reduce heavy grazing, trampling, poaching and erosion problems should be regulated.
- The use of fertilisers and herbicides and water pollution should be also regulated.

The NFPS prohibits the following practises including: in-filling or rock removal; creation of new tracks or paths; The implementation of the Plan should reduce damage to siliceous scree slopes caused by farming activities, particularly overgrazing. Its success obviously depends on the farmers' participation.

## 5.3 Overall Habitat Future Prospects

Several schemes (e.g. SFP, REPS, NFPS) address the recovery of large areas of degraded habitat. A national survey of upland habitats to accurately survey and classify upland habitats such as siliceous scree slopes is required. This will provide information to determine the requirements for the conservation of the habitat.

However, a series of impacting activities (i.e. overgrazing, trampling, mountaineering and recreational activities) continue to threaten the habitat both in designated and undesignated sites. In the absence of a field survey, the threats to the habitat are not accurately quantified but it is deemed that the habitat is still moderately threatened and slowly declining. While future prospects are encouraging, the long-term viability is not assured, and thus it is assessed as likely to be **Unfavourable Inadequate.**

## *6 OVERALL ASSESSMENT OF HABITAT CONSERVATION STATUS*

The habitat conservation status of the four main attributes has been assessed as follows:

- The **Favourable Reference Range** (FRR) is estimated to be 100% of the historical habitat range and is thus **Favourable**. The Natural Range for this habitat potentially covers 10,900 $km^2$ (109 grid cells selected x 100 $km^2$), (see **Figure 1 and 1b**).
- The **Extent** of siliceous scree slopes habitat has decreased, though exact figures for the decline are not available. By using the DTM generated polygons for north and north-east facing slopes above 350m in elevation with a slope > 40° on siliceous rocks it is possible to produce a very rough estimate of the potential area of siliceous scree slope in Ireland. This figure has inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria as described above. The extent of the habitat is therefore deemed **Unknown though NPWS have estimated an area of 1.5 $km^2$**. The trend is negative due to overgrazing. **This results in Unfavourable – Inadequate.**
- An Unknown - but likely to be **Unfavourable Inadequate (U1)** assessment is given to the habitat **Structures and Functions** based on the increase in impacting activities and expert opinion.
- The habitat's **Future Prospects** are overall deemed to be Unknown - but likely to be **Unfavourable Inadequate (U1)** - due to pressure from impacting activities (e.g. trampling, leisure activities and overgrazing).

Thus, considering the assessment for the four main attributes for this habitat the overall **Conservation Status** for siliceous scree slopes is Unknown - but likely to be **Unfavourable Inadequate (U1).**

# 7 *Appendices*

## *8 APPENDIX 1. PUBLISHED SOURCES OF DATA ON SILICEOUS SCREE SLOPES* (this information is now contained in the form at the front of this document).

# *9 APPENDIX 2. UNPUBLISHED SOURCES OF DATA ON SILICEOUS SCREE SLOPES*

**Unpublished sources of data on siliceous scree in Ireland.**

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| Name of Author | Information Source | Report |
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## *10 APPENDIX 3. SILICEOUS SCREE DISTRIBUTION MAPPING*

There has been no recent inventory or mapping of the national siliceous scree resource in Ireland. For the purposes of this survey an extensive literature review of both published and unpublished material was undertaken and records documenting the occurrence of the indicator species of siliceous scree as listed in **Table 3** in the main body of the report were collated in a *MS Access* **Upland Habitats Database**. This database contains records of the obligate and facultative alpine species of the five Annex I upland habitats (4060, 8110, 8120, 8210, 820) in Ireland and was designed specifically for the purposes of this report.

The database contains information on the following:

- Species Name
- Designated Site Code (NATURA 2000 sites or Natural Heritage Areas)
- Description of the location of the species
- Altitudinal information (either in feet (‘) or metres (m) depending on the antiquity of the record)
- Grid Reference (if provided) – these were assigned an accuracy rating
- Source of data (published or unpublished reference)
- Date of record
- List of associated species (if present)
- Indication of whether the description indicated a single species record, an assemblage of species or a description of habitat cover*
- Any information on substrate or underlying geology

* Given the variability of data sources, records of indicator species have been described as either an assemblage of species, a single species location or as an indication of habitat cover, depending on the quality and source of the data. For example a historical record by Corry (1884), which only contained details of a particular species at a certain altitude on Ben Whisken (Site Code: 000623) was entered as a single plant species location, whereas a description of several arctic-alpine species on a cliff above a corrie lake on Mount Brandon (Site Code: 000375) by Stelfox (1951) was entered as a species assemblage. Where there was a good description of an area of alpine heath (such as that given by Conaghan *et. al.* (1994) in the NHA Site Card for the Twelve Bens (Site Code: 002031)) this was entered as habitat cover.

Data for all of the above fields in the database was not necessarily contained in the original publication/source for each record and based on the description of the locations given an appropriate Site Code was assigned to each record using the Discovery and 62” Mapping on Arc View 3.2.

The **Upland Habitats Database** currently holds c.4,500 records of obligate and facultative alpine species of all Annex I upland habitats (i.e. 4060, 8110, 8120, 8210 and 8220) which have been gleaned from a variety of sources (both published and unpublished as documented in **Appendices 1** and **2** respectively). Given the antiquity of the bulk of the data (c.1700 of the records date from the 1800s to the 1950s) and the lack of accurate geographical references (only c.1500 records have grid references of varying accuracy (see below for further information) the GIS application of much of the collated data is limited. Full reference should be made to the **Upland Habitats Database** for lists of records for sites and locations/descriptions of indicative alpine species for habitats as the bulk of records will not be illustrated in **Figures 1 to 3** due to their lack of grid references. When reviewing these records of species one needs to be cognisant of the fact that very few of them are uniquely indicative to a particular habitat (e.g. *Polygonum viviparum* (a true alpine species) is found in four of the Annex I upland habitats (8110, 8120, 8210 and 8220)) so records of this species cannot be used to indicate the presence of any single habitat. These species have been identified as being characteristic in the absence of a dedicated field survey of these habitats. On completion of such a survey phytosociological classification and analysis may provide clearer definitions for these habitats in an Irish context.

Several new potential locations for siliceous scree in addition to those known designated sites for, which siliceous scree is a qualifying interest (see **Appendix 3 below**) were identified in this manner following the literature review. Some of these sites were already designated as SACs but siliceous scree was not listed as a qualifying interest, others were existing NHAs and others were undesignated (see **Appendix 3 below**).

**Designated sites for, which siliceous scree is a qualifying interest.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 000453 | CARLINGFORD MOUNTAIN | SAC/NHA |
| 002031 | THE TWELVE BENS/GARRAUN COMPLEX | SAC/NHA |
| 002122 | WICKLOW MOUNTAINS | SAC/NHA |

An additional site Bruse Hill (Site Code: 000002) is listed as an NHA on the sole basis of the presence of *Cryptogramma crispa*.

GIS data sources, which are related to ecological factors that determine the occurrence of siliceous scree were used to produce the indicative natural range and potential distribution maps shown on **Figures 1** and **2**. These include:

- Contour lines >350m elevation. Ordnance Survey (1995) – 1:50,000 Discovery Series, 10m contour interval,
- A Digital Terrain Modelling package (2007) generated polygons, which were used to identify areas of potential siliceous scree based on the following criteria:
  - elevation above 350m,
  - upland areas above 350m with a slope > 40°
  - north and north-east facing slopes with a slope > 40°

The areas, which were identified, were further refined to exclude the mountain ranges, which are formed of limestone. Investigation of the polygons created by the DTM indicated that not all slopes, which potentially contain siliceous scree, had been accurately identified (e.g. the north prison of Lugnaquilla within Wicklow Mountains SAC (Site Code: 002122) was not shown) and this was thought to be due to the use of the slope criteria. The use of this data thus has some limitations.

Although the use of recent (2000) digital aerial photographs of Ireland, which were ortho-rectified, was investigated it became apparent that it was not possible to use these remotely to identify areas of siliceous scree. This is because it is not possible to distinguish it accurately from exposed rock in mosaics of vegetation of wet heath, dry heath and upland grassland.

**Figure 1** shows the potential natural range of siliceous scree in Ireland at a scale of 1 : 2,000,000. This map is based on the locations of north and north-east facing slopes (> 40°) in upland areas >350m in elevation (shown as purple squares). In order to overcome the limitations of the DTM model (which did not show all north and north east facing cliffs where siliceous scree is known to exist as described above) all 10km squares, which contain sites for which siliceous scree is a qualifying interest as well as sites where the habitat may potentially be present were also used (shown as pink squares).

The potential range of the habitat was also extended by the addition of several of the sites for *Cryptogramma crispa*, which occur below these elevation criteria and these are shown on a 10km basis (light blue squares). This principally relates to the record for Co. Cavan which is recorded from Bruse Hill pNHA (Site Code: 000002) however this species was last seen in 1938 so it is questionable as to whether or not it should be included. However the record for Carlingford Mountain (Site Code: 00543) in Co. Louth also occurs at elevations below 350m and would therefore not otherwise be displayed in the natural range of the habitat. This habitat thus has a naturally discontinuous range in Ireland, as it is restricted by altitude and by the location of siliceous geology.

**It must be stated, however, that although areas of siliceous scree may occur in these mountain ranges they may not conform to the Habitats Directive definition, as this will depend on the species complement present. In the absence of a dedicated field survey, which will confirm the occurrence of those indicator species this figure should be very much viewed as an over-estimation. To determine a range based solely on the <u>known</u> locations of *Cryptogramma crispa* would indicate a range as low as 500km² (5 grid cells selected x 100 km²). Whilst *Cryptogramma crispa* may be a true indicator of siliceous scree habitats on Continental Europe this does not hold true for Ireland where it has been documented on exposed slabs of siliceous rock (Wicklow Mountains SAC (Site Code: 002122) (Dr Curtis, pers. obs.) and on Bruse Hill, Co. Cavan at 260m. Further investigation of the ecological nature of this species in an Irish context is highly desirable.**

**SACs (designated) and NHAs*, which contain areas of upland habitat at elevations > 350m with N and NE facing slopes > 40°and which potentially contain siliceous scree as derived from the digital terrain model, but that do not list siliceous scree as a qualifying interest.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 000093 | CAHA MOUNTAINS | SAC/NHA |
| 000189 | SLIEVE LEAGUE | SAC/NHA |
| 000190 | SLIEVE TOOEY/TORMORE ISLAND/LOUGHROS BEG BAY | SAC/NHA |
| 000365 | KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S REEKS AND CARAGH RIVER CATCHMENT | SAC/NHA |
| 000375 | MOUNT BRANDON | SAC/NHA |
| 000483 | CROAGH PATRICK | SAC/NHA |
| 000485 | CORRAUN PLATEAU | NHA |
| 000534 | OWENDUFF/NEPHIN COMPLEX | SAC/NHA |
| 000646 | GALTEE MOUNTAINS | SAC/NHA |
| 000735 | MAUMTRASNA MOUNTAIN COMPLEX | NHA |
| 001059 | HUNGRY HILL BOG NHA* | NHA |
| 001179 | MUCKISH MOUNTAIN | SAC/NHA |
| 001342 | CLOONEE AND INCHIQUIN LOUGHS, URAGH WOOD | SAC/NHA |
| 001873 | DERRYCLOGHER (KNOCKBOY) BOG | SAC/NHA |
| 001879 | GLANMORE BOG | SAC/NHA |
| 001881 | MAULAGOWNA BOG | SAC/NHA |
| 001932 | MWEELREA/SHEEFFRY/ERRIFF COMPLEX | SAC/NHA |
| 001952 | COMERAGH MOUNTAINS | SAC/NHA |
| 001955 | CROAGHAUN/SLIEVEMORE | SAC/NHA |
| 002008 | MAUMTURK MOUNTAINS | SAC/NHA |

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 002046 | OWENDOO AND CLOGHERVADDY BOGS | NHA |
| 002047 | CLOGHERNAGORE BOG AND GLENVEAGH NATIONAL PARK | SAC/NHA |
| 002185 | SLIEVE MISH MOUNTAINS | SAC |
| 002268 | ACHILL HEAD | SAC/NHA |
| 002301 | RIVER FINN | SAC/NHA |
| 002384 | DOUGH – THUR MOUNTAIN NHA | NHA |

* Only those NHAs, which have NHA in the Site Name, are currently designated.

**There are extensive areas of potential locations for this habitat type within these sites, which have been identified using this process for, which no field data exists. These areas require urgent site survey and could form the basis of further additional qualifying interests for the site or for designation as potential NHAs for the habitat.**

# 11 APPENDIX 4. OTHER SOURCES OF DATA

## A. Commonage Framework Plans – Department of Agriculture & Food and the National Parks and Wildlife Service (NPWS).

The Department of Agriculture & Food and the NPWS have produced the Commonage Framework Plans (CFPs) and NHA/SAC/SPA stocking and damage assessments. These plans crudely describe the habitats, condition of the land use and plant species found in each sub-unit of each agricultural unit. Depending on the condition of the land, a % de-stocking is recommended and a time-frame suggested for recovery of the land.

Common ownership of large areas of unfenced heath and bog land is the principal type of land ownership in the western peatland and upland areas of Ireland. Thus, up to 80% of all land in Connemara and west Mayo is commonage (O'Connor, 2000). According to the maps produced by the CFP the overall extent of commonage land in Ireland is approximately 438,000ha. Unfortunately, it is not possible to use this dataset to determine the extent or area of siliceous scree slopes in Ireland as this habitat was not identified in the report. In addition, the mapping of habitats was done at a crude level and the main mapping criterion was damage level and not habitat type.

The CFPs thus can only be used to provide an indication of the damage status of habitats (including siliceous scree slopes) on commonage land, and this was crudely used to ascertain the conservation status of structure and functions of this habitat.

## B. NPWS Enquiries Database

This is a comprehensive NPWS internal database, which includes data on designated sites and habitats contained within them. This database was used to confirm the sites for, which siliceous scree slope was a qualifying interest.

## C. Habitat Assignment Project (NPWS, 2006)

This desktop project was undertaken by NPWS and the main aim was to identify and list the habitats listed in the Annex I of the Habitats Directive (92/43/EEC) which were reported within a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, Aerial photographs, NGO proposals, etc.

## 12 APPENDIX 5. COMMONAGE FRAMEWORK PLANS DATA

The CFPs mapped the extent and severity of grazing damage within agricultural sub-units. The criteria use to assess the level of damage and the resultant destocking levels is given below (**Table 1**). In addition, the habitats occurring within these areas were also mapped. The following habitats were recognised during the Commonage Framework Plan surveys and their symbols are indicated within brackets:

| | | | |
|---|---|---|---|
| (I) | Blanket bog | (II) | Wet Heath |
| (III) | Dry Heath (includes maritime) | (IV) | Upland grassland |
| (V) | Other habitats | (VI) | Improved grassland |
| (VII) | Dune | | |
| (VIII) | Unimproved wet grassland | | |
| (IX) | Unimproved dry grassland | | |
| (X) | Fen/Marsh/Swamp | | |
| (XI) | Saltmarsh | (XII) | Beach/Shingle/Reef/Shore |
| (XIII) | Limestone Pavement / Grassland | (XIV) | Limestone Pavement (>75%) |
| (XV) | Scrub | | |
| (XVI) | Permanent open water (turlough) | | |

As can be seen there is no specific category given for siliceous scree slope.

**Table Criteria for the assessment of damage and the resultant destocking levels (Conaghan, 2001).**

| Damage category | Condition of vegetation/amount of bare soil | Suggested destocking level |
|---|---|---|
| Undamaged (U) | Vegetation not grazed or only very lightly grazed. No bare ground present. | 0% |
| Moderate to undamaged (MU) | <5% bare ground. Grazing usually evident, but damage only just detectable. | 30% |
| Moderately damaged (MM) | <5% bare ground. Signs of damage intermediate in intensity between MU and MS. | 50% |
| Moderate to severely damaged (MS) | <5% bare ground. Damage widespread and obvious. | 65% |
| Severely Damaged (S) | >5% bare ground. Damage due to grazing obvious and widespread. | 85% |
| Very Severely Damaged (S*) | >10% bare ground with abundant evidence of high grazing levels. | 100% |

Commonage lands, which are likely to contain siliceous scree slope either on its own or as a mosaic with other habitats, were mapped during the CFP. A broad-brush review of this data indicates that 73% of the lands in commonage within sites, which contain siliceous scree slopes, show some degree of damage.

# 13 APPENDIX 6. GLOSSARY

ALTITUDE - Vertical height above sea level.

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for, which SACs have to be designated.

BLANKET BOG – Bogs, which carpet the landscape, following the underlying topography. They can cover extensive areas along the west coast and on uplands throughout the country.

CALCAREOUS –Rich in calcium, Lime loving.

CALCAREOUS ROCKY SLOPES – these are areas of exposed rock, which are typically found on the north and north-east facing slopes of mountains of calcareous origin, i.e. limestone mountains. These slopes are typically >40°, and are found at elevations above 350m. Calcareous rocky slope vegetation is also found in mountain ranges, which are siliceous in origin. These are typically areas of cliff, which have been metamorphosed in the past and, which are slightly more mineral rich than the adjoining areas. The true alpine species for this habitat includes – *Alchemilla alpina, Alchemilla glaucescens, Arenaria ciliata, Asplenium viride, Cardaminopsis petraea, Deschampsia caespitosa ssp. alpina, Epilobium alsinifolium, Euphrasia frigida, Oxyria digyna, Phegopteris connectilis, Poa alpina, Polygonum viviparum, Polystichum lonchitis, Salix phylicifolia, Saussurea alpina, Saxifraga hartii, Saxifraga nivalis, Saxifraga oppositifolia, Saxifraga rosacea, Silene acaulis, Thalictrum alpinum.*

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CORINE - Information and mapping system, developed within the context of the Commission of the European Communities biotope project, which is used as a tool for the description of sites of importance for nature conservation in Europe. It catalogues recognisable communities of flora and fauna. The primary objective of this catalogue is to identify all major communities whose presence contributes to the conservation significance of a site. Included in this list of communities are interesting but rare natural or near-natural communities as well as the more widespread semi-natural ones.

DEHLG - Department of Environment, Heritage and Local Government

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions, which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for, which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within, which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in, which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive, this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms, which are all influenced by the underlying geology.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

MOSAIC - Used to describe habitats that occur together and cannot easily be mapped separately.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which, the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats, which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

QUALIFYING INTERESTS – The habitat(s) and/or species for, which an SAC or SPA is designated.

REPS - Rural Environment Protection Scheme. This is an Agri-Environmental programme, which seeks to draw up agreements with farmers, according to the type of farming, landscape and features on the land. The overall objectives of REPS are to achieve: the use of farming practices, which reduce the polluting effects of agriculture by minimising nutrient loss- an environmentally favourable extensification of crop farming, and sheep farming and cattle farming; - ways of using agricultural land, which are compatible with protection and improvement of the environment, the countryside, the landscape, natural resources the soil and genetic diversity; - long-term set-aside of agricultural land for reasons connected with the environment; - land management for public access;- education and training for farmers in types of farming compatible with the requirements of environmental protection and upkeep of the countryside.

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from, which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SACs have also been known as cSACs, which stands for "candidate Special Areas of Conservation", and pcSACs, which stands for "proposed candidate Special Areas of Conservation."

SILICEOUS SCREE – these are areas of scree which are typically found on the north and north-east facing slopes of mountains of siliceous origin, but they may occur on other aspects also, particularly in the northern counties of Ireland. These slopes are typically >40°, and are found at elevations above 350m. The true alpine species for this habitat includes – *Cryptogramma crispa*, *Oxyria digyna*, *Polygonum viviparum*, *Salix herbacea* and *Vaccinium vitis-idaea*.

SPAs - Special Protection Areas for Birds are areas, which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

## 8110 Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsetalia ladani*)

| National Level | |
|---|---|
| **Habitat Code** | 8110 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |
| **Biogeographic level** | |
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | Anonymous. (1979). Areas of scientific interest in Co. Mayo. *An Foras Forbartha, Dublin.*<br>Birks, H. J. B., Birks, H. H. and D. A. Ratcliffe. (1969). Mountain plants on Slieve League, Co. Donegal. *Irish Naturalists' Journal.* Vol. 16. P. 203.<br>Brodie, J. (1991). Some observations on the flora of Clare Island, Western Ireland. *Irish Naturalists' Journal.* Vol. 23. No. 9. P. 376 - 377.<br>Brunker, J. P. (1950). Flora of the County Wicklow. *Dundalgan Press, Dundalk.*<br>Colgan, N (1904). Flora of County Dublin: flowering plants, higher cryptograms and *characeae.* Hodges Figgis, Dublin.<br>Cotton, D. F. C. and M. Cawley. (1991). New records of vascular plants from Cos. Sligo (H28) and Leitrim (H29). *Irish Naturalists' Journal.* Vol. 24. No. 7. P. 288 - 295.<br>Curtis, T. (1976). A preliminary report on areas of scientific interest in Co. Wicklow. *An Foras Forbartha, Dublin.*<br>Curtis, T. G. F. (1981). Report on field outing to Kincaslough, Co. Donegal, 16th - 17th June. *Watsonia.* Vol. 13. No. 3. P. 261.<br>Curtis, T. G. F. (1993). *Polygonum viviparum* in Ireland with particular reference to the flora and vegetation of the Mount Brandon range, Co. Kerry. *Irish Naturalists' Journal.* Vol. 24. No. 7. P. 274 - 280.<br>Curtis, T. G. F. and Madden, B (2005). Site report for proposed wind farm at Slieve Corraun. Published EIS.<br>Curtis, T. G. F. and C. Mhic Daeid. (1981). Report on field outing to Mullaghanattin, Glencar, Co. Kerry, 21st - 23rd July. *Watsonia.* Vol. 13. No. 3. P. 261 - 262.<br>Curtis, T. G. F. and C. Mothershill. (1977). New additions to the flora of County Leitrim (H29). *Bulletin of The Irish Biogeographical Society.* No. 2. P. 42 - 44.<br>Curtis, T. G. F., Goodwillie, R. and R. Young. (1978). Areas of scientific interest in Co. Sligo. *Revised and expanded report. An Foras Forbartha, Dublin.*<br>Curtis, T. G. F. and McGough, H.N., and Akeroyd, J.R. (1981). The flora of the Mullet Peninsula. West Mayo (H27). Bulletin of the Irish Biogerographical Society. No 5. Pgs. 38-46.<br>Curtis, T.G.F. and R. Young. (1977). Areas of scientific interest in Co. Wicklow. *An Foras Forbartha, Dublin.*<br>Day, G. V. (2002). BSBI field meetings in Ireland 2002. *Irish Botanical News.* P. 39 - 42.<br>Doyle, G. J. and P. J. Foss. (1986). A resurvey of Clare Island Flora. *Irish Naturalists' Journal.* Vol. 22. No. 3. P. 85 - 89.<br>Dublin Naturalists Field Club. (1998). Flora of County Dublin. *Dublin Naturalists Field Club, Dublin.*<br>Fahy, E. (1974). A preliminary report on areas of scientific interest in County Tipperary. *An Foras Forbartha, Dublin.* |

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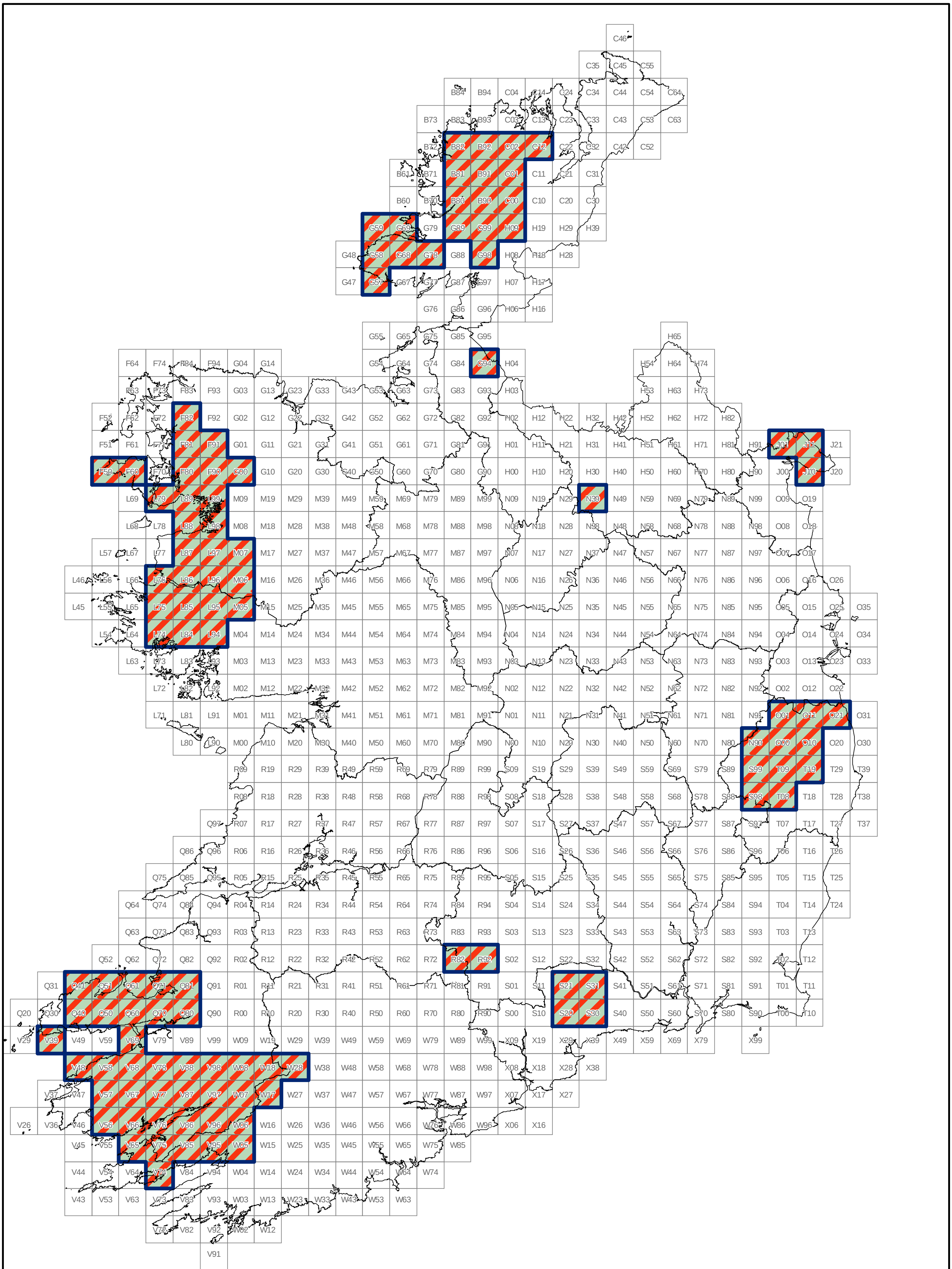
| | |
|---|---|
| Range | |
| Surface area | The Natural Range for this habitat potentially covers 10,900 km² (109 grid cells selected x 100 km²). |
| Date | 1800s to 2006. |
| Quality of data | 1 = poor (based on very incomplete data with expert opinion). |
| Trend | Likely to be stable. |
| Trend-Period | 1950 - 2006 |
| Reasons for reported trend | |
| **Area covered by habitat** | |
| Distribution map | See **Figures 2** and **3**. |
| Surface area | Unknown though estimated by NPWS to be 1.5 km² |
| Date | 1800 - 2006. |
| Method used | 1 =Mostly based on expert opinion |
| Quality of data | 1 = poor (based on very incomplete data with expert opinion) |
| Trend | Negative. |
| Trend-Period | 1950 – 2006 |
| Reasons for reported trend | 3 = direct human influence ( overgrazing and trampling) |
| Justification of % thresholds for trends | Increase in the intensity of impacting activities (e.g. overgrazing, trampling) suggest this negative trend. |
| Main pressures | 142 Overgrazing by sheep<br>390 Mining and extraction activities<br>301 Quarries<br>501 Paths, tracks or cycling paths<br>530 Improved access to the sites<br>610 Outdoor sports and leisure activities<br>624 Mountaineering, rock climbing, speleology<br>702 Air pollution – acidification<br>720 Trampling, overuse |
| Threats | 142 Overgrazing by sheep<br>501 Paths, tracks or cycling paths<br>530 Improved access to the site<br>610 Outdoor sports and leisure activities<br>624 Mountaineering, rock climbing, speleology<br>702 Air pollution – acidification<br>720 Trampling, overuse |
| ***Complementary information*** | |
| **Favourable reference range** | Favourable, as the Favourable Reference Range for this habitat potentially covers 10,900 km² (109 grid cells selected x 100 km²), (see **Figure 1**). |
| **Favourable reference area** | The precise surface area of siliceous scree slopes in Ireland is unknown and cannot be accurately determined in the absence of a dedicated field survey to confirm the complement of species present. Nonetheless, a rough estimate has been given by NPWS leading to an assessment of Unfavourable Inadequate. It is felt that Favourable Reference Area is > current area. |
| **Typical species** | Vascular plants within siliceous scree are described as either obligate (true) alpine species or facultative species (which are those that are also found at lower elevations and in other habitats).<br>**Obligate alpine species:**<br>*Cryptogramma crispa*, Oxyria digyna, Polygonum viviparum, Salix herbacea, Vaccinium vitis-idaea*<br>**Facultative species:**<br>*Agrostis canina, Agrostis capillaris, Arctostaphylos uva-ursi, Antennaria dioica, Calluna vulgaris, Daboecia cantabrica, Empetrum nigrum, Erica cinerea, Hymenophyllum tunbrigense, Hymenophyllum wilsonii, Juniperus communis, Vaccinium myrtillus .*<br>**Bryophytes:**<br>*Barbilophozia floerkii, Campylopus paradoxus, Cladonia furcata, Cladonia impexa, Cladonia* |

| | |
|---|---|
| | *squamosa, Cladonia uncialis, Dicranum majus, Dicranum scoparium, Eurhynchium praelongum, Hypnum cupressiforme, Isopterygium elegans, Lophozia ventricosa, Mnium hornum, Oedipodium griffithianum, Plagiothecium undulatum, Pleurozium schreberi, Pogonatum urnigerum, Polytrichum alpinum, Polytrichum formosum, Pseudotaxiphyllum elegans, Ptilidium ciliare, Racomitrium spp., Rhytidiadelphus loreus.*<br><br>* This is the only true alpine species, which is unique to this habitat. |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | 1. As this habitat is restricted by altitude, the range does not extend beyond the current known distribution.<br><br>2. By using the Digital Terrain Model generated polygons for north and north-east facing slopes on siliceous geologies above 350m in elevation with a slope > 40º it is possible to produce a very rough estimate of the potential area of siliceous scree slope in Ireland. This figure has inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria, whereby areas where siliceous slopes are known to occur are not depicted. These areas are also likely to contain other habitats such as calcareous and siliceous rocky slope, alpine heath or dry and wet heath. The area as defined using the DTM is approximately 1,141 ha or 11.41 km². It is not possible to determine what percentage of this area corresponds to siliceous scree slope as opposed to the other habitats listed above. The precise surface area of siliceous scree slopes in Ireland is therefore **Unknown** and cannot be accurately determined in the absence of a dedicated field survey to confirm the complement of species present. However, a figure has been **estimated using expert judgement by NPWS** based on approximate proportions covered by the habitat. |
| **Conclusions**<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | **Favourable** |
| **Area** | **Unfavourable Inadequate** |
| **Specific structures and functions (incl. typical species)** | **Unfavourable Inadequate (U1)** – based on the increase in impacting activities and expert opinion. |
| **Future prospects** | **Unfavourable Inadequate (U1)** – due to pressure from impacting activities (e.g. overgrazing, trampling). |
| **Overall assessment of CS** | **Unfavourable Inadequate (U1).** |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Siliceous scree of the montane to snow levels *(Androsacetalia alpinae* and *Galeopsietalia ladani)***

**8110**

| | |
|---|---|
| | Current Distribution (109 cells) |
| | Current Range (109 cells) |
| | Favourable Reference Range (109 cells) |
| W48 | 10km grid cells |

Date: October 2007

# 8120 CALCAREOUS AND CALCHIST SCREES OF THE MONTANE TO ALPINE LEVELS IN IRELAND

## CONSERVATION STATUS ASSESSMENT REPORT

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# 8120 CALCAREOUS AND CALCHIST SCREES OF THE MONTANE TO ALPINE LEVELS

# CONSERVATION STATUS ASSESSMENT REPORT

## 1 *HABITAT CHARACTERISTICS IN IRELAND*

### Definition of calcareous and calchist screes of the montane to alpine levels in Ireland

A definition of calcareous and calchist screes of the montane to alpine levels (hereafter referred to as calcareous scree) cannot be made without first reference to the term 'montane', which is also understood as 'alpine' in Ireland. In the historical literature, the convention in Ireland has been to apply the term 'alpine' to those areas of habitat above 350-450 metres (1,200 – 1,500 ft) in altitude. However, the easy application of this label is very difficult as areas of 'alpine' vegetation may occur much lower than this, and the occurrence of this habitat is ultimately dependent on a number of factors principally geographical location, aspect, levels of exposure and not least, biogeographical history. In general, an alpine zone on Irish mountains occurs within the altitudinal range above but, moving northwards and westwards, it is met with at increasingly lower levels.

From a vegetation point of view, assemblages of alpine plants of screes, are confined to areas of scree located at the foot of the more or less vertical, bare, north-east facing cliffs or areas of outcropping rock on slopes, which had their origins during the last glacial periods. It is widely considered that the alpine species occupying these areas are relictual in nature and represent the last vestiges of the arctic/tundra floristic component that was widespread in Ireland during the Pleistocene period.

There has been little published on the vegetation of Irish mountains, even though some systematic work was carried out on them during the 1970s. However, White and Doyle (1982) recognized 7 associations within 4 Classes, which probably encompass the range of variation found within the alpine cliff communities.

**Table 1** presents a list of Associations indicative of scree and rocky slopes, which are specifically alpine in nature and, which correspond to the Annex I habitats. Calcareous scree is mainly included in the Classes 'Spring Vegetation' and 'Artic-Alpine grass heaths', but it should be noted that there is often overlap between it and the other scree and rocky Annex I habitats, which include:

- 4060 Alpine and Boreal Heaths
- 8210 Calcareous rocky slopes with chasmophytic vegetation
- 8220 Siliceous rocky slopes with chasmophytic vegetation

and that these habitats above often occur as part of a mosaic of vegetation, which can include alpine heath, upland grasslands, wet heath and dry heath. Consequently, it is considered that the term 'alpine' only be applied to those categories listed in, which the diagnostic species, appropriate to each is present. It should be noted that there is some doubt as to the exact nature of some of the categories as a systematic phytosociological survey of Irish alpine vegetation has not yet been carried out.

**Table 1. Table of plant associations found on alpine cliffs in Ireland based on White & Doyle (1982) and Curtis (1993).**

| Class | Association | Diagnostic species |
|---|---|---|

| Class | Association | Diagnostic species |
|---|---|---|
| Pioneer communities of scree[1] | *Cryptogrammetum*<br><br>*Oxyrietum digynae* | *Cryptogramma crispa.*<br><br>*Oxyria digyna.* |
| Wall fern -*Asplenietea-rupestria* | *Polysticho-Asplenietum viridis* | *Polystichum lonchitis, Asplenium viride.* |
| Spring vegetation - *Montio-Cardaminetea* | *Philonotido fontanae-Saxifragetum stellaris*<br><br>*Saxifrago-Chrysosplenietum oppositifolii*<br><br>*Saxifragetum aizoidis* | *Saxifraga stellaris, Montia fontana ssp fontana, Dicranella palustris, Philonotis fontana, Scapania uliginosa.*<br><br>*Chrysosplenium oppositifolium, Saxifraga stellaris.*<br><br>*Saxifraga aizoides, S. oppositifolia, Alchemilla glabra, Selaginella selaginoides.* |
| Arctic-alpine grass heaths | *Breutelio-Seslerietum*[2] | *Arenaria ciliata, Saxifraga aizoides, Silene acaulis, Euphrasia salisburgensis, Breutelia chrysocoma, Sesleria albicans.* |

*Notes:*

1. The nature of the Pioneer communities of screes is fragmentary and so the status of this Class in Ireland is still uncertain.
2. White and Doyle assign the *Breutelia-Seslerietum* to the Class of Arctic-Alpine grass heaths when it is actually an association found on wet cliffs on the Ben Bulben massif.

For most habitats listed in the Interpretation Manual of the Habitats Directive, there is a direct correspondence between its name and an Association of vegetation, which has been formally recognized by phytosociologists. However, for the Habitat Directive categories of alpine cliff habitats there is no direct equivalence between the habitat title and a specific Association of vegetation. Instead, there has been a broad, generic approach to the classification of alpine categories within the Interpretation Manual and consequently the formal assignation of areas of alpine habitat to these is not easily accomplished.

In some cases, individual Associations appear to be restricted to certain Interpretation Manual categories e.g. the *Polysticho-Asplenietum viridis* to Calcareous rocky slopes. However, the majority of Associations can occur in 2 or 3 Interpretation Manual categories viz. *Saxifragetum aizoidis* and *Breutelia-Seslerietum* in both Calcareous scree slopes and Calcareous rocky slopes, whilst the *Philonotido fontanae-Saxifragetum stellaris* may be included within both of the Chasmophytic categories of Calcareous and Siliceous slopes. The consequences of this are that the accommodation of Irish alpine habitats, species and vegetation within the categories of the Interpretation Manual is not easily accomplished and it must be recognized, that on the ground, there is a great deal of overlap between Habitats Directive categories.
However, for the purposes of the Habitats Directive, alpine cliff and scree habitats in Ireland are considered to belong to four categories:

The alpine cliff and scree communities are accommodated within:

- **(8110) Siliceous scree of the montane to snow levels**
- **(8120) Calcareous and calcshist screes of the montane to alpine levels**
- **(8210) Calcareous rocky slopes with chasmophytic vegetation**
- **(8220) Siliceous rocky slopes with chasmophytic vegetation**

**Calcareous scree** is applied to areas of open rocky habitat consisting of eroded material of calcareous origin on steep slopes and consisting of boulders, or smaller fragments ranging from stones to coarse pebbles. These slopes are unstable and liable to slippage. As there are few areas of limestone in Ireland, this habitat is restricted and the best examples are seen on the Ben Bulben plateau, especially at Gleniff, Glenade and Ben Whisken. It is as yet uncertain how to characterise the vegetation other than to state that it contains alpine plants, in low numbers and very widely scattered in distribution. The association *Breutelio-Seslerietum* listed by White & Doyle (op.cit.) under Arctic alpine grass heaths can be included here and the *Saxifragetum aizoidis* Association of Spring Vegetation, as listed in **Table 1.**

Though the four categories used to accommodate alpine scree and rocky vegetation in Ireland, for the purposes of the Habitats Directive, are appropriate for the designation of Special Areas for Conservation (SAC), they cannot be considered comprehensive for the purposes of defining alpine cliff and scree habitats and their vegetation. For the purposes of confirming the occurrence of and identifying montane areas where alpine screes are found the conspectus of Associations given in **Table 1** should be used. However, a preliminary assignation of the associations of alpine vegetation to the appropriate Habitats Directive category is presented in **Table 2**. It is stressed that this is approximate and the production of a definitive account must await a thorough field investigation of the nature of Irish alpine vegetation.

**Table 2. NATURA 2000 alpine cliff and scree habitat categories and the likely plant associations based on White and Doyle (1982), which they contain.**

| NATURA 2000 Habitat title | Probable identity of plant association (White and Doyle (1982)) |
|---|---|
| **Siliceous scree** | *Cryptogrammetum;*<br>*Oxyrietum digynae;*<br>*Lycopodio-alpini-Rhacomitrietum lanuginosi* |
| **Calcareous scree** | *Saxifragetum aizoidis;*<br>*Breutelio-Seslerietum* |
| **Chasmophytic vegetation: Calcareous** | *Polysticho-Asplenietum viridis;*<br>*Philonotido fontanae-Saxifragetum stellaris;*<br>*Saxifragetum aizoidis;*<br>*Breutelia-Seslerietum;*<br>*Arctostaphylo-Dryadetum;*<br>*Lycopodio-alpini-Rhacomitrietum lanuginosi* |
| **Chasmophytic vegetation: Siliceous** | *Philonotido fontanae-Saxifragetum stellaris;*<br>*Saxifrago-Chrysosplenietum oppositifoli;*<br>*Herberto-Polytrichetum alpini;*<br>*Lycopodio-alpini-Rhacomitrium lanuginosi* |

It can be seen from **Table 2** that some alpine associations occur in more than one habitat and in reality their expression is a function of the rock type on, which they occur, the altitude, aspect, substrate size and degree of slope. In general, the greatest diversity of species occurs within the Calcareous scree/ Calcareous Chasmophytic habitats on the limestone mountains of the north-west with a lesser degree of diversity found within the Calcareous Chasmophytic habitat found on mountains of other rock types.

## List of alpine and calcareous scree plant species in Ireland

The listing of plant species occurring in alpine areas in Ireland is made possible for the vascular plants by the availability of lists from papers prepared by 19th century botanists, principally H.C. Hart who was the first to systematically examine the major mountain ranges in Ireland and who provided altitudinal data along with species occurrences.

This has been added to over the 20th century by the discovery of further sites for alpine plants and it can be concluded that the species complements of Irish mountains is reasonably well known for the ferns and flowering plants. However, for the cryptogams, this is not the case and only certain well-botanised sites such as Ben Bulben (Site Code: 000623) and the Macgillicuddy's Reeks (Site Code: 000365) are well documented. However, the systematic survey of many Irish counties for bryophytes is ongoing and will eventually result in a comprehensive overview of the alpine mosses and liverworts.

Defining an alpine plant in Ireland is often made difficult as what may be alpine here may not be elsewhere in Europe and this is confounded by the behaviour of some lowland species, which occur on mountain tops and cliffs and act as alpine elements. For example, sea pink, *Armeria maritima* is found on the summit of Carrauntoohill at 1,034 m whilst on alpine cliffs a form of the common scurvy grass, *Cochlearia officinalis* a common coastal species, is sometimes found. A further illustration of the ecologically fickle nature of many Irish plants is crowberry, *Empetrum nigrum*, usually a species of high mountains but in County Mayo and Donegal, it occurs at sea level.

The list of true alpines in Ireland is small, that is species, which never occur lower than 350m or away from cliff habitats and these are the true post-Pleistocene relicts, which can be considered as **Obligate Alpines** due to their virtual confinement to vertical, north-east facing cliffs or on exposed mountain ridges and summits. There conditions are severe enough to inhibit competition from coarser species and inaccessible enough to prevent grazing by animals. These may be joined here by what may be termed **Facultative Alpines**, which are species found in other habitats, not necessarily montane, but, which are also commonly associated with alpine locations.

**Table 3** lists the calcareous scree species, which are found at high altitude in Ireland. It excludes species, which are very widespread and found across a range of habitats from sea level to mountain tops.

**Table 3: List of species found on calcareous scree in Ireland.**

| Scientific Name | Obligate or Facultative Alpine Species |
|---|---|
| *Alchemilla glaucescens* | Obligate |
| *Arenaria ciliata* | Obligate |
| *Cardaminopsis petraea* | Obligate |
| *Polygonum viviparum* | Obligate |
| *Salix phylicifolia* | Obligate |
| *Saxifraga oppositifolia* | Obligate |
| *Silene acaulis* | Obligate |
| *Angelica sylvestris* | Facultative |
| *Arabis hirsuta* | Facultative |
| *Cystopteris fragilis* | Facultative |
| *Draba incana* | Facultative |
| *Dryas octopetala* | Facultative |
| *Euphrasia salisburgensis* | Facultative |
| *Juniperus communis* | Facultative |
| *Koeleria macrantha* | Facultative |
| *Saxifraga aizoides* | Facultative |
| *Saxifraga hypnoides* | Facultative |
| *Sesleria albicans* | Facultative |
| *Thymus praecox* | Facultative |
| *Barbilophozia floerkii* | |
| *Campylopus paradoxus* | |
| *Cladonia furcata* | |
| *Cladonia impexa* | |
| *Cladonia squamosa* | |
| *Cladonia uncialis* | |
| *Dicranum majus* | |
| *Dicranum scoparium* | |
| *Eurhynchium praelongum* | |
| *Hypnum cupressiforme* | |
| *Isopterygium elegans* | |
| *Lophozia ventricosa* | |
| *Mnium hornum* | |
| *Oedipodium griffithianum* | |
| *Plagiothecium undulatum* | |
| *Pleurozium schreberi* | |
| *Pogonatum urnigerum* | |
| *Polytrichum alpinum* | |
| *Polytrichum formosum* | |
| *Pseudotaxiphyllum elegans* | |
| *Ptilidium ciliare* | |
| *Racomitrium* spp. | |
| *Rhytidiadelphus loreus* | |

## 2 *HABITAT MAPPING*

There has been no recent inventory or mapping of the national calcareous scree resource in Ireland. For the purposes of this survey, an extensive literature review of both published and unpublished material was undertaken (**Appendices 1** and **2**). Records documenting the occurrence of the species recorded from calcareous scree (as listed in **Table 3**) were collated in an *MS Access* **Uplands Habitats Database**. This database contains records of the obligate and facultative species of the five Annex I upland habitats (4060, 8110, 8120, 8210, 820) in Ireland and was designed specifically for the purposes of this report.

The **Upland Habitats Database** of this project, currently holds c.4,500 records of indicator species of all Annex I upland habitats (i.e. 4060, 8110, 8120, 8210 and 8220) which have been gleaned from a variety of sources (both published and unpublished as documented in **Appendices 1** and **2** respectively). Given the antiquity of the bulk of the data (c.1700 of the records date from the 1800s to the 1950s) and the lack of accurate geographical references (only c.1500 records have grid references of varying accuracy (see below and **Appendix 3** for further information) the GIS application of much of the collated data is limited. The bulk of records will not be illustrated in **Figures 1 to 3** due to their lack of grid references.

The database contains information on the following:

- Species Name
- Designated Site Code (NATURA 2000 sites (SACs) or Natural Heritage Areas (NHAs))
- Description of the location of the species
- Altitudinal information (either in feet (′) or metres (m) depending on the antiquity of the record)
- Grid Reference (if provided) – these were assigned an accuracy rating
- Source of data (published or unpublished reference)
- Date of record
- List of associated species (if present)
- Indication of whether the description indicated a single species record, an assemblage of species or a description of habitat cover*
- Any information on substrate or underlying geology

*Given the variability of data sources, records of indicator species have been described either as an assemblage of species, a single species location or as an indication of habitat cover, depending on the quality and source of the data. For example a historical record by Corry (1884), which only contained details of a particular species at a certain altitude on Ben Whisken (Site Code: 000623) was entered as a single plant species location, whereas a description of several arctic-alpine species on a cliff above a corrie lake on Mount Brandon (Site Code: 000375) by Stelfox (1951) was entered as a species assemblage. Where there was a good description of an area of alpine heath (such as that given by Conaghan et. al. (1994) in the NHA Site Card for the Twelve Bens (Site Code: 002031)) this was entered as habitat cover.

Data for all of the above fields in the database was not necessarily contained in the original publication/source for each record and based on the description of the locations given, an appropriate SAC Site Code was assigned to each record using the Discovery and 6″ Mapping on Arc View 3.2.

**GIS**

GIS data sources, which are related to ecological factors that determine the occurrence of calcareous scree, were used to produce the indicative natural range and potential distribution maps shown on **Figures 1** and **2**. These include:

- Contour lines >350m elevation. Ordnance Survey (1995) – 1:50,000 Discovery Series, 10m contour interval,

- A Digital Terrain Modelling package (2007) generated polygons, which were used to identify areas of potential calcareous rocky slope based on the following criteria:
    - elevation above 350m,
    - upland areas above 350m with a slope > 40º,
    - north and north-east facing slopes with a slope > 40º.

These areas were further refined to exclude the mountain ranges which are formed of siliceous material.

Although the use of recent (2000) digital aerial photographs of Ireland, which were ortho-rectified, was investigated, it became apparent that it was not possible to use these remotely to identify areas of calcareous scree. This is because it is not possible to distinguish it accurately from scree in mosaics of vegetation of wet heath, dry heath, rocky habitats and upland grassland.

## Habitat Range

Calcareous scree which supports the habitat is largely restricted to those areas of north and north-east facing slopes (>40º) above 350-450 metres (c.1,200 – 1,500ft) in height. The occurrence of this habitat is ultimately dependent on a number of factors, principally geographical location, aspect, levels of exposure, nature of the solid geology, local erosional features and fluvio-glacial history. The actual range of calcareous scree of montane to snow levels habitat as defined in the Habitats Directive Interpretation Manual is unknown in Ireland.

In general a calcareous scree zone on Irish limestone mountains occurs within the altitudinal range above, but has been recorded at elevations below 350m such as the Bricklieve Mountains (Site Code: 001656). From an alpine vegetation point of view, calcareous scree is usually confined to the north and north-east facing slopes of Limestone Mountains and may be found at the base of north and north-east facing cliffs and on the steeper slopes. Calcareous scree is very localised in upland areas in a few selected parts of Ireland (Counties Sligo and Leitrim).

**Figure 1** shows the natural range of calcareous montane scree habitat in Ireland. This map is based on a variety of different data sources.

- Firstly the locations, within SACs selected for the habitat, of north and north-east facing slopes (> 40º) in upland areas (>350m in elevation) were plotted on a 10km² basis (purple squares). Calcareous scree potentially occurs in the limestone mountain ranges of Ireland located in the north-west of the country in Counties Sligo and Leitrim. There is an absence of calcareous scree in the midlands of Ireland, in spite of the presence of extensive areas of limestone, due to the lowland character of the landscape. Although the Burren in Co. Clare is one of the more famous areas of limestone mountains in Ireland the mountains there are too low to support this habitat. The species complement in both areas may not all conform to the Habitats Directive definition
- Due to the limitations of the DTM in accurately identifying all slopes which potentially contain calcareous scree (as described above), the locations of all sites for which calcareous scree is a qualifying interest were also plotted on a 10km² basis (pink squares) – note that this included sites which are below 350m in elevation.
- Finally sites were identified as potentially containing calcareous scree on the basis of the occurrence of true obligate species for the habitat. No extra squares were added on this criteria.

As can be seen this habitat has a naturally discontinuous range in north-west Ireland, as it is restricted by altitude and aspect.

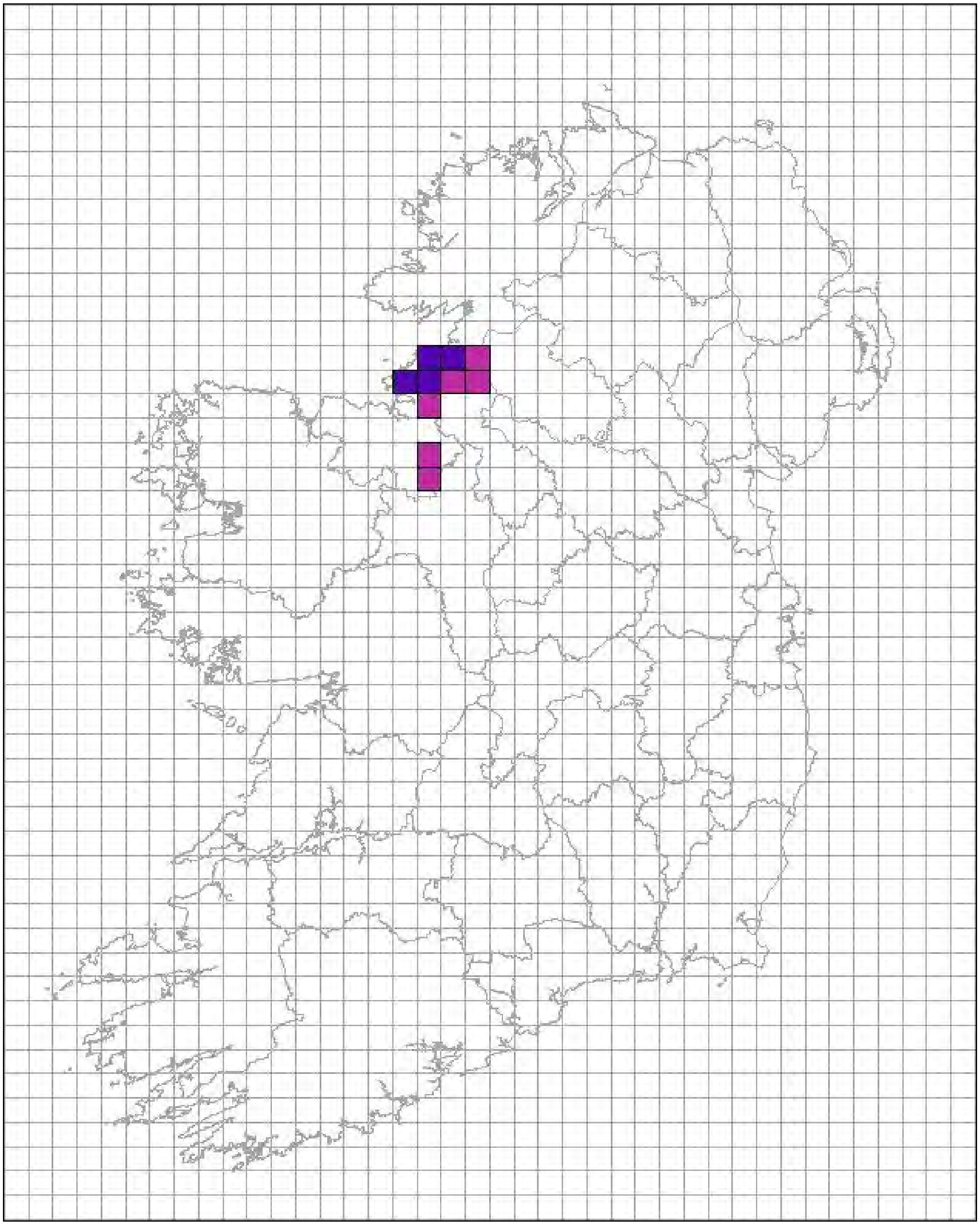

**Figure 1. Map showing the natural range, the favourable reference range and the distribution of calcareous scree in Ireland on a 10km² basis, which shows squares that contain north and north-east facing slopes (> 40°) in limestone upland areas >350m in elevation (purple squares) and the locations of designated SAC sites below this elevation for, which calcareous scree is a qualifying interest as well as other sites where the habitat may be present(pink squares). This map is presented at a scale of 1 : 2,400,00.**

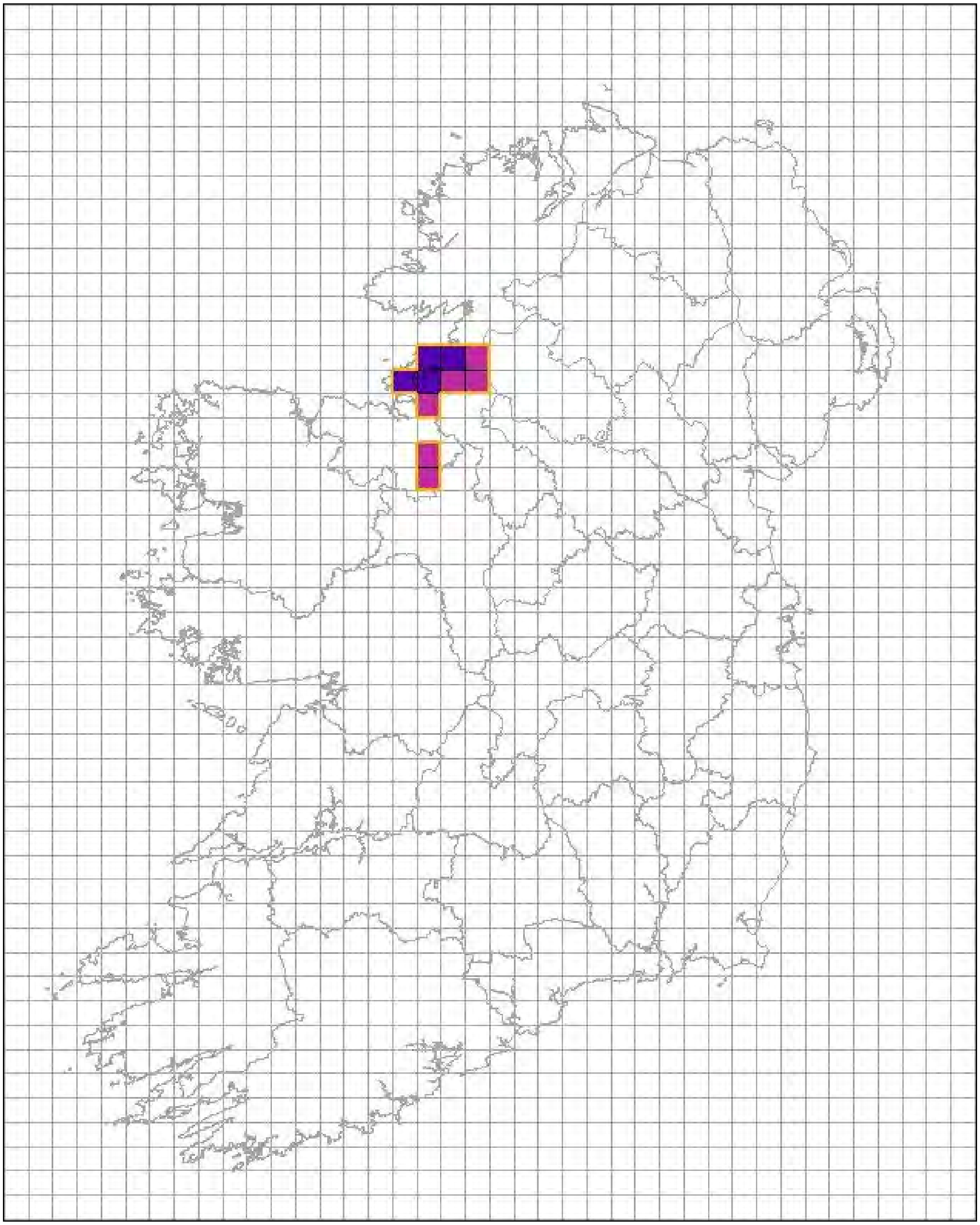

**Figure 1b. Range and Favourable Reference Range for calcareous scree in Ireland, which is based on the historic natural range of the habitat.**

## Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between current habitat range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

An assessment based on the historical range of calcareous scree indicates that the natural range polygon of the habitat in Ireland (see **Figure 1**), as defined by the locations on limestone > 350 m with north and north-east facing slopes > $40^0$ and sites for which calcareous scree is a qualifying interest and by the documented records of true alpine indicator species collated in the project database, potentially covers 1,000 km² (10 grid cells selected x 100 km²) **(See Figure 3)**. The natural range of the habitat is thus documented.

In general, the conservation status of the habitat range is deemed **Favourable** as the physical conditions for the presence of calcareous scree are still present and the natural range of the habitat is thus likely to remain unchanged. However, no specific studies have been undertaken on the conservation status of the habitat range in Ireland during the reporting period making any assessment of the annual decline or otherwise in the habitat range problematic.

The Favourable Reference Range (FRR) is considered the same as the current range.

**Habitat Range Area:** Can be considered as the area of the polygon, which contains all of the grid cells, which contain the habitat, which are defined by the documented records of indicator species collated in the project database and the location of potential locations for the habitat. This potentially covers 1,000 km² (10 grid cells selected x 100 km²).

**Favourable Reference Range**: This is considered the same as the Habitat Range Area and as described above, i.e. 1,000 km² (10 grid cells selected x 100 km²).

## Habitat Extent

It is not possible to accurately quantify the extent of calcareous scree in Ireland, as there has been no systematic mapping of this habitat. The distribution of the habitat as shown on **Figure 1 and 2** is based on the location of north and north-east facing slopes (with a slope >40°) above 350m in elevation in the limestone mountain ranges of the north-west where calcareous scree could be expected. By using the DTM generated polygons it is possible to produce a very rough estimate of the potential area of calcareous scree in Ireland. The area of calcareous scree is likely to be significantly below 30.16 Ha or 0.3 Km², which is the area of all entire polygons. Note that this figure does not include areas of scree from the Bricklieve Mountains (Site Code: 001656) which is below 350m in elevation but does support the habitat.

This figure has further inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria as described above, whereby areas where calcareous scree is known to occur are not always depicted. In addition, these areas are also likely to contain other habitats such as siliceous scree, siliceous and calcareous rocky slope, alpine heath, or dry and wet heath. Thus, in the absence of a recent survey, it is impossible to define clear boundaries between these habitats using this form of data.

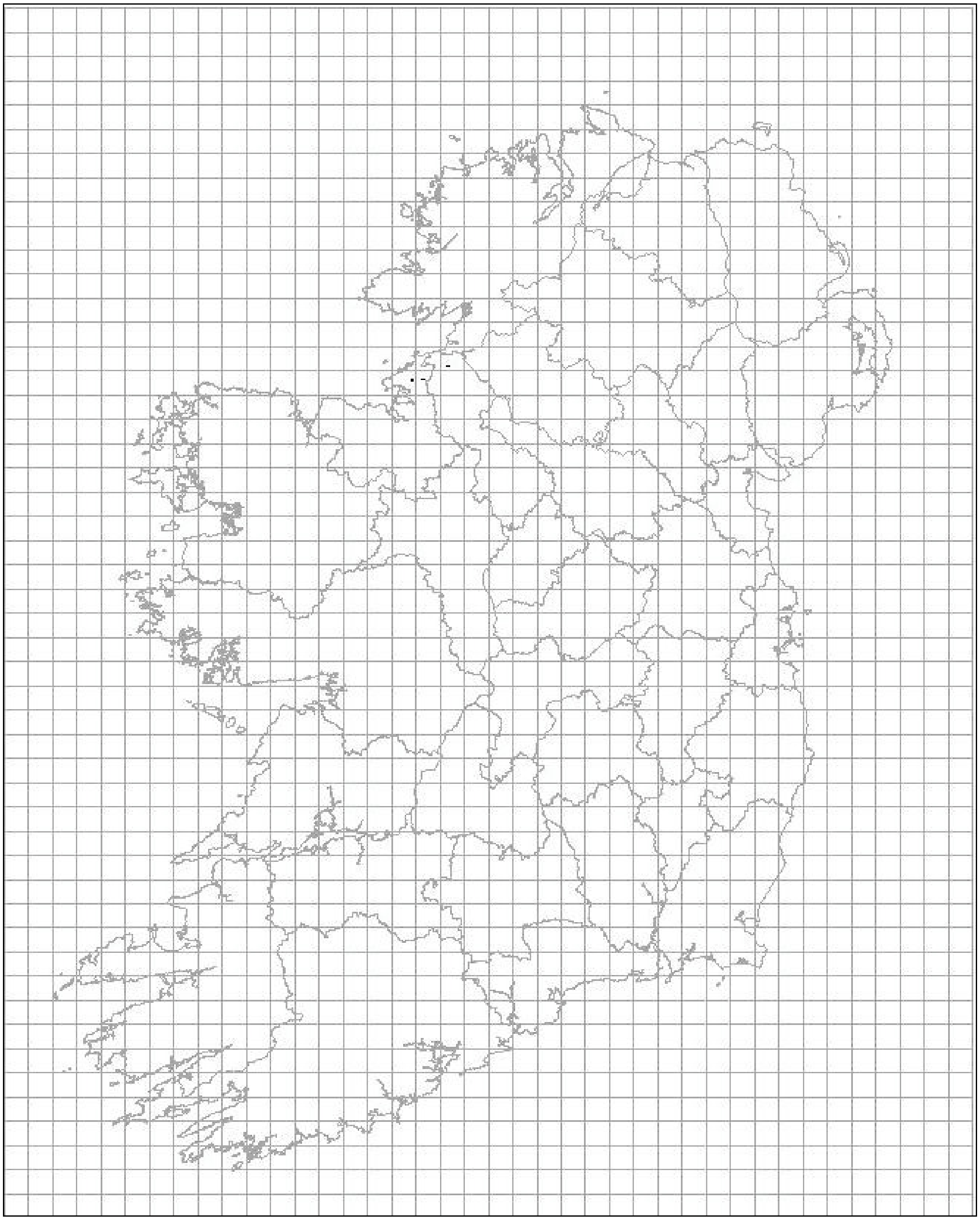

**Figure 2. Map showing the potential distribution of calcareous scree in Ireland based on the locations of north and north-east facing slopes (> 40°), (shown in black in Counties Sligo and Leitrim) at elevations >350m on limestone mountains. This map is presented at a scale of 1 : 2,400,00.**

Using the data available in literature and other sources (**Appendix 3**) the records were assigned an accuracy rating in the databse set up for this project and were then plotted in Arc View 3.2 using an appropriate visual scale. This data was used coupled with the other criteria to indicate the likely extent of the habitat.

Apart from using DTM polygons, the key species used to try to determine an indicative extent of **calcareous scree** in Ireland are the four 'true' alpine species, which are characteristic for this habitat as listed in **Table 3** as follows:

- *Alchemilla glaucescens*
- *Arenaria ciliata*
- *Salix phylicifolia*
- *Silene acaulis*

Records for these species are available at an accuracy of 100m and 1m and a map of the indicative locations of calcareous scree is presented in **Figure 3**. There were 83 records available at this accuracy level and these are identified as either single species records (shown as orange points) (47 records available) or as species assemblages (36 records) (shown as green points).

It should be noted that not all areas of scree associated with north and north-east facing slopes within the natural range of the habitat support the species listed in **Table 3** so these areas may not therefore correspond to the Habitats Directive Definitions of the habitat.

It is not possible to more accurately determine the extent of this habitat in the absence of a dedicated field survey. The extent of the habitat is therefore currently **Unknown**.

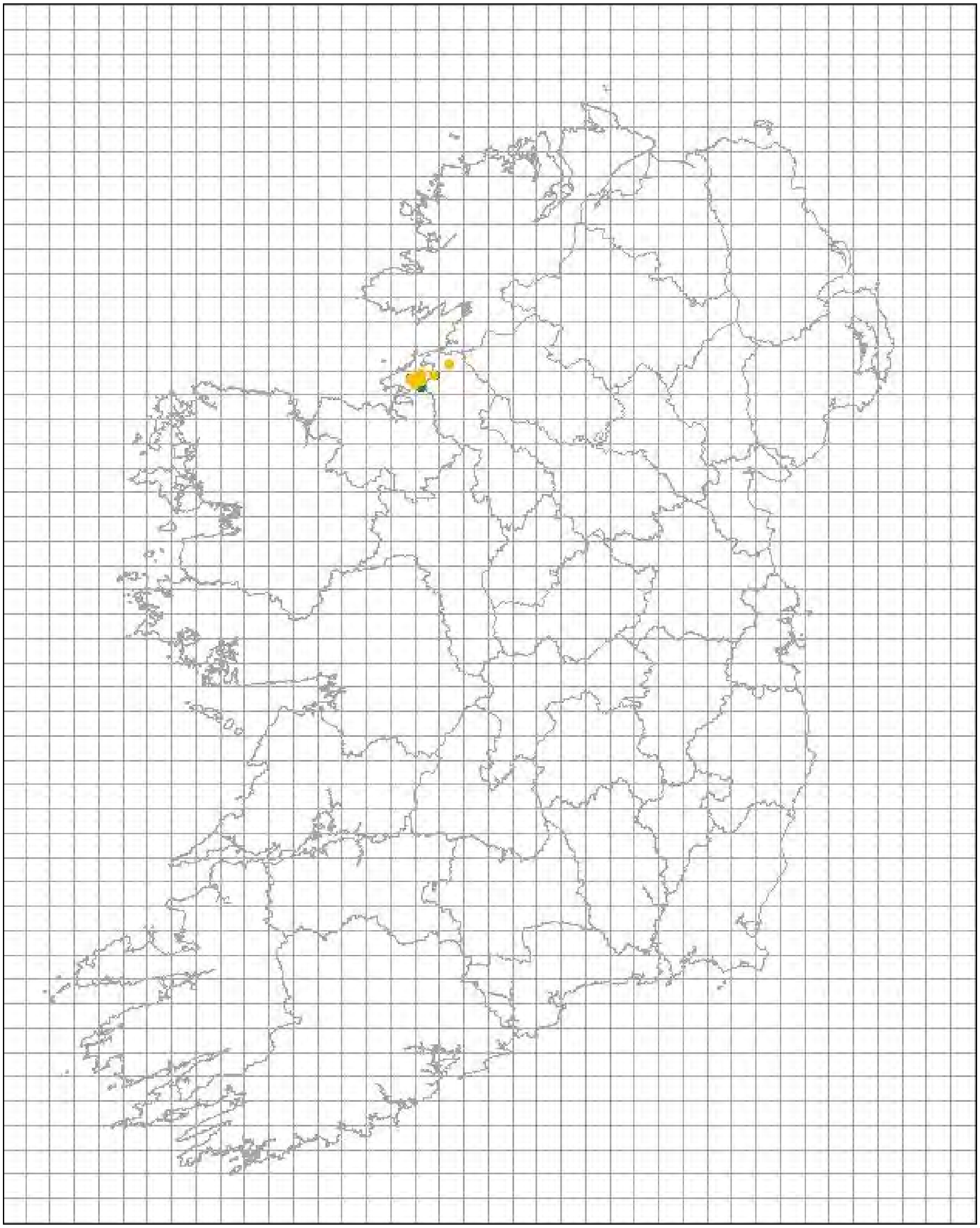

**Figure 3. Map showing the indicative extent of calcareous scree in Ireland based on the distribution of the four true alpine species characteristic for the habitat for, which accurate grid references were available. There were 83 records available at this accuracy level and these are identified as either single species records (shown as orange points) (47 records available) or as species assemblages (36 records) (shown as green points). This map is presented at a scale of 1 : 2,400,00.**

A decision has been taken by NPWS to calculate/estimate a best expert judgement on the area. The CORINE data base was consulted in an effort to calculate the area of bare rocks as defined by CORINE. However, bare rocks of e.g. Wicklow or Hungry Hill did not show up, and similarly for other areas, possibly because CORINE mapped at the scale of 25 ha. Given this, the area of calcareous scree was estimated by NPWS as outlined on **Table 4.**

**Table 4 Estimation of area of Calcareous Scree Habitat in Ireland**

| | |
|---|---|
| Area covered by DTM on north and north-east facing slopes > $40^0$ > 350 m for calcareous geology for Sligo and Leitrim though excluding the Bricklieves as it < 350 m | 0.3 $km^2$, |
| Of the estimated 0.3 $km^2$ calculated for calcareous geology, NPWS assumes that 60% is vegetated so 40% possibly consists of bare scree and rocky habitat. | 0.12 $km^2$ |
| Of this estimation, NPWS further assumes that bare scree is less in area than rocky habitat in ratio 60:40 | 0.048 $km^2$ |
| As the entire DTM may be an underestimate and as Bricklieves have been excluded as they are lower than 350m, increase this figure to 0.05 $km^2$ | 0.05 $km^2$ |

This best expert judgement figure can be improved upon following a dedicated survey.

## Conservation Status of Habitat Extent

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the extent of a habitat can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat extent in the reporting period (a decrease in habitat extent greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between current habitat extent and the Favourable Reference Area (FRA) (if current habitat extent is 10% below FRA the habitat extent is considered Unfavourable Bad).

As mentioned previously the current extent of the habitat is **Unknown though a best expert judgement is provided**. The significance of the land use and activities on the extent of this habitat are not clearly understood due to lack of survey data. Any over-grazing impacting activities in so remote a habitat are deemed to be less significant than similar impacts on the wet heath and blanket bogs of the uplands. The loss of the intrinsic suite of species may have led to a reduction in the area of the habitat. Mining and tourism related activities are also deemed to be threats to the alpine habitats. It is recognised that all of these impacting activities may play a role in damaging the habitat. As it is not known whether there has been a loss in habitat area or not, but it is known that there are damaging impacts which may have impacted on the area, a ranking of **Unfavourable-Inadequate** scoring is given.

The conservation status of the habitat extent is deemed **UnFavourable-Inadequate** and the trend is negative due to impacting activities. Favourable Reference Area is considered to be **Unfavourable Inadequate** as it is perceived to be > the current estimated area. The period for this trend is 1950s to the present. Further survey with more accurate information before the next reporting cycle may indicate a more Favourable Assessment.

**Area covered by the habitat:** The accurate extent of calcareous scree habitat in Ireland is **Unknown. However an estimate of 0.05 km²** has been calculated.

**Favourable Reference Area:** Though the area is calculated using best expert judgement, it is nonetheless felt that, in this instance, there has been a decline in area within the reporting period (1950s to 2006) due to impacting activities. Loss of habitat equates with loss of specific species and not the loss of actual rock. The extent of the loss is unknown but is not considered to be > 10%. Favourable Reference Area is considered to be **Unfavourable Inadequate** as it is perceived to be > the current estimated area.

# *3 STRUCTURES AND FUNCTIONS*

## 3.1 Structures and Functions of the Habitat

Satisfactory data on habitat quality and habitat change trends are lacking for this habitat in Ireland.

An increase in the intensity of impacting activities on the habitat has occurred since the 1950's in Ireland. This increase has been due mainly to the overstocking of sheep in the uplands, which results in slippage, erosion, loss of species and loss of habitat. The Commonage Framework Plan did not isolate upland exposed rocky slopes as a habitat type within the survey and it is therefore not possible to use any of the data from this survey in accurately identifying the level of grazing damage to calcareous scree slopes. A gross measure of the levels of grazing damage to those sites, which contain calcareous scree that are located within areas of commonage indicates that approximately 53% of the land has some levels of damage. Given the high levels of damage to other habitats in these commonage areas, the impact of grazing and trampling is likely to have negatively impacted on calcareous scree slopes.

A secondary impact is due to an increase in leisure activities in the uplands notably hill walking, mountaineering, rock climbing and para-gliding. Hill walking and rock climbing may cause trampling and erosion of the scree habitat and ultimately loss of the species that characterise this Annex I habitat. Quarrying poses another threat. However, due to the economics involved in such activities in such remote upland areas, it does not pose a significant threat.

The significance of the increasing impact of these activities on the habitat is unknown. They may have resulted in some decline in the habitat in general but it is not possible to quantify this at present. Associated with this is a possible decline in the structures and functions of the habitat. There is no documented study such as the Commonage Framework Plans that documents the effects of such activities on the structures and functions of the calcareous scree slope habitat and as described above the grazing impact of sheep on calcareous scree slopes was not assessed separately.

### 3.1.1 Conservation Status of Structures and Functions of the Habitat

The variation in the conservation status of the structure and functions of calcareous scree cannot be quantified. The above activities may have altered the quality of the habitat in localised areas (notably on sites, which are popular hill walking and mountaineering areas such as Ben Bulben (Site Code: 000623 and the Bricklieve Mountains (Site Code: 001656) in Counties Leitrim and Sligo and Co. Sligo respectively). Due to the lack of information, the conservation status of structure and functions of the habitat is **Unknown** but the trend is negative due to the pressures described above. However according to NPWS, given that the habitat structure is intact in many of the more remote areas and given that damage by grazing is not deemed to be as severe on scree habitats as it is on blanket bog and wet heath, an assessment **of Unfavourable Inadequate** is appropriate.

## Typical Species

Calcareous screes are characterised by some species, which are truly alpine in nature and occur in this habitat due to their altitudinal requirements (Obligate alpine species). As described above many of these species are common to several other Annex I upland habitats including;

- (8120) Calcareous and calcshist screes of the montane to alpine levels,
- (8220) Siliceous rocky slopes with chasmophytic vegetation.

Calcareous screes also contain a number of other species, which may also be found in other associated habitats (these are termed Facultative species) and at lower elevations. They have been listed in **Table 3.**

### 3.1.2 Conservation Status of Habitat Typical Species

An accurate assessment of the conditions of typical calcareous scree habitat species cannot be carried out in the absence of a specific field monitoring program. However, the assessment of the condition of the structures and functions of the habitat based on impacting activities and the influence of these activities on the typical species of the habitats will let us ascertain the conservation status of the latter. Furthermore, a decline in the calcareous scree slope habitat's structure and functions as mentioned previously already indicates a decline in the species typical of the habitat. The conservation status of habitat structures and functions is thus regarded as **Unfavourable Inadequate** for this habitat. As habitat quality and typical species are so interdependent, it can be suggested that an **Unknown** status would be appropriate but an **Unfavourable Inadequate** conservation status can also be inferred for Typical Species.

## 4 *IMPACTS AND THREATS*

The main damages influencing the calcareous scree habitat in Ireland based on best expert opinion are as follows:

**Table 4. Damaging activities affecting calcareous scree, main ecological effects and future trends.**

| **Damage type** (EU Code) | **Main ecological effects** | **Likely future trends of damage** |
|---|---|---|
| **Outdoor recreation** (501, 530, 610, 622, 624, 720) | Erosion of habitat and loss of species. | Future incidence uncertain. Risk greatest in popular walking areas or close to urban areas, e.g. Ben Bulben. |
| **Overgrazing** (142) | Where very severe, complete removal of indicator species occurs with very poor prospects for recovery. | Intensity set to decline when destocking recommendations are implemented. |
| **Mining and extraction** (390) | Removal of calcareous scree and loss of species and habitats associated with it. | Increasing level of quarrying due to increased demand for rock materials for construction or the cement industry. |
| **Air Pollution** (702) | Acidification. | Potential loss of ion exchange and subsequent loss of species. At a pH, lower than 3 most species are unlikely to survive. |

### Overgrazing

Overgrazing by sheep is one of the damaging activities affecting calcareous screes and this has been observed in several locations such as Ben Bulben (Site Code: 000623) and Arroo Mountain (Site Code: 001403) in Counties Sligo and Leitrim.

A revised and subsequently amended Rural Environment Protection Scheme (REPS) was introduced in May 1999. As a result, degraded commonage areas were assessed and managed according to a specific management tool – "The Commonage Framework Plan (CFP)" surveyed and assessed the condition of almost all commonage areas in the Republic of Ireland. In order to facilitate the restoration of these areas the Plan recommends a destocking level for each commonage or site surveyed. Within the scheme, damage is assessed according to a 6 point scale ranging from U (undamaged) to S* (very severely damaged) and each point on this scale has an associated destocking level. In addition to mapping the extent and severity of grazing damage within commonages, the habitats occurring within these areas was also indicated but unfortunately upland rocky habitats and screes were not identified. However, as detailed in section 3.2 above approximately 53% of the lands, which contain calcareous screes that are located within commonage areas have some levels of damage.

### Overgrazing Trend

Stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (FAPRI-Ireland Partnership 2003). However, this could potentially result in sites being abandoned, which may, in the case of scree, lead to habitat loss through vegetation encroachment. The Rural Environment Protection Scheme (REPS) and National Farm Plan Scheme also aim to address a reduction in over-grazing levels. The implementation of these three schemes should reduce damage on calcareous screes caused by farming activities and particularly target over grazing. To date the results of the implementation of measures recommended by these schemes is unknown. Thus, it cannot be stated that the threat to calcareous scree slopes from intensive overgrazing or under-grazing is declining.

## Quarries

Quarries are a known historical threat to calcareous scree slopes as documented by the location of the barytes mine on Ben Bulben (Site Code: 000623) now closed and a more recent quarry on Aghavoigil Bog NHA (Site Code: 002340).

### Quarrying Trend

The future trends for quarrying are unknown but if the current economic growth continues in Ireland, there may be increasing pressures on calcareous scree sites in gaining access for other rock material for the cement and building industries. However, planning control of quarrying has improved greatly with regard to opening of new quarries and re-opening of old works since the introduction of regulations under Section 261 of the Planning and Development Act 2000.

## Outdoor Recreation

Trackway erosion of upland habitats such as alpine heath, wet heath, dry heath, screes and rocky slopes, caused by tourist use of popular walking routes has been highlighted as a problem in Ireland since the beginning of the 1990s. Problems with erosion of upland habitats are for example associated with Ben Bulben (Site Code: 000623). Tracks are clearly visible in some areas of calcareous scree. The increase in popularity of hill walking in Ireland in recent years is likely to only result in more pressure on sensitive upland habitats such as calcareous scree. The ease and speed of access to these most remote areas of our mountain ranges has increased with the arrival of ATVs and scrambler bikes.

### Outdoor Recreation Trend

Trackway erosion is considered an increasing threat to calcareous scree. There is a similar increase in the threat as a result of increased ownership of ATV's and Four Wheel Drive vehicles and accessibility to upland areas. Hill walking continues to increase as a popular recreation in Ireland and our mountains are actively promoted to visiting walkers.

## Site Inspection Form results

Regional NPWS Management is responsible for patrolling designated sites and enforcing relevant legislation (e.g. Habitats Directive 92/43 EEC or the Wildlife Act). NPWS Conservation Rangers are required to summarise information collected on the integrity of sites within their areas during the course of their duties. They are given the responsibility for reporting the information required under the Site Inspection Reporting (SIR) programme. Reporting is carried out on a three yearly cycle that began in 1998.

There are no reported activities in the period 1998 – 2003.

## *5 FUTURE PROSPECTS*

### Negative Future Prospects

Calcareous screes have undergone a negative impact in the last fifty years principally as a result of overgrazing and leisure activities. Whilst over-grazing is an impact which can be resolved through management agreements with landowners (see Positive Future Prospects below) other impacts such as acidification and damage from walkers and increased recreational access to the mountains resulting in trampling has also become an increasing problem, which is less easily managed.

### Positive Future Prospects

**Single Farm Payment (SFP)**
As already noted, stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (SFP) (FAPRI-Ireland Partnership 2003). As long as the market value of hill sheep remains low, there is little incentive for farmers to maintain large flocks in the uplands.

Payment under the SFP requires the farmer to keep lands in "Good Agricultural and Environmental Condition"

**The Rural Environment Protection Scheme (REPS)**
REPS is an EU-funded scheme for environmentally sensitive farming, introduced in 1994, which includes incentives to reduce stocking densities within proposed NHAs, SACs and on those lands designated as degraded (overgrazed) by the Department of Agriculture, Food and Forestry.

The positive impact of this scheme for calcareous scree conservation is dependent on several factors such as the uptake of REPS by farmers with large flock numbers in overgrazed areas. A reduction on the stocking density as a result of the implementation of the Commonage Framework Plan recommendations should reduce the impact associated with sheep grazing on these areas.

**National Farm Plan Scheme (NFPS)**
The NPWS launched a new 5 year National Farm Plan Scheme (NFPS) for landowners who are not in REPS within designated areas (SACs, SPAs) and commonage, in February 2006. This follows on from the requirements of the EU Natural Regulations and the Wildlife (Amendment) Act, 2000. The scheme allows the Department to pay farmers and landowners for losses incurred through restrictions caused by the designation of lands as a SAC or a SPA or to pay for certain actions, which are of benefit to nature and are agreed in a Farm Plan.

In the particular case of calcareous scree and other upland habitats, the NFPS provides the following recommendations:

- Stocking density rates must be set down by a planner.

- The location of feeding points to reduce heavy grazing, trampling, poaching and erosion problems should be regulated.
- The use of fertilisers and herbicides and water pollution should be also regulated.

The NFPS prohibits the following practises including: in-filling or rock removal; creation of new tracks or paths. Its success obviously depends on the farmers' participation.

### Overall Habitat Future Prospects

Several schemes (e.g. SFP, REPS, NFPS) address the recovery of large areas of degraded habitat. A national survey of upland habitats to accurately survey and classify upland habitats such as calcareous scree is required. This will provide information to determine the requirements for the conservation of the habitat.

However, a series of impacting activities (i.e., trampling, mountaineering, recreational activities and overgrazing) continue to threaten the habitat both in designated and undesignated sites. In the absence of a field survey, the threats to the habitat are not accurately quantified but it is deemed that the habitat is still moderately threatened and slowly declining. While future prospects are encouraging, the long-term viability is not assured, and thus it is assessed as likely to be **Unfavourable Inadequate.**

## *6 OVERALL ASSESSMENT OF HABITAT CONSERVATION STATUS*

The habitat conservation status of the four main attributes has been assessed as follows:

- The **Favourable Reference Range** (FRR) is estimated to be 100% of the historical habitat range and is thus **Favourable**. The Natural Range for this habitat potentially covers 1,000 $km^2$ (10 grid cells selected x 100 $km^2$), (see **Figure 1 and 1b**).
- The **Extent** of calcareous scree habitat has probably decreased, though exact figures for the decline are not available. By using the DTM generated polygons for north and north-east facing slopes on limestone geology above 350m in elevation with a slope > $40^o$ it is possible to produce a very rough estimate of the potential area of calcareous scree in Ireland. The extent of the habitat is therefore deemed unknown **though NPWS have estimated an area** and the trend is negative due to overgrazing and an increasing amount of leisure activities. **This results in Unfavourable – Inadequate.**
- An Unknown - but likely to be **Unfavourable Inadequate (U1)** assessment is given to the habitat **Structures and Functions** based on the increase in impacting activities and expert opinion.
- The habitat's **Future Prospects** are likely to be **Unfavourable Inadequate (U1)** - due to pressure from impacting activities (e.g. trampling, leisure related activities and overgrazing).

Thus, considering the assessment for the four main attributes for this habitat the overall **Conservation Status** for calcareous scree is Unknown - but likely to be **Unfavourable Inadequate (U1).**

# 7 Appendices

# 8 *APPENDIX 1. PUBLISHED SOURCES OF DATA ON CALCAREOUS SCREE SLOPES* (this information is now contained in the form at the front of this document).

# *9 APPENDIX 2. UNPUBLISHED SOURCES OF DATA ON CALCAREOUS SCREE SLOPES*

**Unpublished sources of data on calcareous scree slopes in Ireland.**

| Name of Author | Information Source | Report |
|---|---|---|
| Anonymous. (1994). | 001403 NHA Site Card. | Unpublished report, National Parks and Wildlife Service. |
| Casey, S. (1997). | Conservation Plan for NATURA 2000 Site – Arroo Mountains cSAC (Site Code: 001403). | Unpublished report, National Parks and Wildlife Service. |
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| Douglas, C., Dunnells, D., Scally, L. and M. B. Wyse Jackson. (1990). | A survey to locate lowland-highland blanket bogs of scientific interest in counties Donegal, Cavan, Leitrim and Roscommon. | Unpublished report, National Parks and Wildlife Service. |
| Hakelier, N. (1972). | Rare and Threatened Bryophyte Survey. | Unpublished report, National Parks and Wildlife Service. |
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| Holyoak, D. (2002). | Rare and threatened bryophyte survey. | Unpublished report, National Parks and Wildlife Service. |
| Holyoak, D. (2003). | Rare and threatened bryophyte survey. | Unpublished report, National Parks and Wildlife Service. |

| Name of Author | Information Source | Report |
|---|---|---|
| Holyoak, D. (2004). | Rare and threatened bryophyte survey. | Unpublished report, National Parks and Wildlife Service. |
| Leach H. and M. Loftus. (1993). | 000623 NHA Site Card (site visits 18/10/93- 21/10/93 and 26/10/93-27/10/93). | Unpublished report, National Parks and Wildlife Service. |
| Mooney, E., Goodwillie, R. and C. Douglas. (1991). | Survey of mountain blanket bogs of scientific interest. | Unpublished report, National Parks and Wildlife Service. |
| NATURA 2000. (1999). | 001656 explanatory notes. | Unpublished report, National Parks and Wildlife Service. |
| NATURA 2000. (1999). | 000623 explanatory notes. | Unpublished report, National Parks and Wildlife Service. |
| Rare and threatened plant database. (2007). | National Parks and Wildlife Service. | Unpublished report, National Parks and Wildlife Service. |
| Ryan, C., Foley, P., Flexen, M. and T. O'Donoghue. (1995). | 000375 NHA Site Card (site visits 16 - 19/10/5, 25 and 27/10/95, 02/11/95). | Unpublished report, National Parks and Wildlife Service. |
| Stewart, N. (1993). | Bryophyte Report. | Unpublished report to NPWS. |
| Stewart, N. F. (1991). | BSBI Atlas Field Card for Ben Bulben. | Unpublished field records. |
| Van Doorslaer, L., Leach, H., O' Connor, M., Keane, S., Loftus, M., Mullinger, S and Wyse Jackson, M. (1993). | 001656 NHA Site Card | Unpublished report, National Parks and Wildlife Service. |

## *10 APPENDIX 3. CALCAREOUS SCREE DISTRIBUTION MAPPING*

The database contains information on the following:

- Species Name
- Designated Site Code (NATURA 2000 sites or Natural Heritage Areas)
- Description of the location of the species
- Altitudinal information (either in feet (‘) or metres (m) depending on the antiquity of the record)
- Grid Reference (if provided) – these were assigned an accuracy rating
- Source of data (published or unpublished reference)
- Date of record
- List of associated species (if present)
- Indication of whether the description indicated a single species record, an assemblage of species or a description of habitat cover*
- Any information on substrate or underlying geology

* Given the variability of data sources, records of indicator species have been described either as an assemblage of species, a single species location or as an indication of habitat cover, depending on the quality and source of the data. For example a historical record by Corry (1884), which only contained details of a particular species at a certain altitude on Ben Whisken (Site Code: 000623) was entered as a single plant species location, whereas a description of several arctic-alpine species on a cliff above a corrie lake on Mount Brandon (Site Code: 000375) by Stelfox (1951) was entered as a species assemblage. Where there was a good description of an area of alpine heath (such as that given by Conaghan et. al. (1994) in the NHA Site Card for the Twelve Bens (Site Code: 002031)) this was entered as habitat cover.

Data for all of the above fields in the database was not necessarily contained in the original publication/source for each record and based on the description of the locations given an appropriate Site Code was assigned to each record using the Discovery and 62” Mapping on Arc View 3.2.

Potential locations for calcareous scree in addition to those known designated sites for, which calcareous scree is a qualifying interest (see **Table 3**) were identified in this manner following the literature review. Some of these sites were already designated as SACs but calcareous scree was not listed as a qualifying interest (see **Table 4**), others were existing NHAs (see **Table 5**).

**Table 3. Designated sites for, which calcareous scree is a qualifying interest.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 000623 | BEN BULBEN, GLENIFF AND GLENADE COMPLEX | SAC/NHA |
| 001656 | BRICKLIEVE MOUNTINS AND KEISHCORRAN | SAC/NHA |

**Table 4. Additional sites identified during the literature review, which are likely to contain calcareous scree based on the presence of indicator species or elevation.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 001403 | AROO MOUNTAIN | SAC/NHA |

It must be stated, however, that although areas of calcareous scree may occur in these mountain ranges they may not conform to the Habitats Directive definition, as this will depend on the species complement present.

**Table 5. NHAs*, which contain areas of upland habitat at elevations > 350m and potentially contain calcareous scree as derived from the digital terrain model.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 002430 | Aghavogil Bog NHA* | NHA |
| 002435 | Crockauns/Keelogyboy Bogs NHA* | NHA |

* Only those NHAs, which have NHA in the Site Name, are currently designated.

**Extent:**
The literature review and consultations with experts on calcareous scree has indicated that whilst the presence of indicative obligate arctic-alpine species within known sites is reasonably well documented for certain documented mountain ranges, this information cannot be used to determine the precise extent of the habitat either within a site or on a previously undesignated mountain range. In the absence of a national survey, the best attempt that could be made to determine extent was to utilise the rare, threatened and scarce plant data, which gives accurate point locations of obligate arctic-alpine species coupled with altitudinal information to indicate likely areas of calcareous scree.

The principal sources of recent information pertaining to the location and distribution of calcareous scree species, which included grid references* include:

- National Parks & Wildlife Rare, Threatened and Scarce Plant Databases,
- Rare, Threatened and Scarce Plant County Survey Reports,
- The New Atlas of the British and Irish Flora (2002),
- County Floras – many of the locations of indicator species were manually assigned to either a 10km² or 1km² grid based on the descriptions of locations detailed in these publications,
- National Rare and Threatened Bryophyte Surveys,
- Published papers with records of indicator species, which were assigned to either a 10km² or 1km² grid square,
- Unpublished field records of one of the principal authors of this report (Dr. Curtis) and other NPWS staff,

*These data sources provided data in a wide variety of levels of mapped accuracy, which ranged from an accuracy of:
- 1or 10m (recent county rare or threatened plant/bryophyte surveys),
- 100m (unpublished field records),
- 1km² square grids (County flora records)
- 10km² square grids (older publications or historical records of rare or threatened plant species).

These records were thus assigned an accuracy rating (relative to the nearest metre) in the database and were then plotted in Arc View 3.2 using an appropriate visual scale. This data was used coupled with other criteria listed below to indicate the likely extent of the habitat.

The key species used to try to determine an indicative extent of **calcareous scree** in Ireland are the 'true' alpine species for the habitat listed in **Table 3** in the main body of the report as follows:
- *Alchemilla glaucescens*
- *Arenaria ciliata*

- *Salix phylicifolia*
- *Silene acaulis*

Records for these species are available at an accuracy of a 10km square, a 1 km square, at 100m and at 1m and a map of the indicative extent of calcareous scree is presented in **Figure 3**. There were 83 records available at this accuracy level and these are identified as either single species records (shown as orange points) (47 records available) or as species assemblages (36 records) (shown as green points).

By using the data derived from the DTM polygons, which show all areas that are north and north east facing above 350m in calcareous areas the area of calcareous scree is unlikely to be greater than 1176.48 Ha or 11.76 Km² and is more likely to be significantly below 30.16 Ha or 0.3 Km², which is the area of all polygons from north and north east facing slopes above 350m with a slope >40º in calcareous areas. Note that neither of these areas would include areas of scree from the Bricklieve Mountains (Site Code: 001656) which is below 350m in elevation.

The data collated by the Botanical Society of the British Isles was not used for the following reasons:

- typically the mountain summits were not surveyed during the Atlas,
- the data, which are presented, is available only on a 10km basis and at that scale does not indicate 'effort 'i.e. whether a plant was no longer recorded from a location or, that, that location was not surveyed.
- the Atlas data are not fully accurate for the Irish context (many of the records were incorrectly gridded, while others were assigned to the wrong year classes. This was despite detailed corrections from NPWS, which were not corrected).

To produce a map showing anything other than an indicative extent is rendered difficult because the available information relating to the occurrence of this habitat is based on plant species location rather than habitat extent. The areas of calcareous scree are often located within a mosaic of other habitats including exposed rock, heaths and grassland, and so it is difficult to assume a minimum area where the alpine plant species occur. In addition, large areas of upland habitats in Ireland remain unsurveyed.

The **accurate** mapping of the distribution and extent of calcareous and calcshist screes of the montane to alpine levels (8120) habitat as described in the Habitats Directive has therefore not been possible.

## *APPENDIX 4. OTHER SOURCES OF DATA*

### A. Commonage Framework Plans – Department of Agriculture & Food and the National Parks and Wildlife Service (NPWS).

The Department of Agriculture & Food and the NPWS have produced the Commonage Framework Plans (CFPs) and NHA/SAC/SPA stocking and damage assessments. These plans crudely describe the habitats, condition of the land use and plant species found in each sub-unit of each agricultural unit. Depending on the condition of the land, a % de-stocking is recommended and a time-frame suggested for recovery of the land.

Common ownership of large areas of unfenced heath and bog land is the principal type of land ownership in the western peatland and upland areas of Ireland. Thus, up to 80% of all land in Connemara and west Mayo is commonage (O'Connor, 2000). According to the maps produced by the CFP the overall extent of commonage land in Ireland is approximately 438,000ha. Unfortunately, it is not possible to use this dataset to determine the extent or area of calcareous scree slopes in Ireland as this habitat was not identified in the report. In addition, the mapping of habitats was done at a crude level and the main mapping criterion was damage level and not habitat type.

The CFPs thus can only be used to provide an indication of the damage status of habitats (including calcareous scree slopes) on commonage land, and this was crudely used to ascertain the conservation status of structure and functions of this habitat.

### B. NPWS Enquiries Database

This is a comprehensive NPWS internal database, which includes data on designated sites and habitats contained within them. This database was used to confirm the sites for, which calcareous scree slope was a qualifying interest.

### C. Habitat Assignment Project (NPWS, 2006)

This desktop project was undertaken by NPWS and the main aim was to identify and list the habitats listed in the Annex I of the Habitats Directive (92/43/EEC) which were reported within a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, Aerial photographs, NGO proposals, etc. No potential sites were identified from the data.

## *11 APPENDIX 5. COMMONAGE FRAMEWORK PLANS DATA*

The CFPs mapped the extent and severity of grazing damage within agricultural sub-units. The criteria use to assess the level of damage and the resultant destocking levels is given below (**Table 1**). In addition, the habitats occurring within these areas were also mapped. The following habitats were recognised during the Commonage Framework Plan surveys and their symbols are indicated within brackets:

(I) Blanket bog
(II) Wet Heath
(III) Dry Heath (includes maritime)
(IV) Upland grassland
(V) Other habitats
(VI) Improved grassland
(VII) Dune
(VIII) Unimproved wet grassland
(IX) Unimproved dry grassland
(X) Fen/Marsh/Swamp
(XI) Saltmarsh
(XII) Beach/Shingle/Reef/Shore
(XIII) Limestone Pavement / Grassland
(XIV) Limestone Pavement (>75%)
(XV) Scrub
(XVI) Permanent open water (turlough)

As can be seen there is no specific category given for calcareous scree slope.

**Table 1 Criteria for the assessment of damage and the resultant destocking levels (Conaghan, 2001).**

| Damage category | Condition of vegetation/amount of bare soil | Suggested destocking level |
|---|---|---|
| Undamaged (U) | Vegetation not grazed or only very lightly grazed. No bare ground present. | 0% |
| Moderate to undamaged (MU) | <5% bare ground. Grazing usually evident, but damage only just detectable. | 30% |
| Moderately damaged (MM) | <5% bare ground. Signs of damage intermediate in intensity between MU and MS. | 50% |
| Moderate to severely damaged (MS) | <5% bare ground. Damage widespread and obvious. | 65% |
| Severely Damaged (S) | >5% bare ground. Damage due to grazing obvious and widespread. | 85% |
| Very Severely Damaged (S*) | >10% bare ground with abundant evidence of high grazing levels. | 100% |

Commonage lands, which are likely to contain calcareous scree slope either on its own or as a mosaic with other habitats, were mapped during the CFP. A broad-brush review of this data indicates that 53% of the lands in commonage within sites, which contain calcareous scree, show some degree of damage.

## *13. APPENDIX 6. GLOSSARY*

ALTITUDE - Vertical height above sea level.

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for, which SACs have to be designated.

BLANKET BOG – Bogs, which carpet the landscape, following the underlying topography. They can cover extensive areas along the west coast and on uplands throughout the country.

CALCAREOUS –Rich in calcium, Lime loving.

CALCAREOUS ROCKY SLOPES – these are areas of exposed rock, which are typically found on the north and north-east facing slopes of mountains of calcareous origin, i.e. limestone mountains. These slopes are typically >40º, and are found at elevations above 350m. Calcareous rocky slope vegetation is also found in mountain ranges, which are siliceous in origin. These are typically areas of cliff, which have been metamorphosed in the past and, which are slightly more mineral rich than the adjoining areas. The true alpine species for this habitat includes – *Alchemilla alpina, Alchemilla glaucescens, Arenaria ciliata, Asplenium viride, Cardaminopsis petraea, Deschampsia caespitosa ssp. alpina, Epilobium alsinifolium, Euphrasia frigida, Oxyria digyna, Phegopteris connectilis, Poa alpina, Polygonum viviparum, Polystichum lonchitis, Salix phylicifolia, Saussurea alpina, Saxifraga hartii, Saxifraga nivalis, Saxifraga oppositifolia, Saxifraga rosacea, Silene acaulis, Thalictrum alpinum.*

CALCAREOUS SCREE – these are areas of scree, which are typically found on the north and north-east facing slopes of mountains of calcareous origin, i.e. limestone mountains. These slopes are typically >60º, and are found at elevations above 350m. The true alpine species for this habitat includes –*Alchemilla glaucescens, Arenaria ciliata, Cardaminopsis petraea, Polygonum viviparum, Salix phylicifolia, Saxifraga oppositifolia, Silene acaulis.*

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CORINE - Information and mapping system, developed within the context of the Commission of the European Communities biotope project, which is used as a tool for the description of sites of importance for nature conservation in Europe. It catalogues recognisable communities of flora and fauna. The primary objective of this catalogue is to identify all major communities whose presence contributes to the conservation significance of a site. Included in this list of communities are interesting but rare natural or near-natural communities as well as the more widespread semi-natural ones.

DEHLG - Department of Environment, Heritage and Local Government

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions, which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for, which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within, which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in, which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive, this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms, which are all influenced by the underlying geology.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

MOSAIC - Used to describe habitats that occur together and cannot easily be mapped separately.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which, the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats, which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

QUALIFYING INTERESTS – The habitat(s) and/or species for, which an SAC or SPA is designated.

REPS - Rural Environment Protection Scheme. This is an Agri-Environmental programme, which seeks to draw up agreements with farmers, according to the type of farming, landscape and features on the land. The overall objectives of REPS are to achieve: the use of farming practices, which reduce the polluting effects of agriculture by minimising nutrient loss- an environmentally favourable extensification of crop farming, and sheep farming and cattle farming; - ways of using agricultural land, which are compatible with protection and improvement of the environment, the countryside, the landscape, natural resources the soil and genetic diversity; - long-term set-aside of agricultural land for reasons connected with the environment; - land management for public access;- education and training for farmers in types of farming compatible with the requirements of environmental protection and upkeep of the countryside.

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from, which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SACs have also been known as cSACs, which stands for "candidate Special Areas of Conservation", and pcSACs, which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas, which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

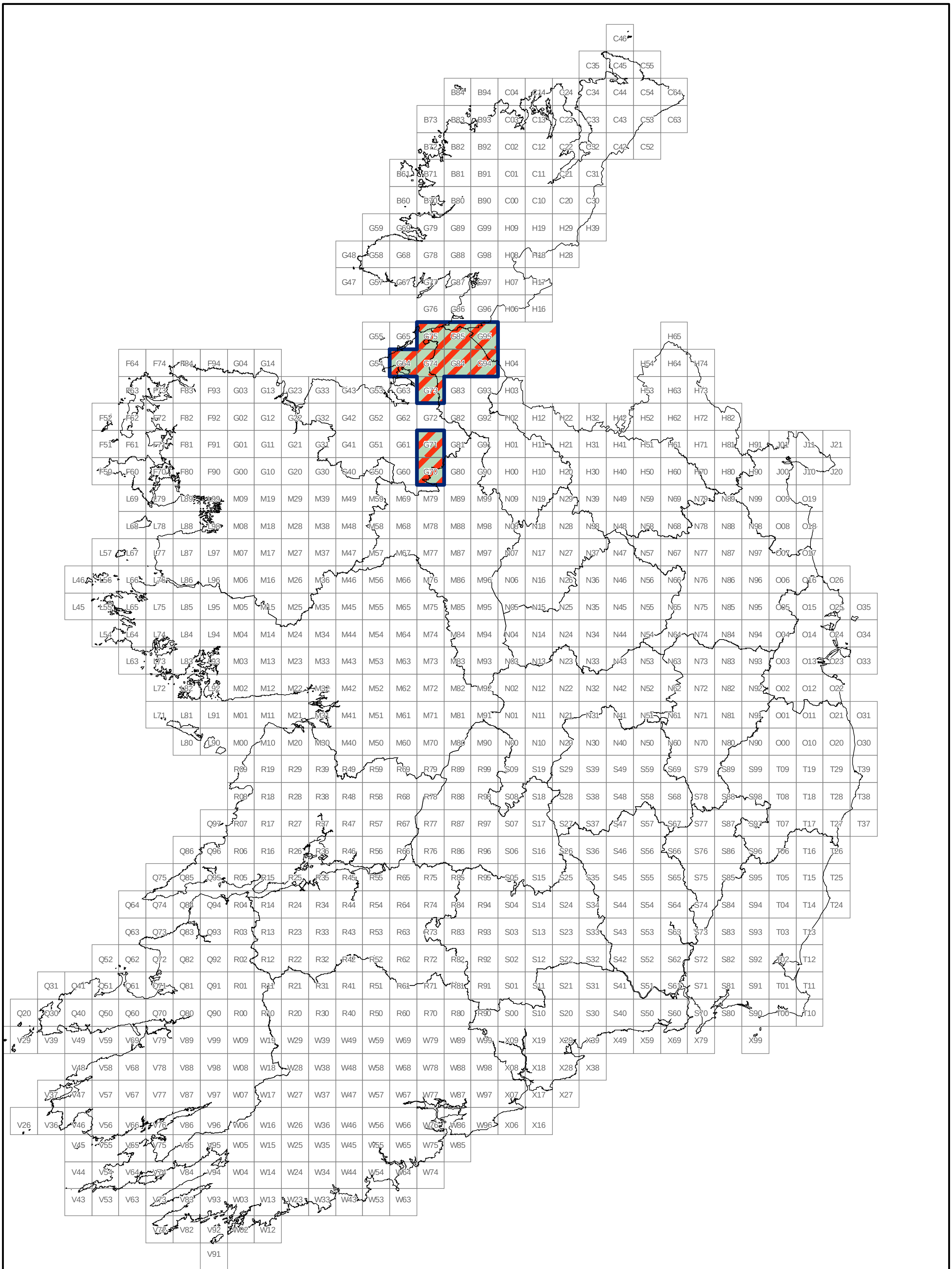
SPECIES - The lowest unit of classification normally used for plants and animals.

## **8120** Calcareous and calchist screes of the montane to alpine levels in Ireland (Thlaspietea rotundifolii)

| National Level | |
|---|---|
| **Habitat Code** | 8120 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |
| **Biogeographic level** | |
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | Barrington, M. A. and R. P. Vowell. (1885). XXV - Report on the flora of Ben Bulben and the adjoining mountain range in Sligo and Leitrim. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. IV - Science. P. 493 - 517.<br>Carrothers, E.N. and J. Mc. K. Moon. (1946). *Arabis petraea* Lam. In Co. Leitrim<br>Corry, T. H. (1884). On the heights attained by plants on Ben Bulben. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. IV - Science. P. 73 - 77.<br>Cotton, D. F. C. and M. Cawley. (1991). New records of vascular plants from Cos. Sligo (H28) and Leitrim (H29). *Irish Naturalists' Journal.* Vol. 24. No. 7. P. 288 - 295.<br>Curtis, T. G. F. and C. Mothershill. (1977). New additions to the flora of County Leitrim (H29). *Bulletin of The Irish Biogeographical Society.* No. 2. P. 42 - 44.<br>Curtis, T. G. F., Goodwillie, R. and R. Young. (1978). Areas of scientific interest in Co. Sligo. *Revised and expanded report. An Foras Forbartha, Dublin.*<br>Day, G. V. (2002). BSBI field meetings in Ireland 2002. *Irish Botanical News.* P. 39 - 42.<br>Gilbert, O. L. and A. M. Fryday. (1996). Observations on the lichen flora of high grounds in the west of Ireland. *Lichenologist.* Vol. 28. No. 2. P. 113 - 127.<br>Goodwillie, R. (1972). A preliminary report on areas of scientific interest in Co. Sligo. *An Foras Forbartha, Dublin.*<br>Goodwillie, R. (1978). Areas of scientific interest in Co. Leitrim. *An Foras Forbartha, Dublin.*<br>Hart, H. C. (1884). XV - Notes on the plants of some of the mountain ranges of Ireland. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. IV - Science. P. 211 - 251.<br>Hart, H. C. (1891). On the range of flowering plants and ferns of the mountains of Ireland. *Scientific Proceedings of the Royal Irish Academy.* Ser. III. Vol. I. P. 512 - 570.<br>Kirby, N., Lockhart, N. and D. Synnott. (1980). Bryological observations at Gleniff, Co. Sligo (H28). *Bulletin of The Irish Biogeographical Society.* No. 4. P. 30 - 32.<br>Moran, B. (1992). Report on DNFC field trip to Co. Sligo. *The Dublin Naturalist's Field Club Newsletter.*<br>Perring, F. H. and S. M. Walters. (1990). Atlas of the British Flora. *BSBI, Wiltshire.*<br>Porley, R. and N. Hodgetts. (2005). Mosses and liverworts. *The New Naturalist Library, HarperCollins.*<br>Praeger, R .L. (1905). *Epilobium alsinefolium* in Co. Leitrim. *Irish Naturalist.* Vol. XIV. P. 223.<br>Praeger, R .L. (1905). Plants of the Ben Bulben District. *Irish Naturalist.* Vol. XIV. P. 221.<br>Praeger, R. L. I. (1909). A tourist's flora of the west of Ireland. *Hodges Figgis, Dublin.*<br>Praeger, R. L. I. (1934). The botanist in Ireland. *Hodges Figgis, Dublin.*<br>Rodwell, J. S. (1998). British Plant Communities. Volume 3 - Grasslands and Montane Communities. *Cambridge University Press, Cambridge.*<br>Sheehy Skeffington, M. and M. O'Connell. (1985). Botanical notes from three sites in east Mayo and Sligo. *Irish Naturalists' Journal.* Vol. 21, P. 419-420. |

| | |
|---|---|
| | Stelfox, A. W. (1955). *Salix hibernica*. *Irish Naturalists' Journal.* Vol. 15. P. 25 - 29.<br>Stelfox, A. W. (1970). The forms of *Cardaminopsis petraea* (L.) in Ireland. *Irish Naturalists' Journal.* Vol. 16. No. 10. P. 308 - 309.<br>Synnott, D. M. (1983). Notes on *Salix phylicifolia* and related Irish willows. *Glasra.* 7: 1 - 10.<br>Webb, D. A. (1947). The vegetation of Carrowkeel, a limestone hill in north-west Ireland.<br>Webb, D. A. and M. J. P. Scannell. (1983). Flora of Connemara and the Burren. *Royal Dublin Society and Cambridge University Press, Cambridge.*White, J. and G. Doyle. (1982). The vegetation of Ireland: a catalogue raisonné. *Journal of Life Sciences. Royal Dublin Society.* 3. P. 289 - 368.<br>Winder, F. G. A. and J. J. Moore. (1947). Some notes on the rarer plants of the Ben Bulben range. *Irish Naturalists' Journal.* Vol. IX. P. 68 - 72. |
| Range | |
| Surface area | The Natural Range for this habitat potentially covers 1,000 km² (10 grid cells selected x 100 km²). |
| Date | 1800s to 2006. |
| Quality of data | 1 = poor (based on very incomplete data with expert opinion). |
| Trend | Likely to be stable. |
| Trend-Period | 1950 - 2006 |
| Reasons for reported trend | |
| **Area covered by habitat** | |
| Surface area | Unknown though estimated by NPWS to be 0.05 $km^2$ |
| Date | 1800 - 2006. |
| Method used | 1 =Mostly based on expert opinion |
| Quality of data | 1 = poor (based on very incomplete data with expert opinion) |
| Trend | Negative. |
| Trend-Period | 1950 – 2006 |
| Reasons for reported trend | 3 = direct human influence ( overgrazing and trampling) |
| Justification of % thresholds for trends | Increase in the intensity of impacting activities (e.g. trampling, overgrazing) suggest this negative trend. |
| Main pressures | 142 Overgrazing by sheep<br>390 Mining and extraction activities<br>624 Mountaineering, rock climbing, speleology |
| Threats | 142 Overgrazing by sheep<br>390 Mining and extraction activities<br>702 Air pollution – acidification |
| ***Complementary information*** | |
| **Favourable reference range** | Favourable, as the Favourable Reference Range for this habitat potentially covers 1,000 km² (10 grid cells selected x 100 km²) |
| **Favourable reference area** | The precise surface area of calcareous scree in Ireland is unknown and cannot be accurately determined in the absence of a dedicated field survey to confirm the complement of species present. Nonetheless, **a rough estimate has been given by NPWS** leading to an assessment of Unfavourable Inadequate. It is felt that Favourable Reference Area is > current area. |
| **Typical species** | Vascular plants within calcareous scree are described as either obligate (true) alpine species or facultative species (which are those that are also found at lower elevations and in other habitats).<br>**Obligate alpine species:**<br>*Alchemilla glaucescens, Arenaria ciliata, Cardaminopsis petraea, Polygonum viviparum, Salix phylicifolia, Saxifraga oppositifolia, Silene acaulis*<br>**Facultative species:**<br>*Angelica sylvestris, Arabis hirsuta, Cystopteris fragilis, Draba incana*<br>*Dryas octopetala, Euphrasia salisburgensis, Juniperus communis, Koeleria macrantha, Saxifraga aizoides, Saxifraga hypnoides, Sesleria albicans* |

| | |
|---|---|
| | *Thymus praecox*<br><br>**Bryophytes and lichens:**<br><br>*Barbilophozia floerkii, Campylopus paradoxus, Cladonia furcata, Cladonia impexa, Cladonia squamosa, Cladonia uncialis, Dicranum majus, Dicranum scoparium, Eurhynchium praelongum, Hypnum cupressiforme, Isopterygium elegans, Lophozia ventricosa, Mnium hornum, Oedipodium griffithianum, Plagiothecium undulatum, Pleurozium schreberi, Pogonatum urnigerum, Polytrichum alpinum, Polytrichum formosum, Pseudotaxiphyllum elegans, Ptilidium ciliare, Racomitrium spp., Rhytidiadelphus loreus.* |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Typical species conservation status: Unfavourable inadequate |
| **Other relevant information** | 1. As this habitat is restricted by altitude, the range does not extend beyond the current known distribution.<br><br>2. By using the Digital Terrain Model generated polygons for north and north-east facing slopes on limestone geology above 350m in elevation with a slope > 40º it is possible to produce a very rough estimate of the potential area of calcareous scree in Ireland. These areas are also likely to contain other habitats such as siliceous and calcareous rocky slopes, siliceous scree, alpine heath or dry and wet heath. Bricklieve Mtns, which do support the habitat, are excluded as they are lower than 350m. The area as defined using the DTM is approximately 0.3 km². It is not possible to accurately determine what percentage of this area corresponds to calcareous scree slope as opposed to the other habitats listed above. The precise surface area of calcareous scree in Ireland is therefore **Unknown** and cannot be determined in the absence of a dedicated field survey to confirm the complement of species present. However, **a figure has been estimated by NPWS**, using expert judgement based on approximate proportions covered by the habitat . |
| **Conclusions**<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | **Favourable** |
| **Area** | **Unfavourable Inadequate** |
| **Specific structures and functions (incl. typical species)** | **Unfavourable Inadequate (U1)** - based on the increase in impacting activities and expert opinion. |
| **Future prospects** | **Unfavourable Inadequate (U1)** - due to pressure from impacting activities . |
| **Overall assessment of CS** | **Unfavourable Inadequate (U1).** |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Calcareous and calcshist screes of the montane to alpine levels**
***(Thlaspietea rotundifolii)***

**8120**

Current Distribution (10 cells)
Current Range (10 cells)
Favourable Reference Range (10 cells)
W48 10km grid cells

Date: October 2007

# 8210 CALCAREOUS ROCKY SLOPES WITH CHASMOPHYTIC VEGETATION

# CONSERVATION STATUS ASSESSMENT REPORT

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# 8210 CALCAREOUS ROCKY SLOPES WITH CHASMOPHYTIC VEGETATION

# CONSERVATION STATUS ASSESSMENT REPORT

## *1 HABITAT CHARACTERISTICS IN IRELAND*

### 1.1 Definition of calcareous rocky slopes with chasmophytic vegetation in Ireland

A definition of calcareous rocky slopes with chasmophytic vegetation (hereafter referred to as calcareous rocky slope) cannot be made without first reference to the term 'montane', which is also understood as 'alpine' in Ireland. In the historical literature, the convention in Ireland has been to apply the term 'alpine' to those areas of habitat above 350-450 metres (1,200 – 1,500 ft) in altitude. However, the easy application of this label is very difficult as areas of 'alpine' vegetation may occur much lower than this, and the occurrence of this habitat is ultimately dependent on a number of factors principally geographical location, aspect, levels of exposure and not least, biogeographical history. In general, an alpine zone on Irish mountains occurs within the altitudinal range above but, moving northwards and westwards, it is met with at increasingly lower levels.

From a vegetation point of view, assemblages of alpine plants of screes, are confined to the more or less vertical, bare, north-east facing cliffs or areas of outcropping rock on slopes, which had their origins during the last glacial periods. It is widely considered that the alpine species occupying these areas are relictual in nature and represent the last vestiges of the arctic/tundra floristic component that was widespread in Ireland during the Pleistocene period.

There has been little published on the vegetation of Irish mountains, even though some systematic work was carried out on them during the 1970s. However, White and Doyle (1982) recognized 6 associations within 4 Classes, which probably encompass the range of variation found within the alpine cliff communities.

**Table 1** presents a list of Associations indicative of scree and rocky slopes, which are specifically alpine in nature and, which correspond to the Annex I habitats. Calcareous rocky slopes are in a wide variety of classes including the 'Spring Vegetation', 'Wall Fern', 'Bog and Wet Heath' and 'Artic-Alpine grass heaths' Classes, but it should be noted that there is often overlap between it and the other scree and rocky Annex I habitats, which include:

- 4060 Alpine and Boreal Heaths
- 8120 Calcareous scree of the montane to snow levels
- 8220 Siliceous rocky slopes with chasmophytic vegetation

and that these habitats above often occur as part of a mosaic of vegetation, which can include alpine heath, upland grasslands, wet heath and dry heath. Consequently, it is considered that the term 'alpine' only be applied to those categories listed, in which the diagnostic species, appropriate to each is present. It should be noted that there is some doubt as to the exact nature of some of the categories as a systematic phytosociological survey of Irish alpine vegetation has not yet been carried out.

**Table 1. Table of plant associations found on alpine cliffs and alpine heaths in Ireland based on White & Doyle (1982) and Curtis (1993).**

| Class | Association | Diagnostic species |
|---|---|---|
| Wall fern - *Asplenietea-rupestria* | *Polysticho-Asplenietum viridis* | *Polystichum lonchitis, Asplenium viride.* |
| Spring vegetation - *Montio-Cardaminetea* | *Philonotido fontanae-Saxifragetum stellaris*<br><br>*Saxifragetum aizoidis* | *Saxifraga stellaris, Montia fontana ssp fontana, Dicranella palustris, Philonotis fontana, Scapania uliginosa.*<br><br>*Saxifraga aizoides, S. oppositifolia, Alchemilla glabra, Selaginella selaginoides.* |
| Arctic-alpine grass heaths | *Breutelio-Seslerietum*[1] | *Arenaria ciliata, Saxifraga aizoides, Silene acaulis, Euphrasia salisburgensis, Breutelia chrysocoma, Sesleria albicans.* |
| Bog and Wet Heath | *Arctostaphylo-Dryadetum*[2]<br><br>*Lycopodio-alpini-Rhacomitrietum lanuginosi* | *Dryas octopetala, Calluna vulgaris, Juniperus communis* ssp. *nana, Arctostaphylos uva-ursi, Pyrola minor, Empetrum nigrum, Listera cordata.*<br><br>*Lycopodium alpinum, Racomitrium lanuginosum, Salix herbacea, Carex bigelowii, Juniperus communis* ssp *nana, Arctostaphylos uva-ursi, Vaccinium vitis-idaea.* |

*Notes:*

[1] White and Doyle assign the *Breutelia-Seslerietum* to the Class of Arctic-Alpine grass heaths when it is actually an association found on wet cliffs on the Ben Bulben massif.

[2] The *Arctostaphylo-Dryadetum* is an association found on the higher parts of the Burren and is properly montane in nature

For most habitats listed in the Interpretation Manual of the Habitats Directive, there is a direct correspondence between its name and an Association of vegetation, which has been formally recognized by phytosociologists. However, for the Habitats Directive categories of alpine cliff habitats there is no direct equivalence between the habitat title and a specific Association of vegetation. Instead, there has been a broad, generic approach to the classification of alpine categories within the Interpretation Manual and consequently the formal assignation of areas of alpine habitat to these is not easily accomplished.

In some cases, individual Associations appear to be restricted to certain Interpretation Manual categories e.g. the *Polysticho-Asplenietum viridis* to Calcareous rocky slopes. However, the majority of Associations can occur in 2 or 3 Interpretation Manual categories viz. *Saxifragetum aizoidis* and *Breutelia-Seslerietum* in both Calcareous scree slopes and Calcareous rocky slopes, whilst the *Philonotido fontanae-Saxifragetum stellaris* may be included within both of the Chasmophytic categories of Calcareous and Siliceous slopes. The consequences of this are that the accommodation of Irish alpine habitats, species and vegetation within the categories of the Interpretation Manual is not easily accomplished and it must be recognized, that on the ground, there is a great deal of overlap between Habitats Directive categories.
However, for the purposes of the Habitats Directive, alpine cliff and scree habitats in Ireland are considered to belong to four categories:

The alpine cliff and scree communities are accommodated within:

- **(8110) Siliceous scree of the montane to snow levels**
- **(8120) Calcareous and calcshist screes of the montane to alpine levels**
- **(8210) Calcareous rocky slopes with chasmophytic vegetation**
- **(8220) Siliceous rocky slopes with chasmophytic vegetation**

Both categories of **Chasmophytic vegetation on rocky slopes** usually occur together or in close proximity to each other on Irish mountains. The calcareous subtype is well represented on limestone mountains and on siliceous areas of cliff which have been metamorphosed in the past and, which are slightly more mineral rich than the adjoining areas. Typically this last scenario pertains in small veins running through country rock, which is essentially siliceous in nature though in certain cases an entire mountain of metamorphic rock can occur amidst a range of relatively impoverished strata, such as at Muckanaght in the Twelve Bens in Connemara. The more siliceous components of the **Silicicolous subtype** equate approximately to the Wall fern class in Table 1 whilst the **Calcareous subtype** is broadly accommodated within the Spring vegetation and Arctic alpine grass heath listed there.

Though the four categories used to accommodate alpine scree and rocky vegetation in Ireland, for the purposes of the Habitats Directive, are appropriate for the designation of Special Areas for Conservation (SAC), they cannot be considered comprehensive for the purposes of defining alpine cliff and scree habitats and their vegetation. For the purposes of confirming the occurrence of and identifying montane areas where alpine screes and rocky habitats are found the conspectus of Associations given in **Table 1** should be used. However, a preliminary assignation of the associations of alpine vegetation appropriate to calcareous rocky slope is presented in **Table 2**. It is stressed that this is approximate and the production of a definitive account must await a thorough field investigation of the nature of Irish alpine vegetation.

**Table 2. NATURA 2000 alpine cliff and scree habitat categories and the likely plant associations based on White and Doyle (1982), which they contain.**

| NATURA 2000 Habitat title | Probable identity of plant association (White and Doyle (1982)) |
|---|---|
| **Siliceous scree** | *Cryptogrammetum;*<br>*Oxyrietum digynae;*<br>*Lycopodio-alpini-Rhacomitrietum lanuginosi* |
| **Calcareous scree** | *Saxifragetum aizoidis;*<br>*Breutelio-Seslerietum* |
| **Chasmophytic vegetation: Calcareous** | *Polysticho-Asplenietum viridis;*<br>*Philonotido fontanae-Saxifragetum stellaris;*<br>*Saxifragetum aizoidis;*<br>*Breutelia-Seslerietum;*<br>*Arctostaphylo-Dryadetum;*<br>*Lycopodio-alpini-Rhacomitrietum lanuginosi* |

| | |
|---|---|
| **Chasmophytic vegetation: Siliceous** | *Philonotido fontanae-Saxifragetum stellaris; Saxifrago-Chrysosplenietum oppositifoli; Herberto-Polytrichetum alpini; Lycopodio-alpini-Rhacomitrium lanuginosi* |

Some alpine associations occur in more than one habitat and in reality their expression is a function of the rock type on which they occur, the altitude, aspect, substrate size and degree of slope. In general, the greatest diversity of species occurs within the Calcareous scree/ Calcareous rocky slope habitats on the limestone mountains of the north-west with a lesser degree of diversity found within the Calcareous rocky slope habitat found on mountains of other rock types.

## 1.2 List of alpine and calcareous rocky plant species in Ireland

The listing of plant species occurring in alpine areas in Ireland is made possible for the vascular plants by the availability of lists from papers prepared by 19th century botanists, principally H.C. Hart who was the first to systematically examine the major mountain ranges in Ireland and who provided altitudinal data along with species occurrences. This has been added to over the 20th century by the discovery of further sites for alpine plants and it can be concluded that the species complements of Irish mountains is reasonably well known for the ferns and flowering plants. However, for the cryptogams, this is not the case and only certain well-botanised sites such as Ben Bulben (Site Code: 000623) and the Macgillicuddy's Reeks (Site Code: 000365) are well documented. However, the systematic survey of many Irish counties for bryophytes is ongoing and will eventually result in a comprehensive overview of the alpine mosses and liverworts.

Defining an alpine plant in Ireland is often made difficult as what may be alpine here may not be elsewhere in Europe and this is confounded by the behaviour of some lowland species, which occur on mountain tops and cliffs and act as alpine elements. For example, sea pink, *Armeria maritima* is found on the summit of Carrauntoohill at 1,034 m whilst on alpine cliffs a form of the common scurvy grass, *Cochlearia officinalis* a common coastal species, is sometimes found. A further illustration of the ecologically fickle nature of many Irish plants is crowberry, *Empetrum nigrum*, usually a species of high mountains but in County Mayo, it occurs at sea level.

The list of true alpines in Ireland is small, that is species, which never descend lower than 350m or away from cliff habitats and these are the true post-Pleistocene relicts, which can be considered as **Obligate Alpines** due to their virtual confinement to vertical, north-east facing cliffs or on exposed mountain ridges and summits. There conditions are severe enough to inhibit competition from coarser species and inaccessible enough to prevent grazing by animals. These may be joined here by what may be termed **Facultative Alpines**, which are species found in other habitats, not necessarily montane, but, which are also commonly associated with alpine locations.

**Table 3** lists the calcareous rocky slope species, which are found at high altitude in Ireland. It excludes species, which are very widespread and found across a range of habitats from sea level to mountain tops.

**Table 3: List of species found on calcareous rocky slopes in Ireland.**

| Latin Name | Obligate or Facultative Alpine Species |
|---|---|
| *Alchemilla alpina* | Obligate |
| *Alchemilla glaucescens* | Obligate |

| Latin Name | Obligate or Facultative Alpine Species |
|---|---|
| *Arenaria ciliata* | Obligate |
| *Asplenium viride* | Obligate |
| *Cardaminopsis petraea* | Obligate |
| *Deschampsia caespitosa* ssp. *alpina* | Obligate |
| *Epilobium alsinifolium* | Obligate |
| *Euphrasia frigida* | Obligate |
| *Oxyria digyna* | Obligate |
| *Phegopteris connectilis* | Obligate |
| *Poa alpina* | Obligate |
| *Polygonum viviparum* | Obligate |
| *Polystichum lonchitis* | Obligate |
| *Salix phylicifolia* | Obligate |
| *Saussurea alpina* | Obligate |
| *Saxifraga hartii* | Obligate |
| *Saxifraga nivalis* | Obligate |
| *Saxifraga oppositifolia* | Obligate |
| *Saxifraga rosacea* | Obligate |
| *Silene acaulis* | Obligate |
| *Thalictrum alpinum* | Obligate |
| *Angelica sylvestris* | Facultative |
| *Anthriscus sylvestris* | Facultative |
| *Arabis hirsuta* | Facultative |
| *Campanula rotundifolia* | Facultative |
| *Cochlearia officinalis (alpina)* | Facultative |
| *Crepis paludosa* | Facultative |
| *Cystopteris fragilis* | Facultative |
| *Draba incana* | Facultative |
| *Dryas octopetala* | Facultative |
| *Epilobium brunnescens* | Facultative |
| *Euphrasia salisburgensis* | Facultative |
| *Galium boreale* | Facultative |
| *Galium sterneri* | Facultative |
| *Geum rivale* | Facultative |
| *Juniperus communis* | Facultative |
| *Koeleria macrantha* | Facultative |
| *Meconopsis cambrica* | Facultative |
| *Plantago maritima* | Facultative |
| *Ranunculus auricomus* | Facultative |
| *Rhodiola rosea* | Facultative |
| *Samolus valerandi* | Facultative |
| *Saxifraga aizoides* | Facultative |
| *Saxifraga hypnoides* | Facultative |
| *Selaginella selaginoides* | Facultative |
| *Sesleria albicans* | Facultative |
| *Silene dioica* | Facultative |
| *Silene uniflora* | Facultative |
| *Thalictrum minus* | Facultative |
| *Thymus praecox* | Facultative |
| *Hieracium anglicum* | Facultative |
| *Jungermannia spp.* | |

## 2 *HABITAT MAPPING*

There has been no recent inventory or mapping of the national calcareous rocky slopes resource in Ireland. For the purposes of this survey, an extensive literature review of both published and unpublished material was undertaken (**Appendices 1** and **2**). Records documenting the occurrence of the species recorded from calcareous rocky slopes (as listed in **Table 3**) were collated in an *MS Access* **Uplands Habitats Database**. This database contains records of the obligate and facultative species of the five Annex I upland habitats (4060, 8110, 8120, 8210, 820) in Ireland and was designed specifically for the purposes of this report.

The **Upland Habitats Database** of this project, currently holds c.4,500 records of indicator species of all Annex I upland habitats (i.e. 4060, 8110, 8120, 8210 and 8220) which have been gleaned from a variety of sources (both published and unpublished as documented in **Appendices 1** and **2** respectively). Given the antiquity of the bulk of the data (c.1700 of the records date from the 1800s to the 1950s) and the lack of accurate geographical references (only c.1500 records have grid references of varying accuracy (see below and **Appendix 3** for further information) the GIS application of much of the collated data is limited. The bulk of records will not be illustrated in **Figures 1 to 3** due to their lack of grid references.

The database contains information on the following:

- Species Name
- Designated Site Code (NATURA 2000 sites (SACs) or Natural Heritage Areas (NHAs))
- Description of the location of the species
- Altitudinal information (either in feet (′) or metres (m) depending on the antiquity of the record)
- Grid Reference (if provided) – these were assigned an accuracy rating
- Source of data (published or unpublished reference)
- Date of record
- List of associated species (if present)
- Indication of whether the description indicated a single species record, an assemblage of species or a description of habitat cover*
- Any information on substrate or underlying geology

*Given the variability of data sources, records of indicator species have been described either as an assemblage of species, a single species location or as an indication of habitat cover, depending on the quality and source of the data. For example a historical record by Corry (1884), which only contained details of a particular species at a certain altitude on Ben Whisken (Site Code: 000623) was entered as a single plant species location, whereas a description of several arctic-alpine species on a cliff above a corrie lake on Mount Brandon (Site Code: 000375) by Stelfox (1951) was entered as a species assemblage. Where there was a good description of an area of alpine heath (such as that given by Conaghan et. al. (1994) in the NHA Site Card for the Twelve Bens (Site Code: 002031)) this was entered as habitat cover.

Data for all of the above fields in the database was not necessarily contained in the original publication/source for each record and based on the description of the locations given, an appropriate SAC Site Code was assigned to each record using the Discovery and 6″ Mapping on Arc View 3.2.

**GIS**

GIS data sources, which are related to ecological factors that determine the occurrence of calcareous rocky slopes, were used to produce the indicative natural range and potential distribution maps shown on **Figures 1** and **2**. These include:

- Contour lines >350m elevation. Ordnance Survey (1995) – 1:50,000 Discovery Series, 10m contour interval,
- A Digital Terrain Modelling package (2007) generated polygons, which were used to identify areas of potential calcareous rocky slope based on the following criteria:
    - elevation above 350m,
    - upland areas above 350m with a slope > 40º,
    - north and north-east facing slopes with a slope > 40º.

Investigation of the polygons created by the DTM indicated that not all slopes, which potentially contain calcareous rocky slopes, had been accurately identified (e.g. the north prison of Lugnaquilla within Wicklow Mountains SAC (Site Code: 002122) was not shown) and this was thought to be due to the use of the slope criteria. The use of this data thus has some limitations.

Although the use of recent (2000) digital aerial photographs of Ireland, which were ortho-rectified, was investigated, it became apparent that it was not possible to use these remotely to identify areas of calcareous rocky slope. This is because it is not possible to distinguish it accurately from scree in mosaics of vegetation of wet heath, dry heath and upland grassland.

## 2.1 Habitat Range

Calcareous rocky slopes are largely restricted to those areas of north and north-east facing slopes (>40º) above 350-450 metres (c.1,200 – 1,500ft) in height and can be found on both calcareous mountains and on areas of cliff, within siliceous mountain ranges, which have been metamorphosed in the past. These areas are slightly more mineral rich than the adjoining areas and hence can support calcicole species. The occurrence of this habitat is ultimately dependent on a number of factors, principally geographical location, aspect, levels of exposure, nature of the solid geology, local erosional features and fluvio-glacial history. The actual range of calcareous rocky slopes habitat as defined in the Habitats Directive Interpretation Manual is unknown in Ireland.

**Figure 1** shows the natural range of calcareous rocky slope in Ireland. This map is based on a variety of different data sources.

- Firstly the locations, of north and north-east facing slopes (> 40º) in upland areas (>350m in elevation) were plotted on a $10km^2$ basis (purple squares).
- Due to the limitations of the DTM in accurately identifying all slopes which potentially contain calcareous rocky slope (as described above), the locations of all SAC sites for which calcareous rocky slopes is a qualifying interest were also plotted on a $10km^2$ basis (pink squares) – note that this included sites which are below 350m in elevation (see **Appendix 3**).
- All remaining areas of SACs, which are either siliceous or calcareous in origin and where a portion of the SAC contains slopes above 350m with a north/north-east facing aspect and slopes > 40º were also plotted (see **Appendix 3**) as red squares.
- Two additional NHA sites were identified on the basis of geology and were confirmed from the Blanket Bog database as potentially containing calcareous rocky slope (these are shown as orange squares) (see **Appendix 3)**.
- Finally additional sites were identified as potentially containing calcareous rocky slopes on the basis of the presence of the true obligate species for the habitat and are shown as pale green squares (see **Appendix 3**).

As can be seen this habitat has a naturally discontinuous range in Ireland, as it is restricted by altitude and aspect.

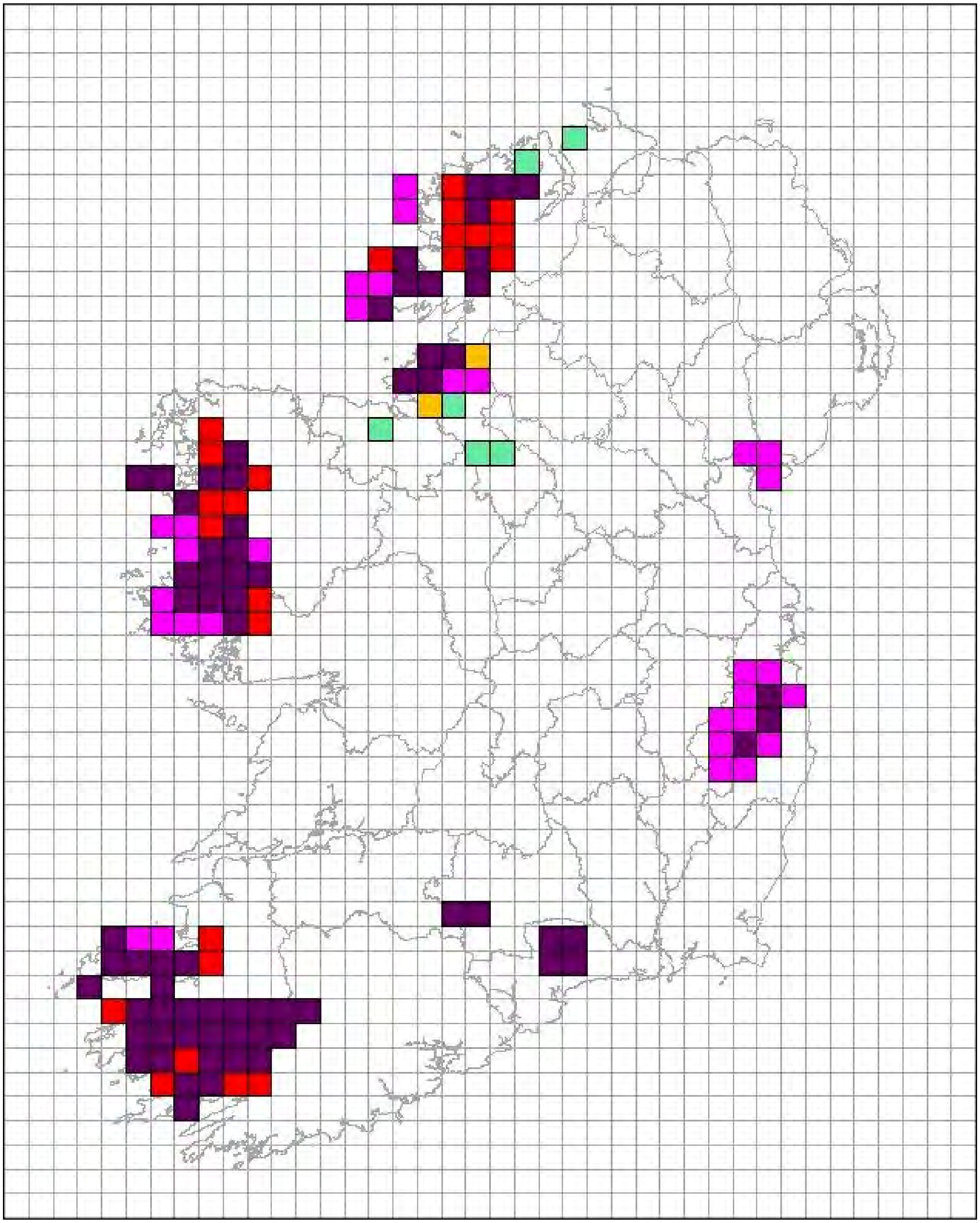

**Figure 1. Map showing the natural range, the favourable reference range and the distribution of calcareous rocky slopes in Ireland at 1 : 2,400,000 on a 10km² basis. The wine squares represent north and north-east facing slopes (> 40°) in both siliceous and calcareous upland areas >350m in elevation; pink squares represent the remaining areas of SACs selected for the habitat even if lower than 350m; red squares represents areas of the other SACs where north-east facing slopes > 350m are present but where portions of the SAC are below this, green squares represent the locations of obligate alpine species for the habitat; orange squares represent two NHAs > 350 m which may support the habitat. Further explanation on the data sourced used to create this map is presented in Appendix 3.**

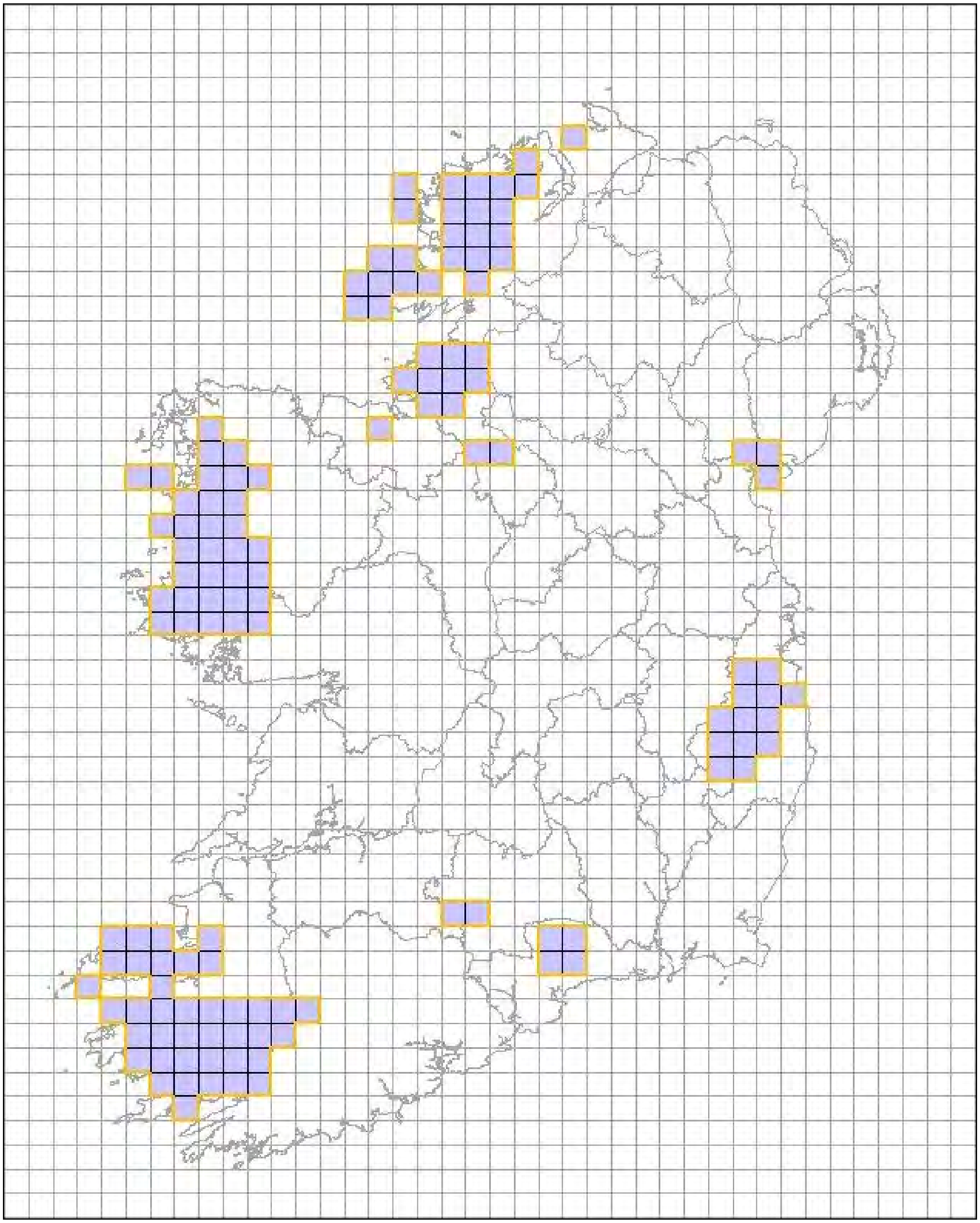

**Figure 1b. Range and Favourable Reference Range for calcareous rocky slopes in Ireland, which is based on the historic natural range of the habitat.**

## 2.2 Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between current habitat range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

An assessment based on the historical range of calcareous rocky slopes indicates that the natural range polygon of the habitat in Ireland (see **Figure 1**), as defined by the documented records of true alpine indicator species collated in the project database, locations > 350 m with north and north-east facing slopes > $40^0$ and sites for which calcareous rocky slope is a qualifying interest potentially covers 13,200 km² (132 grid cells selected x 100 km²) **(**See **Figure 1)**. The natural range of the habitat is thus documented.

In general, the conservation status of the habitat range is deemed **Favourable** as the physical conditions for the presence of calcareous rocky slopes are still present and the natural range of the habitat is thus likely to remain unchanged. However, no specific studies have been undertaken on the conservation status of the habitat range in Ireland during the reporting period making any assessment of the annual decline or otherwise in the habitat range problematic.

The Favourable Reference Range (FRR) is considered the same as the current range.

**Habitat Range Area:** Can be considered as the area of the polygon, which contains all of the grid cells, which contain the habitat, which are defined by the documented records of indicator species collated in the project database and the location of potential locations for the habitat. This potentially covers 13,200 km² (132 grid cells selected x 100 km²).

**Favourable Reference Range**: This is considered the same as the Habitat Range Area and as described above, i.e. 13,200 km² (132 grid cells selected x 100 km²).

## 2.3 Habitat Extent

It is not possible to quantify the extent of calcareous rocky slopes in Ireland, as there has been no systematic mapping of this habitat. The distribution of the habitat as shown on **Figure 2** is based on the location of north and north-east facing slopes (with a slope >40°) above 350m in elevation in the limestone and siliceous mountain ranges where calcareous rocky slopes could be expected. By using the DTM generated polygons for north and north-east facing slopes above 350m in elevation with a slope > 40° it is possible to produce a very inaccurate estimate of the potential area of calcareous rocky slope in Ireland. This figure has inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria as described above, whereby areas where calcareous rocky slope is known to occur are not depicted. These areas are also likely to contain other habitats such as siliceous and calcareous scree, siliceous rocky slope, alpine heath or dry and wet heath. The area of north and north-east facing slopes above 350m in elevation with a slope > 40º as defined using the DTM in areas of siliceous geology and limestone mountains is approximately 1,171 Ha or 11.71 km².

It is not possible to accurately determine what percentage of this inaccurate area corresponds to calcareous rocky slope as opposed to the other habitats listed above. A small proportion of these slopes are in areas of pure limestone.

**Figure 3** attempts to show an indication of the habitat based on the known locations of the 21 obligate alpine species found in the habitat (**Table 3**). The literature review and consultations with experts on calcareous rocky slopes has indicated that whilst the presence of indicative obligate arctic-alpine species within known sites is reasonably well documented for certain documented mountain ranges, this information cannot be used to determine the precise extent of the habitat either within a site or on a previously undesignated mountain range.

It must also be noted that not all areas of rocky slopes associated with north and north-east facing slopes within the natural range of the habitat support the species listed in **Table 3** so these areas would therefore not correspond to the Habitats Directive Definitions of the habitat. Calcareous rocky slopes are also frequently associated with other habitats such as siliceous rocky habitats, calcareous scree, wet heath, dry heath or calcareous grassland and thus it is impossible to define clear boundaries between these habitats using any of the other forms of data available to this assessment. It is not possible to more accurately determine the extent of this habitat in the absence of a dedicated field survey. The accurate extent of the habitat is therefore currently Unknown.

Given the following the area was calculated as **Unknown:**

- the area of 1,171 Ha may on the one hand be an under-estimate of the relevant slopes as not all are picked up by DTM
- that the same area may be an over-estimate as much of the upland alpine geology in Ireland is siliceous (even allowing for calcareous strata also being found on siliceous geology)
- that time did not allow for an examination of locations of steep ground/cliffs against geology and aerial photographs
- the lack of any systematic survey of this habitat in the recent or distant past

A decision was taken by NPWS to calculate/estimate a best expert judgement on the area. The CORINE data base was consulted in an effort to calculate the area of bare rocks as defined by CORINE. However, bare rocks of e.g. Wicklow or Hungry Hill did not show up, and similaly for other areas, possibly because CORINE mapped at the scale of 25 ha. Given this, the area of calcareous rocky was estimated by NPWS as outlined on **Table 4.**

The main concentration of calcareous upland geology is Sligo and Leitrim. Within this region it is not possible to determine what percentage of this area corresponds to calcareous rocky slope as opposed to the other alpine habitats listed above. However, it is known that calcareous rocky slopes are more abundant than calcareous screes in the uplands on calcareous geology.

**Table 4 Estimation of area of Calcareous Rocky Habitat in Ireland**

| | |
|---|---|
| Area covered by DTM on north and north-east facing slopes > $40^0$ > 350 m for both siliceous and calcareous geology – under estimate | 11.71 km$^2$ |
| Calcareous slopes (see slopes on calcareous scree) is 0.3; mainly for Sligo and Leitrim though excluding the Bricklieves as it < 350 m | 0.3 km$^2$ |
| NPWS assumes that circa 20% of the siliceous geology throughout the remainder of the country (11.41 km$^2$) supports calcareous or metamorphosed strata suited to the habitat. This figure of 20% is based on the fact that the report suggests many siliceous sites support the habitat (Appendix 3). | 2.282 km$^2$ |
| Of the estimated combined .3 + 2.282 km$^2$ (2.582 km$^2$) suited to calcareous rocky habitat, NPWS assumes that 60% is vegetated so 40% possibly consists of bare scree and rocky habitat. | 1.032 km$^2$ |
| Of this estimation, NPWS further assumes that bare rocky ground is greater in area than scree in ratio 60:40 | .6196 km$^2$ |
| As the entire DTM may be an underestimate increase this figure to 0.75 km$^2$ | 0.75 km$^2$ |

This best expert judgement figure can be improved upon following a dedicated survey.

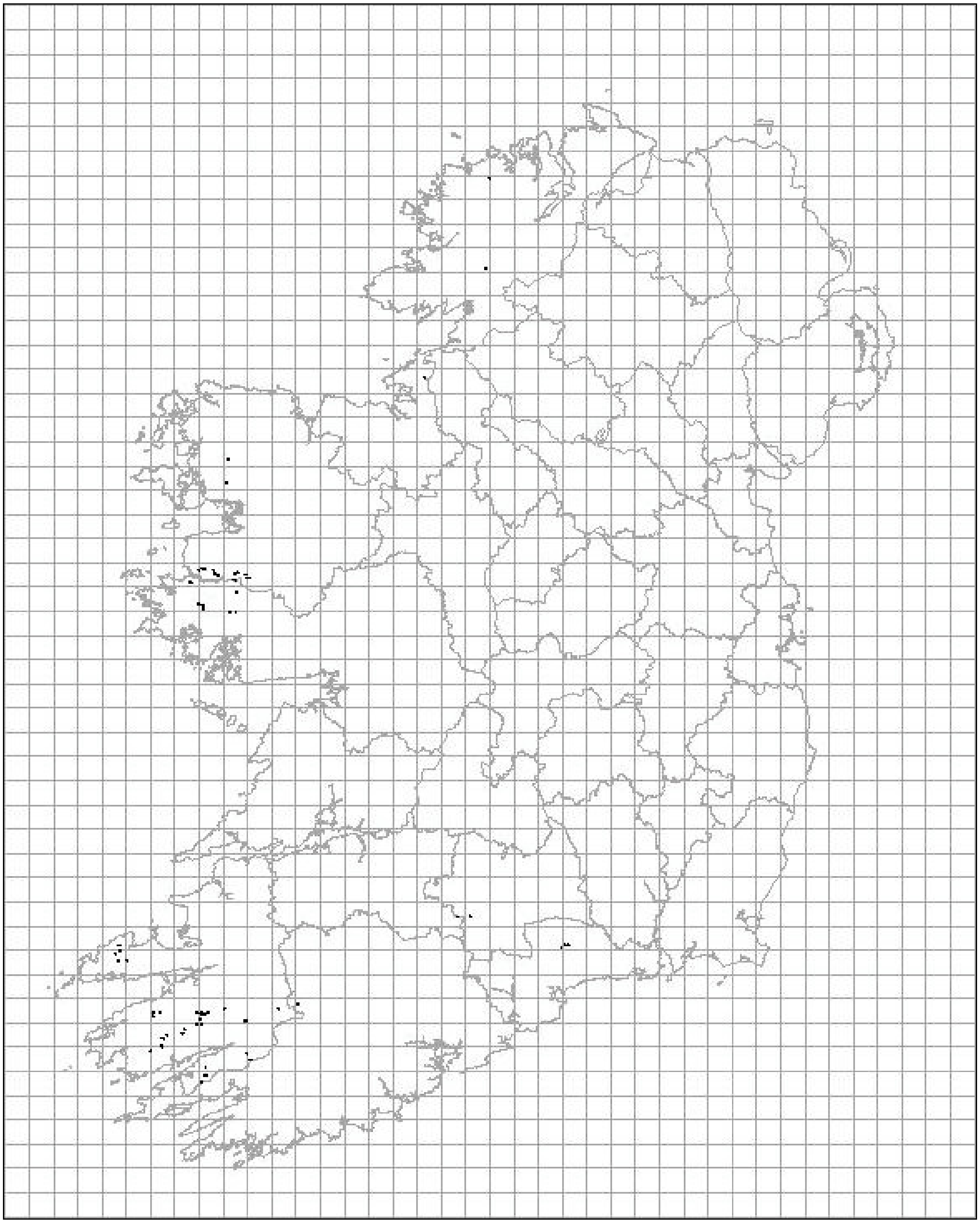

**Figure 2. Map showing the potential distribution of calcareous rocky slope in Ireland within the known range of the habitat based on the locations of north and north-east facing slopes (> 40°), (shown in black) at elevations >350m on limestone and siliceous mountains. Note that at this scale of 1: 2,400,000 some areas such as those identified within the Wicklow Mountains are not visible.**

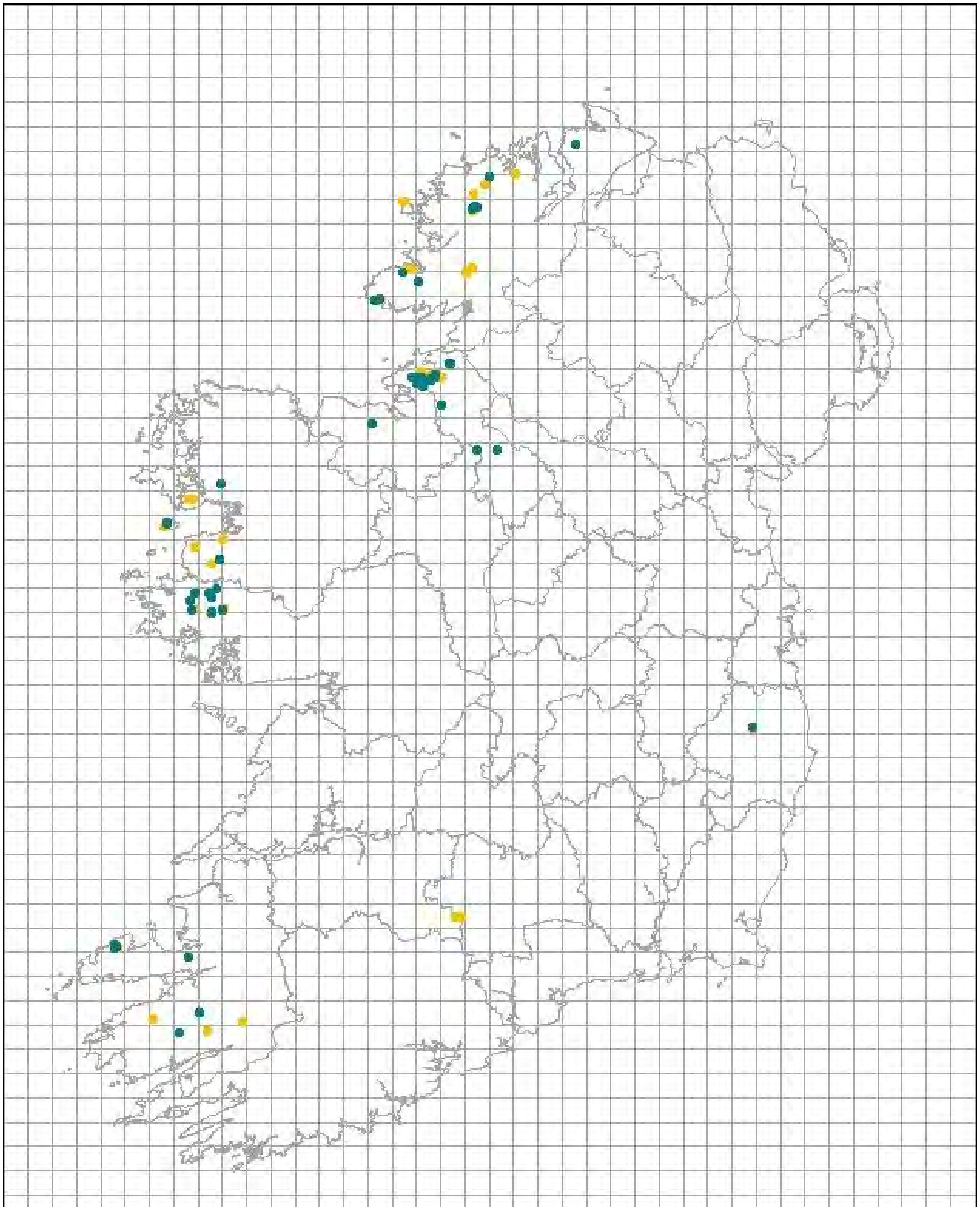

**Figure 3. Map showing an indication of calcareous rocky slopes in Ireland based on the locations of the twenty one true alpine species characteristic for the habitat, for which accurate grid references were available. There were 350 records available, 146 of these were of single species records (shown as orange points) and 204 were of species assemblages (shown as green points). This map is presented at a scale of 1 : 2,400,000.**

## 2.4 Conservation Status of Habitat Extent

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the extent of a habitat can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat extent in the reporting period (a decrease in habitat extent greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between current habitat extent and the Favourable Reference Area (FRA) (if current habitat extent is 10% below FRA the habitat extent is considered Unfavourable Bad).

As mentioned previously the current extent of the habitat is **Unknown though a best expert judgement is provided**. The significance of the land use and activities on the extent of this habitat are not clearly understood due to lack of survey data. Any over-grazing impacting activities in so remote a habitat are deemed to be less significant than similar impacts on the wet heath and blanket bogs of the uplands. Nonetheless, overgrazing is known to have had a deleterious effect on this habitat in certain sites such as Mweelrea/Sheefry/Erriff Complex (Site Code: 001932), The Twelve Bens (Site Code: 002031) and Ben Bulben (Site Code 000623). The loss of the intrinsic suite of species may have led to a reduction in the area of the habitat. Mining and tourism related activities are also deemed to be threats to the alpine habitats. It is recognised that all of these impacting activities may play a role in damaging the habitat. As it is not known whether there has been a loss in habitat area or not, but it is known that there are damaging impacts which may have impacted on the area, a ranking of Unfavourable-Inadequate scoring is given.

The conservation status of the habitat extent is deemed **UnFavourable-Inadequate** and the trend is negative due to impacting activities. Favourable Reference Area is considered to be Unfavourable Inadequate as it is perceived to be > the current estimated area. The period for this trend is 1950s to the present. Further survey with more accurate information before the next reporting cycle may indicate a more Favourable Assessment.

**Area covered by the habitat:** The accurate extent of calcareous rocky slopes habitat in Ireland is **Unknown. However an estimate of 0.75 km²** has been calculated.
**Favourable Reference Area:** Though the area is calculated using best expert judgement, it is nonetheless felt that, in this instance, there has been a decline in area within the reporting period (1950s to 2006) due to impacting activities. Loss of habitat equates with loss of specific species and not the loss of actual rock. The extent of the loss is unknown but is not considered to be > 10%. Favourable Reference Area is considered to be Unfavourable Inadequate as it is perceived to be > the current estimated area.

## *3 STRUCTURES AND FUNCTIONS*

### 3.1 Structures and Functions of the Habitat

Satisfactory data on habitat quality and habitat change trends are lacking for this habitat in Ireland.

An increase in the intensity of impacting activities on the habitat has occurred since the 1950's in Ireland. This increase has been due mainly to the overstocking of sheep in the uplands, which results in slippage, erosion, loss of species and loss of habitat. The Commonage Framework Plan did not isolate upland exposed rocky slopes as a habitat type within the survey and it is therefore not possible to use any of the data from this survey in accurately identifying the level of grazing damage to calcareous rocky slopes. A gross measure of the levels of grazing damage to those sites, which contain calcareous rocky slope that are located within areas of commonage indicates that approximately 66% of the land has some levels of damage. Given the high levels of damage to other habitats in these commonage areas, the impact of grazing and trampling is likely to have negatively impacted on calcareous rocky slopes.

A secondary impact is due to an increase in leisure activities in the uplands notably hill walking, mountaineering, rock climbing and para-gliding. Hill walking and rock climbing may cause trampling and erosion of the rocky slopes habitat and ultimately loss of the species that characterise this Annex I habitat. Quarrying poses another threat. However, due to the economics involved in such activities in such remote upland areas, it does not pose a significant threat.

The significance of the increasing impact of these activities on the habitat is unknown. They may have resulted in some decline in the habitat in general but it is not possible to quantify this at present. Associated with this is a possible decline in the structures and functions of the habitat. There is no documented study such as the Commonage Framework Plans that documents the effects of such activities on the structures and functions of the calcareous rocky slope habitat and as described above the grazing impact of sheep on calcareous rocky slopes was not assessed separately.

#### 3.1.1 Conservation Status of Structures and Functions of the Habitat

The variation in the conservation status of the structure and functions of calcareous rocky slopes cannot be quantified. Overgrazing has altered the quality of the habitat in the Mweelrea/Sheefry/Erriff Complex (Site Code: 001932), The Twelve Bens (Site Code: 002031) and Ben Bulben (Site Code 000623). The leisure activities detailed above may have altered the quality of the habitat in localised areas (notably on sites, which are popular hill walking and mountaineering areas such as Ben Bulben (Site Code: 000623 and the Wicklow Mountains (Site Code: 002122).

Due to the lack of information, the conservation status of structure and functions of the habitat is **Unknown** and the trend is negative due to the pressures described above. However according to NPWS, given that the habitat structure is intact in many of the more remote areas and given that damage by grazing is not deemed to be as severe on rocky habitats as it is on blanket bog and wet heath, an assessment **of Unfavourable inadequate** is appropriate.

## 3.2 Typical Species

Calcareous rocky slopes are characterised by some species, which are truly alpine in nature and occur in this habitat due to their altitudinal requirements (Obligate alpine species). As described above many of these species are common to several other Annex I upland habitats including;

- (4060) Alpine and boreal heath,
- (8120) Calcareous and calcshist screes of the montane to alpine levels,
- (8220) Siliceous rocky slopes with chasmophytic vegetation.

Calcareous rocky slopes also contain a number of other species, which may also be found in other associated habitats (these are termed Facultative species) and at lower elevations. They have been listed in **Table 3.**

### 3.2.1 Conservation Status of Habitat Typical Species

An accurate assessment of the conditions of typical calcareous rocky slope habitat species cannot be carried out in the absence of a specific field monitoring program. However, the assessment of the condition of the structures and functions of the habitat based on impacting activities and the influence of these activities on the typical species of the habitats will let us ascertain the conservation status of the latter. Furthermore, a decline in the calcareous rocky slope habitat's structure and functions as mentioned previously already indicates a decline in the species typical of the habitat. The conservation status of habitat structures and functions is thus regarded as **Unfavourable Inadequate** for this habitat. As habitat quality and typical species are so interdependent, it can be suggested that an **Unknown** status would be appropriate but an **Unfavourable Inadequate** conservation status can also be inferred for Typical Species.

## *4 IMPACTS AND THREATS*

The main damages influencing the calcareous rocky slope habitat in Ireland based on best expert opinion are as follows:

### 4.1 Overgrazing

Overgrazing by sheep is one of the principal damaging activities affecting calcareous rocky slopes and this has been observed in several locations such as Ben Bulben (Site Code: 000623) and Arroo Mountain (Site Code: 001403) in Counties Sligo and Leitrim, The Twelve Bens (Site Code: 002031) and Mweelrea/Sheefry/Erriff Complex (Site Code: 001932) in Counties Galway and Mayo.

A revised and subsequently amended Rural Environment Protection Scheme (REPS) was introduced in May 1999. As a result, degraded commonage areas were assessed and managed according to a specific management tool – "The Commonage Framework Plan (CFP)" surveyed and assessed the condition of almost all commonage areas in the Republic of Ireland. In order to facilitate the restoration of these areas the Plan recommends a destocking level for each commonage or site surveyed. Within the scheme, damage is assessed according to a 6 point scale ranging from U (undamaged) to S* (very severely damaged) and each point on this scale has an associated destocking level. In addition to mapping the extent and severity of grazing damage within commonages, the habitats occurring within these areas was also indicated but unfortunately upland rocky habitats and screes were not identified. However, as detailed in section 3.2 above approximately 66% of the lands, which contain calcareous rocky slopes that are located within commonage areas have some levels of damage.

**Overgrazing Trend**

Stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (FAPRI-Ireland Partnership 2003). While this is positive towards conserving the habitat, this could, however, potentially result in sites being abandoned, which may, in the case of rocky habitats, lead to habitat loss through encroachment by other vegetation not typical of the habitat. The Rural Environment Protection Scheme (REPS) and National Farm Plan Scheme also aim to address a reduction in over-grazing levels. The implementation of these three schemes should reduce damage on calcareous screes caused by farming activities and particularly target over grazing. To date the results of the implementation of measures recommended by these schemes is unknown. Thus, it cannot be stated that the threat to calcareous rocky slopes from intensive overgrazing or under-grazing is declining.

### 4.2 Quarries

Quarries are a known historical threat to calcareous rocky slopes as documented by the location of the barytes mine on Ben Bulben (Site Code: 000623) and the gold mines in the Wicklow Mountains (002122) – both now closed.

**Quarrying Trend**

The future trends for quarrying are unknown but if the current economic growth continues in Ireland, there may be increasing pressures on calcareous rocky slope sites for material for the cement and building industries. However, planning control of quarrying has improved greatly with regard to opening of new quarries and re-opening of old works since the introduction of regulations under Section 261 of the Planning and Development Act 2000.

## 4.3 Outdoor Recreation

Trackway erosion of upland habitats such as alpine heath, wet heath, dry heath, screes and rocky slopes, caused by tourist use of popular walking routes has been highlighted as a problem in Ireland since the beginning of the 1990s. Problems with erosion of upland habitats are for example associated with Ben Bulben (Site Code: 000623). Tracks are clearly visible in some areas of calcareous rocky slopes, and the increase in popularity of hill walking in Ireland in recent years is likely to result in more pressure on sensitive upland habitats such as calcareous rocky slope. The ease and speed of access to the most remote areas of our mountain ranges has increased with the arrival of ATVs and scrambler bikes.

### Outdoor Recreation Trend

Trackway erosion is considered an increasing threat to calcareous rocky slopes. There is a similar increase in the threat to calcareous rocky slopes as a result of increased ownership of ATV's and Four Wheel Drive vehicles and accessibility to upland areas. Hill walking continues to increase as a popular recreation in Ireland and our mountains are actively promoted to visiting walkers.

## 4.4 Site Inspection Form results

Regional NPWS Management is responsible for patrolling designated sites and enforcing relevant legislation (e.g. Habitats Directive 92/43 EEC or the Wildlife Act). NPWS Conservation Rangers are required to summarise information collected on the integrity of sites within their areas during the course of their duties. They are given the responsibility for reporting the information required under the Site Inspection Reporting (SIR) programme. Reporting is carried out on a three yearly cycle that began in 1998.

There are no reported activities in the period 1998 – 2003.

# *5 FUTURE PROSPECTS*

## 5.1 Negative Future Prospects

Calcareous rocky slopes have undergone a severe negative impact in the last fifty years principally as a result of overgrazing. Whilst this is an impact which can be resolved through management agreements with landowners (see Positive Future Prospects below) other impacts such as acidification and damage from walkers and increased recreational access to the mountains resulting in trampling has also become an increasing problem, which is less easily managed.

## 5.2 Positive Future Prospects

### Single Farm Payment (SFP)

As already noted, stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (SFP) (FAPRI-Ireland

Partnership 2003). As long as the market value of hill sheep remains low, there is little incentive for farmers to maintain large flocks in the uplands.

Payment under the SFP requires the farmer to keep lands in "Good Agricultural and Environmental Condition"

**The Rural Environment Protection Scheme (REPS)**
REPS is an EU-funded scheme for environmentally sensitive farming, introduced in 1994, which includes incentives to reduce stocking densities within proposed NHAs, SACs and on those land designated as degraded (overgrazed) by the Department of Agriculture, Food and Forestry.

The positive impact of this scheme for calcareous rocky slope conservation is dependent on several factors such as the uptake of REPS by farmers with large flock numbers in overgrazed areas. A reduction on the stocking density as a result of the implementation of the Commonage Framework Plan recommendations should reduce the impact associated with sheep grazing on areas of rocky slopes.

**National Farm Plan Scheme (NFPS)**
In February 2006, the NPWS launched a new 5 year National Farm Plan Scheme (NFPS) for landowners not in REPS but with designated areas (SACs, SPAs) and commonage. This follows on from the requirements of the EU Natural Regulations and the Wildlife (Amendment) Act, 2000. The scheme allows the Department to pay farmers and landowners for losses incurred through restrictions caused by the designation of lands as a SAC or a SPA or to pay for certain actions, which are of benefit to nature and are agreed in a Farm Plan.

In the particular case of calcareous rocky slopes and other upland habitats, the NFPS provides the following recommendations:

- Stocking density rates must be set down by a planner.
- The location of feeding points to reduce heavy grazing, trampling, poaching and erosion problems should be regulated.
- The use of fertilisers and herbicides and water pollution should be also regulated.

The NFPS prohibits the following practises including: in-filling or rock removal; creation of new tracks or paths; The implementation of the Plan should reduce damage to calcareous rocky slopes caused by farming activities, particularly overgrazing. Its success obviously depends on the farmers' participation.

## 5.3 Overall Habitat Future Prospects

Several schemes (e.g. SFP, REPS, NFPS) address the recovery of large areas of degraded habitat. A national survey of upland habitats to accurately survey and classify upland habitats such as calcareous rocky slopes is required. This will provide information to determine the requirements for the conservation of the habitat.

However, a series of impacting activities (i.e. overgrazing, trampling, mountaineering and recreational activities) continue to threaten the habitat both in designated and undesignated sites. In the absence of a field survey, the threats to the habitat are not accurately quantified but it is deemed that the habitat is still moderately threatened and slowly declining. While future prospects are encouraging, the long-term viability is not assured, and thus it is assessed as likely to be **Unfavourable Inadequate.**

## 6 *OVERALL ASSESSMENT OF HABITAT CONSERVATION STATUS*

The habitat conservation status of the four main attributes has been assessed as follows:

- The **Favourable Reference Range** (FRR) is estimated to be 100% of the historical habitat range and is thus **Favourable**. The Natural Range for this habitat potentially covers 13,200 km² (132 grid cells selected x 100 km²), (see **Figure 1 and 1b**).
- The **Extent** of calcareous rocky slopes habitat has decreased, though exact figures for the decline are not available. By using the DTM generated polygons for north and north-east facing slopes above 350m in elevation with a slope > 40º it is possible to produce a very rough estimate of the potential area of calcareous rocky slope in Ireland. This figure has inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria as described above, whereby areas where calcareous rocky slope is known to occur are not depicted. These areas are also likely to contain other habitats such as siliceous and calcareous scree, siliceous rocky slope, alpine heath or dry and wet heath. The area as defined using the DTM in areas of siliceous geology and limestone mountains is approximately 1,171 Ha or 11.71 km². It is not possible to determine what percentage of this area corresponds to calcareous rocky slope as opposed to the other habitats listed above. The extent of the habitat is therefore deemed Unknown **though NPWS have estimated an area of 0.75 km²**. The trend is negative due to overgrazing. **This results in Unfavourable – Inadequate.**
- An Unknown - but likely to be **Unfavourable Inadequate (U1)** assessment is given to the habitat **Structures and Functions** based on the increase in impacting activities and expert opinion.
- The habitat's **Future Prospects** are overall deemed to be Unknown - but likely to be **Unfavourable Inadequate (U1)** - due to pressure from impacting activities (e.g. trampling, leisure related activities and overgrazing,).

Thus, considering the assessment for the four main attributes for this habitat the overall **Conservation Status** for calcareous rocky slopes is Unknown - but likely to be **Unfavourable Inadequate (U1).**

# 7 *Appendices*

# 8 *APPENDIX 1. PUBLISHED SOURCES OF DATA ON CALCAREOUS ROCKY SLOPES* (this information is now contained in the form at the front of this document).

# 9 APPENDIX 2. UNPUBLISHED SOURCES OF DATA ON CALCAREOUS ROCKY SLOPES

## Unpublished sources of data on calcareous rocky slopes in Ireland.

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## *10 APPENDIX 3. CALCAREOUS ROCKY SLOPE DISTRIBUTION MAPPING*

The **Upland Habitats Database** of this project currently holds c.4,500 records of indicator species of all Annex I upland habitats (i.e. 4060, 8110, 8120, 8210 and 8220) which have been gleaned from a variety of sources (both published and unpublished as documented in **Appendices 1** and **2** respectively). Given the antiquity of the bulk of the data (c.1700 of the records date from the 1800s to the 1950s) and the lack of accurate geographical references (only c.1500 records have grid references of varying accuracy (see below for further information) the GIS application of much of the collated data is limited. Full reference should be made to the **Upland Habitats Database** for lists of records for sites and locations/descriptions of indicative alpine species for habitats as the bulk of records will not be illustrated in **Figures 1 to 3** due to their lack of grid references.

When reviewing these records of species one needs to be cognisant of the fact that very few of them are uniquely indicative to a particular habitat (e.g. *Polygonum viviparum* (an obligate alpine species) is found in four of the Annex I upland habitats (8110, 8120, 8210 and 8220) so records of this species cannot be used to indicate the presence of any single habitat. These species have been identified as being characteristic in the absence of a dedicated field survey of these habitats. On completion of such a survey, phytosociological classification and analysis may provide clearer definitions for these habitats in an Irish context.

Given the variability of data sources, records of indicator species have been described either as an assemblage of species, a single species location or as an indication of habitat cover, depending on the quality and source of the data. For example a historical record by Corry (1884), which only contained details of a particular species at a certain altitude on Ben Whisken (Site Code: 000623) was entered as a single plant species location, whereas a description of several arctic-alpine species on a cliff above a corrie lake on Mount Brandon (Site Code: 000375) by Stelfox (1951) was entered as a species assemblage. Where there was a good description of an area of alpine heath (such as that given by Conaghan et. al. (1994) in the NHA Site Card for the Twelve Bens (Site Code: 002031)) this was entered as habitat cover.

Data for all of the above fields in the database was not necessarily contained in the original publication/source for each record and based on the description of the locations given, an appropriate SAC Site Code was assigned to each record using the Discovery and 62" Mapping on Arc View 3.2.

Several new potential locations for calcareous rocky slopes in addition to those known designated sites for, which calcareous rocky slope is a qualifying interest (see **Tables below**) were identified in this manner following the literature review. Some of these sites were already designated as SACs but calcareous rocky slope was not listed as a qualifying interest, others were existing NHAs and others were undesignated.

**Designated SAC sites for, which calcareous rocky slope, is a qualifying interest.**

| Site Code: | Site Name: |
|---|---|
| 000111 | ARAN ISLAND (DONEGAL) CLIFFS |
| 000189 | SLIEVE LEAGUE |
| 000375 | MOUNT BRANDON |
| 000453 | CARLINGFORD MOUNTAIN |
| 000623 | BEN BULBEN, GLENIFF AND GLENADE COMPLEX |
| 000646 | GALTEE MOUNTAINS |
| 001403 | ARROO MOUNTAIN |
| 001932 | MWEELREA/SHEEFFRY/ERRIFF COMPLEX |
| 001952 | COMERAGH MOUNTAINS |
| 002031 | THE TWELVE BENS/GARRAUN COMPLEX |
| 002122 | WICKLOW MOUNTAINS |
| 002243 | CLARE ISLAND CLIFFS |

**SACs (designated) and NHAs*, which contain areas of upland habitat at elevations > 350m with N and NE facing slopes > 40°and which potentially contain calcareous rocky slopes as derived from the digital terrain model, but that do not list calcareous rocky slopes as a qualifying interest.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 000093 | CAHA MOUNTAINS | SAC/NHA |
| 000190 | SLIEVE TOOEY/TORMORE ISLAND/LOUGHROS BEG BAY | SAC/NHA |
| 000365 | KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S REEKS AND CARAGH RIVER CATCHMENT | SAC/NHA |
| 000483 | CROAGH PATRICK | NHA |
| 000485 | CORRAUN PLATEAU | NHA |
| 000534 | OWENDUFF/NEPHIN COMPLEX | SAC/NHA |
| 000735 | MAUMTRASNA MOUNTAIN COMPLEX | NHA |
| 001059 | HUNGRY HILL BOG NHA* | NHA |
| 001179 | MUCKISH MOUNTAIN | SAC/NHA |
| 001342 | CLOONEE AND INCHIQUIN LOUGHS, URAGH WOOD | SAC/NHA |
| 001403 | ARROO MOUNTAIN | SAC/NHA |
| 001873 | DERRYCLOGHER (KNOCKBOY) BOG | SAC/NHA |
| 001879 | GLANMORE BOG | SAC/NHA |
| 001880 | MEENAGUSE SCRAGH | SAC/NHA |
| 001881 | MAULAGOWNA BOG | SAC/NHA |
| 001955 | CROAGHAUN/SLIEVEMORE | SAC/NHA |
| 002008 | MAUMTURK MOUNTAINS | SAC/NHA |
| 002046 | OWENDOO AND CLOGHERVADDY BOGS | NHA |
| 002047 | CLOGHERNAGORE BOG AND GLENVEAGH NATIONAL PARK | SAC/NHA |
| 002185 | SLIEVE MISH MOUNTAINS | SAC |
| 002186 | GRAGEEN FEN AND BOG NHA* | NHA |
| 002268 | ACHILL HEAD | SAC/NHA |
| 002301 | RIVER FINN | SAC/NHA |

* Only those NHAs, which have NHA in the Site Name, are currently designated.

It must be stated, however, that although calcareous rocky slopes may occur in these mountain ranges they may not conform to the Habitats Directive definition, as this will depend on the species complement present.

**NHAs*, which contain areas of upland habitat at elevations > 350m and potentially contain calcareous rocky slopes as derived from the digital terrain model and Blanket Bog Database.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 002430 | Aghavogil Bog NHA* | NHA |
| 002435 | Crockauns/Keelogyboy Bogs NHA* | NHA |

* Only those NHAs, which have NHA in the Site Name, are currently designated.

Additional sites were identified on the basis of indicator species only (see Table below) – note that there is significant overlap of species between this habitat and others such as 8110, 8120 and 8220, so this data may not prove to be truly indicative of locations of calcareous rocky slope.

**Additional sites, which potentially contain calcareous rocky slope habitat based on the presence of indicator species that were not, identified using the Digital Terrain Model.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 000120 | BULBIN MOUNTAIN | NHA* |
| 000477 | CLARE ISLAND | SAC/NHA |
| 000732 | LOUGH OULER | SAC/NHA |
| 001669 | KNOCKALONGY AND KNOCKACHREE CLIFFS | NHA/SAC |
| 001976 | LOUGH GILL | SAC |
| 002687 | BLUESTACK MOUNTAINS | NHA |
| 006009 | COMMON MOUNTAIN, ARDARA, CO. DONEGAL | Undesignated |
| 006015 | BLUESTACK MOUNTAINS (LAVAGH MORE) | Undesignated |

* Only those NHAs, which have NHA in the Site Name, are currently designated.

**Sites, which contain areas of upland habitat at elevations > 350m, and potentially contain calcareous rocky slopes as derived from NPWS Habitat Assignment Database.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 001057 | Gouganebarra Lake | NHA* |
| 001879 | Glanmore Bog (cliffs on northern boundary – mostly outside the site boundary) | NHA/SAC |
| 001881 | Maulagowna Bog (cliffs above Lough Cummer). | NHA/SAC |

* Only those NHAs, which have NHA in the Site Name, are currently designated.

**There are extensive areas of potential locations for this habitat type within the sites presented in these Tables above, which have been identified using this process for which no field data exists. These areas require urgent site survey and could form the basis of further additional qualifying interests for the site or for designation as potential NHAs for the habitat.**

**Extent:**

The literature review and consultations with experts on calcareous rocky slopes has indicated that whilst the presence of indicative obligate arctic-alpine species within known sites is reasonably well documented for certain documented mountain ranges, this information cannot be used to determine the precise extent of the habitat either within a site or on a previously undesignated mountain range.

In the absence of a national survey, the best attempt that could be made to determine extent was to utilise the rare, threatened and scarce plant data, which gives accurate point locations of obligate arctic-alpine species coupled with altitudinal information to indicate likely areas of calcareous rocky slopes.

The principal sources of recent information pertaining to the location and distribution of calcareous rocky slopes species, which included grid references* include:

- National Parks & Wildlife Rare, Threatened and Scarce Plant Databases,
- Rare, Threatened and Scarce Plant County Survey Reports,
- The New Atlas of the British and Irish Flora (2002),
- County Floras – many of the locations of indicator species were manually assigned to either a $10km^2$ or $1km^2$ grid based on the descriptions of locations detailed in these publications,
- National Rare and Threatened Bryophyte Surveys,
- Published papers with records of indicator species, which were assigned to either a $10km^2$ or $1km^2$ grid square,
- Unpublished field records of one of the principal authors of this report (Dr. Curtis) and other NPWS staff,

*These data sources provided data in a wide variety of levels of mapped accuracy, which ranged from an accuracy of:

- 1or 10m (recent county rare or threatened plant/bryophyte surveys),
- 100m (unpublished field records),
- $1km^2$ square grids (County flora records)
- $10km^2$ square grids (older publications or historical records of rare or threatened plant species).

These records were thus assigned an accuracy rating (relative to the nearest metre) in the database and were then plotted in Arc View 3.2 using an appropriate visual scale. This data was used coupled with other criteria listed below to indicate the likely extent of the habitat.

The key species used to try to determine an indicative extent of **calcareous rocky slopes** in Ireland are the 'true' alpine species for the habitat listed in **Table 3** in the main body of the report.

Records for these species are available at an accuracy of 100m, 10m and at 1m and a map of the indicative extent of calcareous rocky slopes is presented in **Figure 3**. There were 350 records available, 146 of these were of single species records (shown as orange points) and 204 were of species assemblages (shown as green points).

The data collated by the Botanical Society of the British Isles was not used for the following reasons:

- typically the mountain summits and cliffs were not surveyed during the Atlas,
- the data, which are presented, is available only on a 10km basis and at that scale does not indicate 'effort 'i.e. whether a plant was no longer recorded from a location or, that, that location was not surveyed.
- the Atlas data are not fully accurate for the Irish context (many of the records were incorrectly gridded, while others were assigned to the wrong year classes. This was despite detailed corrections from NPWS, which were not corrected).

To produce a map showing anything other than an indicative extent is rendered difficult because the available information relating to the occurrence of this habitat is based on plant species location rather than habitat extent. The areas of calcareous rocky slopes are often located within a mosaic of other habitats including exposed siliceous rock, heaths and grassland, and so it is difficult to assume a minimum area where the alpine plant species occur. In addition, large areas of upland habitats in Ireland remain unsurveyed.

The **accurate** mapping of the distribution and extent of calcareous rocky slopes with chasmophytic vegetation (8210) habitat as described in the Habitats Directive has therefore not been possible.

## *11 APPENDIX 4. OTHER SOURCES OF DATA*

### A. Commonage Framework Plans – Department of Agriculture & Food and the National Parks and Wildlife Service (NPWS).

The Department of Agriculture & Food and the NPWS have produced the Commonage Framework Plans (CFPs) and NHA/SAC/SPA stocking and damage assessments. These plans crudely describe the habitats, condition of the land use and plant species found in each sub-unit of each agricultural unit. Depending on the condition of the land, a % de-stocking is recommended and a time-frame suggested for recovery of the land.

Common ownership of large areas of unfenced heath and bog land is the principal type of land ownership in the western peatland and upland areas of Ireland. Thus, up to 80% of all land in Connemara and west Mayo is commonage (O'Connor, 2000). According to the maps produced by the CFP the overall extent of commonage land in Ireland is approximately 438,000ha. Unfortunately, it is not possible to use this dataset to determine the extent or area of calcareous rocky slopes in Ireland as this habitat was not identified in the report. In addition, the mapping of habitats was done at a crude level and the main mapping criterion was damage level and not habitat type.

The CFPs thus can only be used to provide an indication of the damage status of habitats (including calcareous rocky slopes) on commonage land, and this was crudely used to ascertain the conservation status of structure and functions of this habitat.

### B. NPWS Enquiries Database

This is a comprehensive NPWS internal database, which includes data on designated sites and habitats contained within them. This database was used to confirm the sites for, which calcareous rocky slope was a qualifying interest.

### C. Habitat Assignment Project (NPWS, 2006)

This desktop project was undertaken by NPWS and the main aim was to identify and list the habitats listed in the Annex I of the Habitats Directive (92/43/EEC) which were reported within a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, Aerial photographs, NGO proposals, etc. Three potential sites were identified from the data in this database in addition to those derived from other sources. They were:

- 001057 Gouganebarra Lake
- 001879 Glamore Bog
- 001881 Maulagowna Bog

## *12 APPENDIX 5. COMMONAGE FRAMEWORK PLANS DATA*

The CFPs mapped the extent and severity of grazing damage within agricultural sub-units. The criteria use to assess the level of damage and the resultant destocking levels is given below (**Table 1**). In addition, the habitats occurring within these areas were also mapped. The following habitats were recognised during the Commonage Framework Plan surveys and their symbols are indicated within brackets:

| | | | |
|---|---|---|---|
| (I) | Blanket bog | (II) | Wet Heath |
| (III) | Dry Heath (includes maritime) | (IV) | Upland grassland |
| (V) | Other habitats | (VI) | Improved grassland |
| (VII) | Dune | | |
| (VIII) | Unimproved wet grassland | | |
| (IX) | Unimproved dry grassland | | |
| (X) | Fen/Marsh/Swamp | | |
| (XI) | Saltmarsh | (XII) | Beach/Shingle/Reef/Shore |
| (XIII) | Limestone Pavement / Grassland | (XIV) | Limestone Pavement (>75%) |
| (XV) | Scrub | | |
| (XVI) | Permanent open water (turlough) | | |

As can be seen there is no specific category given for calcareous rocky slope.

**Table 1 Criteria for the assessment of damage and the resultant destocking levels (Conaghan, 2001).**

| Damage category | Condition of vegetation/amount of bare soil | Suggested destocking level |
|---|---|---|
| Undamaged (U) | Vegetation not grazed or only very lightly grazed. No bare ground present. | 0% |
| Moderate to undamaged (MU) | <5% bare ground. Grazing usually evident, but damage only just detectable. | 30% |
| Moderately damaged (MM) | <5% bare ground. Signs of damage intermediate in intensity between MU and MS. | 50% |
| Moderate to severely damaged (MS) | <5% bare ground. Damage widespread and obvious. | 65% |
| Severely Damaged (S) | >5% bare ground. Damage due to grazing obvious and widespread. | 85% |
| Very Severely Damaged (S*) | >10% bare ground with abundant evidence of high grazing levels. | 100% |

Commonage lands, which are likely to contain calcareous rocky slope either on its own or as a mosaic with other habitats, were mapped during the CFP. A broad-brush review of this data indicates that 66% of the lands in commonage within sites, which contain calcareous rocky slopes, show some degree of damage and thus the assumption that calcareous rocky slopes also shows a similar proportion of damage is inferred.

## *13 APPENDIX 6. GLOSSARY*

ALTITUDE - Vertical height above sea level.

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for, which SACs have to be designated.

BLANKET BOG – Bogs, which carpet the landscape, following the underlying topography. They can cover extensive areas along the west coast and on uplands throughout the country.

CALCAREOUS –Rich in calcium, Lime loving.

CALCAREOUS ROCKY SLOPES – these are areas of exposed rock, which are typically found on the north and north-east facing slopes of mountains of calcareous origin, i.e. limestone mountains. These slopes are typically >40°, and are found at elevations above 350m. Calcareous rocky slope vegetation is also found in mountain ranges, which are siliceous in origin. These are typically areas of cliff, which have been metamorphosed in the past and, which are slightly more mineral rich than the adjoining areas. The true alpine species for this habitat includes – *Alchemilla alpina, Alchemilla glaucescens, Arenaria ciliata, Asplenium viride, Cardaminopsis petraea, Deschampsia caespitosa ssp. alpina, Epilobium alsinifolium, Euphrasia frigida, Oxyria digyna, Phegopteris connectilis, Poa alpina, Polygonum viviparum, Polystichum lonchitis, Salix phylicifolia, Saussurea alpina, Saxifraga hartii, Saxifraga nivalis, Saxifraga oppositifolia, Saxifraga rosacea, Silene acaulis, Thalictrum alpinum.*

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CORINE - Information and mapping system, developed within the context of the Commission of the European Communities biotope project, which is used as a tool for the description of sites of importance for nature conservation in Europe. It catalogues recognisable communities of flora and fauna. The primary objective of this catalogue is to identify all major communities whose presence contributes to the conservation significance of a site. Included in this list of communities are interesting but rare natural or near-natural communities as well as the more widespread semi-natural ones.

DEHLG - Department of Environment, Heritage and Local Government

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions, which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for, which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within, which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in, which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive, this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms, which are all influenced by the underlying geology.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

MOSAIC - Used to describe habitats that occur together and cannot easily be mapped separately.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which, the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats, which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

QUALIFYING INTERESTS – The habitat(s) and/or species for, which an SAC or SPA is designated.

REPS - Rural Environment Protection Scheme. This is an Agri-Environmental programme, which seeks to draw up agreements with farmers, according to the type of farming, landscape and features on the land. The overall objectives of REPS are to achieve: the use of farming practices, which reduce the polluting effects of agriculture by minimising nutrient loss- an environmentally favourable extensification of crop farming, and sheep farming and cattle farming; - ways of using agricultural land, which are compatible with protection and improvement of the environment, the countryside, the landscape, natural resources the soil and genetic diversity; - long-term set-aside of agricultural land for reasons connected with the environment; - land management for public access;- education and training for farmers in types of farming compatible with the requirements of environmental protection and upkeep of the countryside.

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from, which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SACs have also been known as cSACs, which stands for “candidate Special Areas of Conservation”, and pcSACs, which stands for “proposed candidate Special Areas of Conservation.”

SPAs - Special Protection Areas for Birds are areas, which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

# **8210** Calcareous rocky slopes with chasmophytic vegetation

| National Level | |
|---|---|
| **Habitat Code** | 8210 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |
| **Biogeographic level** | |
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | Anonymous. (1979). Areas of scientific interest in Co. Mayo. *An Foras Forbartha, Dublin.*<br>Barrington, M. A. and R. P. Vowell. (1885). XXV - Report on the flora of Ben Bulben and the adjoining mountain range in Sligo and Leitrim. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. IV - Science. P. 493 - 517.<br>Birks, H. J. B., Birks, H. H. and D. A. Ratcliffe. (1969). Mountain plants on Slieve League, Co. Donegal. *Irish Naturalists' Journal.* Vol. 16. P. 203.<br>Brodie, J. (1991). Some observations on the flora of Clare Island, Western Ireland. *Irish Naturalists' Journal.* Vol. 23. No. 9. P. 376 - 377.<br>Brunker, J. P. (1950). Flora of the County Wicklow. *Dundalgan Press, Dundalk.*<br>Corry, T. H. (1884). On the heights attained by plants on Ben Bulben. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. IV - Science. P. 73 - 77.<br>Cotton, D. F. C. and M. Cawley. (1991). New records of vascular plants from Cos. Sligo (H28) and Leitrim (H29). *Irish Naturalists' Journal.* Vol. 24. No. 7. P. 288 - 295.<br>Curtis, T. (1976). A preliminary report on areas of scientific interest in Co. Wicklow. *An Foras Forbartha, Dublin.*<br>Curtis, T. G. F. (1981). Report on field outing to Kincaslough, Co. Donegal, 16th - 17th June. *Watsonia.* Vol. 13. No. 3. P. 261.<br>Curtis, T. G. F. (1993). *Polygonum viviparum* in Ireland with particular reference to the flora and vegetation of the Mount Brandon range, Co. Kerry. *Irish Naturalists' Journal.* Vol. 24. No. 7. P. 274 - 280.<br>Curtis, T. G. F. and C. Mhic Daeid. (1981). Report on field outing to Mullaghanattin, Glencar, Co. Kerry, 21st - 23rd July. *Watsonia.* Vol. 13. No. 3. P. 261 - 262.<br>Curtis, T. G. F. and C. Mothershill. (1977). New additions to the flora of County Leitrim (H29). *Bulletin of The Irish Biogeographical Society.* No. 2. P. 42 - 44.<br>Curtis, T. G. F., Goodwillie, R. and R. Young. (1978). Areas of scientific interest in Co. Sligo. *Revised and expanded report. An Foras Forbartha, Dublin.*<br>Curtis, T.G.F. and R. Young. (1977). Areas of scientific interest in Co. Wicklow. *An Foras Forbartha, Dublin.*<br>Day, G. V. (2002). BSBI field meetings in Ireland 2002. *Irish Botanical News.* P. 39 - 42.<br>Doyle, G. J. and P. J. Foss. (1986). A resurvey of Clare Island Flora. *Irish Naturalists' Journal.* Vol. 22. No. 3. P. 85 - 89.<br>Dublin Naturalists Field Club. (1998). Flora of County Dublin. *Dublin Naturalists Field Club, Dublin.*<br>Fahy, E. (1974). A preliminary report on areas of scientific interest in County Tipperary. *An Foras Forbartha, Dublin.* |

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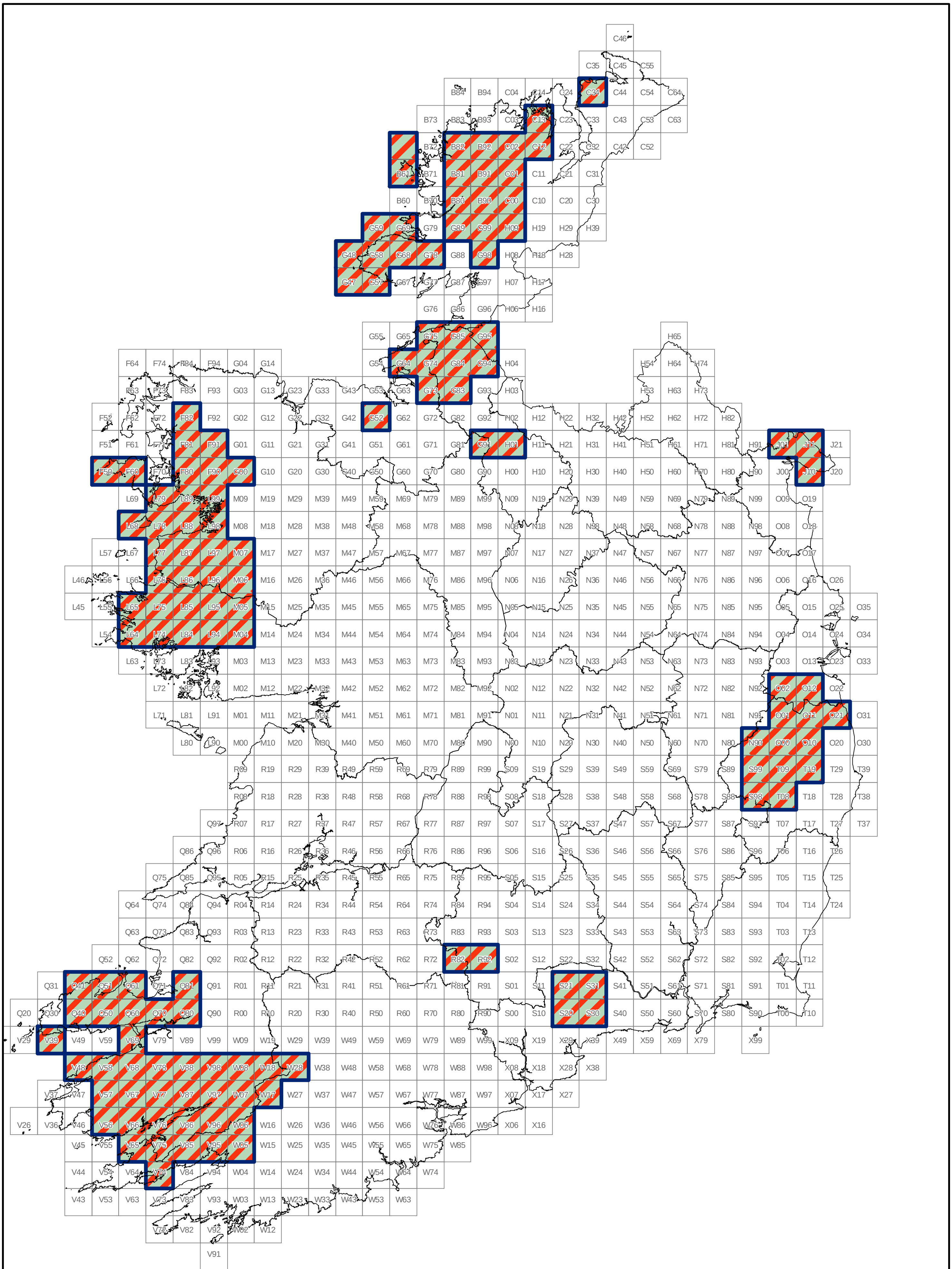
| | |
|---|---|
| | |
| Range | |
| Surface area | The Natural Range for this habitat potentially covers 13,200 km² (132 grid cells selected x 100 km²). |
| Date | 1800s to 2006. |
| Quality of data | 1 = poor (based on very incomplete data with expert opinion). |
| Trend | Likely to be stable. |
| Trend-Period | 1950 - 2006 |
| Reasons for reported trend | |
| **Area covered by habitat** | |
| Surface area | Unknown though estimated by NPWS to be 0.75 km$^2$ |
| Date | 1800 - 2006. |
| Method used | 1 =Mostly based on expert opinion |
| Quality of data | 1 = poor (based on very incomplete data with expert opinion) |
| Trend | Negative. |
| Trend-Period | 1950 – 2006 |
| Reasons for reported trend | 3 = direct human influence ( overgrazing and trampling) |
| Justification of % thresholds for trends | Increase in the intensity of impacting activities (e.g. overgrazing, trampling) suggest this negative trend. |
| Main pressures | 142 Overgrazing by sheep<br>390 Mining and extraction activities<br>624 Mountaineering, rock climbing, speleology |
| Threats | 142 Overgrazing by sheep<br>390 Mining and extraction activities<br>702 Air pollution – acidification |
| ***Complementary information*** | |
| **Favourable reference range** | Favourable, as the Favourable Reference Range for this habitat potentially covers 13,200 km² (132 grid cells selected x 100 km²), (see **Figure 1**). |

| | |
|---|---|
| **Favourable reference area** | The precise surface area of calcareous rocky slopes in Ireland is unknown and cannot be accurately determined in the absence of a dedicated field survey to confirm the complement of species present. Nonetheless, a rough estimate has been given by NPWS leading to an assessment of Unfavourable Inadequate. It is felt that Favourable Reference Area is > current area. |
| **Typical species** | Vascular plants within calcareous rocky slopes are described as either obligate (true) alpine species or facultative species (which are those that are also found at lower elevations and in other habitats).<br><br>**Obligate alpine species:**<br><br>*Alchemilla alpina, Alchemilla glaucescens, Arenaria ciliata, Asplenium viride, Cardaminopsis petraea, Deschampsia caespitosa ssp. alpina, Epilobium alsinifolium, Euphrasia frigida, Oxyria digyna, Phegopteris connectilis, Poa alpina, Polygonum viviparum, Polystichum lonchitis, Salix phylicifolia, Saussurea alpina, Saxifraga hartii, Saxifraga nivalis, Saxifraga oppositifolia, Saxifraga rosacea, Silene acaulis, Thalictrum alpinum.*<br>**Facultative species:**<br><br>*Angelica sylvestris, Anthriscus sylvestris, Arabis hirsute, Campanula rotundifolia, Cochlearia officinalis (alpina), Crepis paludosa, Cystopteris fragilis, Draba incana, Dryas octopetala, Epilobium brunnescens, Euphrasia salisburgensis, Galium boreale, Galium sterneri, Geum rivale, Juniperus communis, Koeleria macrantha, Meconopsis cambrica, Plantago maritima, Ranunculus auricomus, Rhodiola rosea, Samolus valerandi, Saxifraga aizoides, Saxifraga hypnoides, Selaginella selaginoides, Sesleria albicans, Silene dioica, Silene uniflora, Thalictrum minus, Thymus praecox, Hieracium anglicum.*<br><br>**Bryophytes and lichens:**<br><br>*Jungermannia spp.* |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Typical species conservation status: Unfavourable inadequate |
| **Other relevant information** | 1. As this habitat is restricted by altitude, the range does not extend beyond the current known distribution.<br><br>2. By using the Digital Terrain Model generated polygons for north and north-east facing slopes on siliceous and calcareous geologies above 350m in elevation with a slope > 40º it is possible to produce a very rough estimate of the potential area of calcareous rocky slope in Ireland. This figure has inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria, whereby areas where calcareous rocky slope is known to occur are not depicted. These areas are also likely to contain other habitats such as siliceous and calcareous scree, siliceous rocky slope, alpine heath or dry and wet heath. The area as defined using the DTM is approximately 1,171 Ha or 11.71 km². It is not possible to determine what percentage of this area corresponds to calcareous rocky slope as opposed to the other habitats listed above. The precise surface area of calcareous rocky slopes in Ireland is therefore **Unknown** and cannot be accurately determined in the absence of a dedicated field survey to confirm the complement of species present. However, a figure has been estimated using expert judgement by NPWS based on approximate proportions covered by the habitat. |
| **Conclusions**<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | **Favourable** |
| **Area** | **Unfavourable Inadequate** |
| **Specific structures and functions (incl. typical species)** | **Unfavourable Inadequate (U1)** - based on the increase in impacting activities and expert opinion. |

| | |
|---|---|
| **Future prospects** | **Unfavourable Inadequate (U1) -** due to pressure from impacting activities (e.g. overgrazing, trampling). |
| **Overall assessment of CS** | **Unfavourable Inadequate (U1).** |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

## Calcareous rocky slopes with chasmophytic vegetation

8210

- Current Distribution (132 cells)
- Current Range (132 cells)
- Favourable Reference Range (132 cells)
- W48 10km grid cells

Date: October 2007

# **8220** Siliceous rocky slopes with chasmophytic vegetation

## CONSERVATION STATUS ASSESSMENT REPORT

### Table of Contents

# 8220 SILICEOUS ROCKY SLOPES WITH CHASMOPHYTIC VEGETATION CONSERVATION STATUS ASSESSMENT REPORT

## *1 HABITAT CHARACTERISTICS IN IRELAND*

### 1.1 Definition of siliceous rocky slopes with chasmophytic vegetstion

A definition of Siliceous rocky slopes with chasmophytic vegetation (hereafter referred to as siliceous rocky slopes) cannot be made without first reference to the term 'montane', which is also understood as 'alpine' in Ireland. In the historical literature, the convention in Ireland has been to apply the term 'alpine' to those areas of habitat above 350-450 metres (1,200 – 1,500 ft) in altitude. However, the easy application of this label is very difficult as areas of 'alpine' vegetation may occur much lower than this, and the occurrence of this habitat is ultimately dependent on a number of factors principally geographical location, aspect, levels of exposure and not least, biogeographical history. In general, an alpine zone on Irish mountains occurs within the altitudinal range above but, moving northwards and westwards, it is met with at increasingly lower levels.

From a vegetation point of view, assemblages of alpine plants of rocky slopes are confined to areas of rocky slopes located on the more or less vertical, bare, north-east facing cliffs or areas of outcropping rock on slopes, which had their origins during the last glacial periods. It is widely considered that the alpine species occupying these areas are relictual in nature and represent the last vestiges of the arctic/tundra floristic component that was widespread in Ireland during the Pleistocene period.

There has been little published on the vegetation of Irish mountains, even though some systematic work was carried out on them during the 1970s. However, White and Doyle (1982) recognized 12 associations within 6 Classes, which probably encompass the range of variation found within the alpine cliff and alpine heath communities. Curtis (1993) presented some further details on the affinities of the alpine vegetation of Mount Brandon and Slieve League.

**Table 1** presents a list of Associations, indicative of upland habitats such as rocky slopes, which are specifically alpine in nature but it should be stressed that these often occur as part of a larger mosaic of vegetation, which can include blanket bog, wet heath and dry heath. Consequently, it is considered that the term 'alpine' only be applied to those categories listed below in which the diagnostic species, appropriate to each is present.

Siliceous rocky slopes are mainly included in the 'Spring Vegetation' and 'Bog and Wet Heath' Class, and hence, it should be noted that there is often overlap between it and the other upland Annex I habitats, which include:

- 4060 Alpine and boreal heath,
- 8110 Siliceous screes of the montane to alpine levels,
- 8210 Calcareous rocky slopes with chasmophytic vegetation.

It should be noted that there is some doubt as to the exact nature of some of the categories as a systematic phytosociological survey of Irish alpine vegetation has not yet been carried out.

**Table 1. Table of plant associations found on alpine cliffs and heaths in Ireland based on White & Doyle (1982).**

| Class | Association | Diagnostic species |
|---|---|---|
| Pioneer communities of scree* | *Cryptogrammetum*<br><br>*Oxyrietum digynae* | *Cryptogramma crispa.*<br><br>*Oxyria digyna.* |
| Wall fern - *Asplenietea-rupestria* | *Polysticho-Asplenietum viridis* | *Polystichum lonchitis, Asplenium viride.* |
| Spring vegetation - *Montio-Cardaminetea* | *Philonotido fontanae-Saxifragetum stellaris*<br><br>*Saxifrago-Chrysosplenietum oppositifolii*<br><br>*Saxifragetum aizoidis* | *Saxifraga stellaris, Montia fontana ssp fontana, Dicranella palustris, Philonotis fontana, Scapania uliginosa.*<br><br>*Chrysosplenium oppositifolium, Saxifraga stellaris.*<br><br>*Saxifraga aizoides, S. oppositifolia, Alchemilla glabra, Selaginella selaginoides.* |
| Arctic-alpine grass heaths | *Breutelio-Seslerietum*[1] | *Arenaria ciliata, Saxifraga aizoides, Silene acaulis, Euphrasia salisburgensis, Breutelia chrysocoma, Sesleria albicans.* |
| Acid grass - heathlands | *Achilleo-Festucetum tenuifoliae*<br><br>*Nardo-Caricetum binervis* | *Agrostis capillaris, Festuca ovina, F .vivipara, Achillea millefolium, Veronica officinalis, Viola riviniana, Trifolium repens, Holcus lanatus.*<br><br>*Nardus stricta, Carex binervis, Luzula multiflora, Succisa pratensis.* |
| Bog and wet heath | *Lycopodio-alpini-Rhacomitrietum lanuginosi*<br><br>*Herberteto-Polytrichetum alpini*<br><br>*Arctostaphylo-Dryadetum*[2] | *Lycopodium alpinum, Racomitrium lanuginosum, Salix herbacea, Carex bigelowii, Juniperus communis* ssp *nana, Arctostaphylos uva-ursi, Vaccinium vitis-idaea.*<br><br>Bryophytes principally *Herberta adunca, Pleurozia purpurea, Plagiochila spinulosa, Anastrepta orcadensis, Bazzania tricrenata.*<br><br>*Dryas octopetala, Calluna vulgaris, Juniperus communis* ssp. *nana, Arctostaphylos uva-ursi, Pyrola minor*[3]*, Empetrum nigrum, Listera cordata.* |

*Notes:*

* The nature of the Pioneer communities of screes is fragmentary and so the status of this Class in Ireland is still uncertain.

[1] White and Doyle assign the *Breutelia-Seslerietum* to the Class of Arctic-Alpine grass heaths when it is actually an association found on wet cliffs on the Ben Bulben massif.

[2] The *Arctostaphylo-Dryadetum* is an association found on the higher parts of the Burren and is properly montane in nature

[3] This species is unlikely to occur in this community as *Pyrola media* is the characteristic species found within this Association in Ireland.

For most habitats listed in the Interpretation Manual of the Habitats Directive, there is a direct correspondence between its name and an Association of vegetation, which has been formally recognised by phytosociologists. For example, the name '**Alkaline fens'** encompasses the Association of fen vegetation dominated by *Schoenus nigricans* over calcareous peats. However, for the Habitat Directive categories of alpine habitats there is no direct equivalence between the habitat title and a specific Association of vegetation. Instead, there has been a broad, generic approach to the classification of alpine categories within the Interpretation Manual and consequently the formal assignation of areas of alpine habitat to these is not easily accomplished. As has already been pointed out in **Table 1**, there are probably 12 Associations of vegetation, which can be formally recognized in Ireland for alpine areas, 7 for the vegetation of cliff faces and 5 for the vegetation found on the more level areas of uplands at altitude.

In some cases, individual Associations appear to be restricted to certain Interpretation Manual categories e.g. the *Cryptogrammetum* to Siliceous scree and the *Polysticho-Asplenietum viridis* to the Calcareous rocky slope. However, the majority of Associations can occur in 2 or 3 Interpretation Manual categories *viz. Saxifragetum aizoidis* and *Breutelia-Seslerietum* in both Calcareous scree and Calcareous chasmophytic slopes, whilst the *Philonotido fontanae-Saxifragetum stellaris* may be included within both of the Chasmophytic categories of Calcareous and Siliceous slopes. And, the Alpine heath Association of the *Lycopodio-alpini-Rhacomitrietum lanunginosi* apparently occurs within 3 Interpretation Manual alpine habitats. The consequences of this are that the accommodation of Irish alpine habitats, species and vegetation within the categories of the Interpretation Manual is not easily accomplished and it must be recognized, that on the ground, there is a great deal of overlap between Habitats Directive categories. This is especially so for the two Chasmophytic slope habitats.

However, for the purposes of the Habitats Directive alpine cliff and scree habitats in Ireland are considered to belong to four categories:

The alpine cliff communities are accommodated within:
- **(8220) Siliceous rocky slopes with chasmophytic vegetation**
- **(8210) Calcareous rocky slopes with chasmophytic vegetation**
- **(8110) Siliceous scree of the montane to snow levels**
- **(8120) Calcareous and calcshist screes of the montane to alpine levels**

Both categories of **Chasmophytic vegetation on rocky slopes** usually occur together or in close proximity to each other on Irish mountains. The calcareous subtype is well represented on limestone mountains and on areas of cliff, which have been metamorphosed in the past and, which are slightly more mineral rich than the adjoining areas. Typically this last scenario pertains in small veins running through country rock, which is essentially siliceous in nature though in certain cases an entire mountain of metamorphic rock can occur amidst a range of relatively impoverished strata, such as at Muckanaght in the Twelve Bens (Site Code: 002031) in Connemara. The more siliceous components of the **Siliceous subtype** equate approximately to the Wall fern class in **Table 1** whilst the **Calcareous subtype** is broadly accommodated within the Spring vegetation and Arctic alpine grass heath listed there.

Though the four categories used to accommodate alpine scree and rocky vegetation in Ireland, for the purposes of the Habitats Directive, are appropriate for the designation of Special Areas for Conservation, they cannot be considered comprehensive for the purposes of defining alpine cliff and scree habitats and their vegetation. For the purposes of confirming the occurrence of and identifying montane areas where alpine screes and rocky habitats are found the conspectus of Associations given in **Table 1** should be used. However, a preliminary assignation of the associations of alpine vegetation to the appropriate Habitats Directive categories is presented in **Table 2**. It is stressed that this is approximate and the production of a definitive account must await a thorough field investigation of the nature of Irish alpine vegetation.

**Table 2. NATURA 2000 alpine cliff habitat categories and the likely plant associations based on White and Doyle (1982), which they contain.**

| NATURA 2000 Habitat title | Probable identity of plant association |
|---|---|

| | **(White and Doyle (1982))** |
|---|---|
| **Chasmophytic vegetation: Calcareous** | *Polysticho-Asplenietum viridis;*<br>*Philonotido fontanae-Saxifragetum stellaris;*<br>*Saxifragetum aizoidis;*<br>*Breutelia-Seslerietum;*<br>*Arctostaphylo-Dryadetum;*<br>*Lycopodio-alpini-Rhacomitrietum lanuginosi* |
| **Chasmophytic vegetation: Siliceous** | *Philonotido fontanae-Saxifragetum stellaris;*<br>*Saxifrago-Chrysosplenietum oppositifoli;*<br>*Herberto-Polytrichetum alpini;*<br>*Lycopodio-alpini-Rhacomitrium lanuginosi* |

It can be seen from **Table 2** that some alpine associations occur in more than one habitat and in reality their expression is a function of the rock type on, which they occur, the altitude, aspect, substrate size and degree of slope. In general, the greatest diversity of species occurs within the Calcareous scree/ Calcareous Chasmophytic habitats on the limestone mountains of the north-west with a lesser degree of diversity found within the Calcareous Chasmophytic habitat found on mountains of other rock types. The least diversity is found within the Siliceous Chasmophytic habitat except in areas where the bryophyte communities are very well represented.

## 1.2 List of alpine and siliceous scree plant species in Ireland

The listing of plant species occurring in alpine areas in Ireland is made possible for the vascular plants by the availability of lists from papers prepared by 19th century botanists, principally H.C. Hart who was the first to systematically examine the major mountain ranges in Ireland and who provided altitudinal data along with species occurrences. This has been added to over the 20th century by the discovery of further sites for alpine plants and it can be concluded that the species complements of Irish mountains is reasonably well known for the ferns and flowering plants. However, for the cryptogams, this is not the case and only certain well-botanised sites such as Ben Bulben (Site Code: 000623) and the Macgillicuddy's Reeks (Site Code: 000365) are well documented. However, the systematic survey of many Irish counties for bryophytes is ongoing and will eventually result in a comprehensive overview of the alpine mosses and liverworts.

Defining an alpine plant in Ireland is often made difficult as what may be alpine here may not be elsewhere in Europe and this is confounded by the behaviour of some lowland species, which occur on mountain tops and cliffs and act as alpine elements. For example, sea pink, *Armeria maritima* is found on the summit of Carrauntoohill at 1,034 m whilst on alpine cliffs a form of the common scurvy grass, *Cochlearia officinalis* a common coastal species, is sometimes found. A further illustration of the ecologically fickle nature of many Irish plants is crowberry, *Empetrum nigrum*, usually a species of high mountains but in County Mayo, it occurs at sea level.

The list of true alpines in Ireland is small, that is species, which never descend lower than 350m or away from cliff habitats and these are the true post-Pleistocene relicts, which can be considered as **Obligate Alpines** due to their virtual confinement to vertical, north-east facing cliffs or on exposed mountain ridges and summits. There conditions are severe enough to inhibit competition from coarser species and inaccessible enough to prevent grazing by animals. These may be joined here by what may be termed **Facultative Alpines**, which are species found in other habitats, not necessarily montane, but, which are also commonly associated with alpine locations.

**Table 3** lists the siliceous rocky slope species, which are found at high altitude in Ireland. It excludes species, which are very widespread and found across a range of habitats from sea level to mountain tops.

**Table 3: List of species found on siliceous rocky slopes in Ireland.**

| **Scientific Name** | **Obligate or Facultative Alpine Species** |
|---|---|
| *Cardaminopsis petraea* | Obligate |
| *Deschampsia caespitosa* ssp. *alpina* | Obligate |
| *Euphrasia frigida* | Obligate |
| *Festuca vivipara* | Obligate |
| *Minuartia recurva** | Obligate |
| *Oxyria digyna* | Obligate |
| *Phegopteris connectilis* | Obligate |
| *Poa alpina* | Obligate |
| *Polygonum viviparum* | Obligate |
| *Salix herbacea* | Obligate |
| *Saussurea alpina* | Obligate |
| *Saxifraga hartii* | Obligate |
| *Saxifraga rosacea* | Obligate |
| *Saxifraga stellaris** | Obligate |
| *Thalictrum alpinum* | Obligate |
| *Vaccinium vitis-idaea* | Obligate |
| *Agrostis canina* | Facultative |
| *Agrostis capillaris* | Facultative |
| *Antennaria dioica* | Facultative |
| *Anthriscus sylvestris* | Facultative |
| *Calluna vulgaris* | Facultative |
| *Campanula rotundifolia* | Facultative |
| *Cochlearia officinalis (alpina)* | Facultative |
| *Crepis paludosa* | Facultative |
| *Cystopteris fragilis* | Facultative |
| *Deschampsia flexuosa* | Facultative |
| *Epilobium angustifolium* | Facultative |
| *Epilobium brunnescens* | Facultative |
| *Festuca ovina* | Facultative |
| *Geum rivale* | Facultative |
| *Huperzia selago* | Facultative |
| *Hymenophyllum tunbrigense* | Facultative |
| *Hymenophyllum wilsonii* | Facultative |
| *Jasione montana* | Facultative |
| *Juniperus communis* | Facultative |
| *Koeleria macrantha* | Facultative |
| *Listera cordata* | Facultative |
| *Luzula sylvatica* | Facultative |
| *Lycopodium clavatum* | Facultative |
| *Meconopsis cambrica* | Facultative |
| *Nardus stricta* | Facultative |
| *Pedicularis sylvatica* | Facultative |
| *Plantago maritima* | Facultative |
| *Ranunculus auricomus* | Facultative |
| *Rhodiola rosea* | Facultative |
| *Sagina subulata* | Facultative |
| *Samolus valerandi* | Facultative |
| *Saxifraga spathularis* | Facultative |

| **Scientific Name** | **Obligate or Facultative Alpine Species** |
|---|---|
| *Selaginella selaginoides* | Facultative |
| *Silene dioica* | Facultative |
| *Silene uniflora* | Facultative |
| *Solidago virgaurea* | Facultative |
| *Thalictrum minus* | Facultative |
| *Thymus praecox* | Facultative |
| *Vaccinium myrtillus* | Facultative |
| *Andreaea alpina* | |
| *Andreaea rothii* | |
| *Andreaea rupestris* | |
| *Bartramia pomiformis* | |
| *Cynodontium jenneri* | |
| *Diplophyllum albicans* | |
| *Grimmia funalis* | |
| *Grimmia torquata* | |
| *Gymnomitrion concinnatum* | |
| *Gymnomitrion corallioides* | |
| *Gymnomitrion crenulatum* | |
| *Gymnomitrion obtusum* | |
| *Hedwigia ciliata* | |
| *Hedwigia stellata* | |
| *Hieracium anglicum* | |
| *Kiaeria blytii* | |
| *Kiaeria starkei* | |
| *Lophozia opacifolia* | |
| *Marsupella spp.* | |
| *Nardia scalaris* | |
| *Racomitrium affine* | |
| *Racomitrium aquaticum* | |
| *Racomitrium fasiculare* | |
| *Racomitrium heterostichum* | |
| *Racomitrium sudeticum* | |
| *Rhabdoweisia crennulata* | |
| *Rhabdoweisia crispata* | |
| *Rhabdoweisia fugax* | |

* Note these obligate alpine species are restricted to the siliceous rocky slope habitat.

## 2 *HABITAT MAPPING*

There has been no recent inventory or mapping of the national siliceous rocky slope resource in Ireland. For the purposes of this survey, an extensive literature review of both published and unpublished material was undertaken (**Appendices 1** and **2**). Records documenting the occurrence of the species recorded from siliceous rocky slopes (as listed in **Table 3**) were collated in an *MS Access* **Uplands Habitats Database**. This database contains records of the obligate and facultative species of the five Annex I upland habitats (4060, 8110, 8120, 8210, 820) in Ireland and was designed specifically for the purposes of this report.

The **Upland Habitats Database** of this project, currently holds c.4,500 records of indicator species of all Annex I upland habitats (i.e. 4060, 8110, 8120, 8210 and 8220) which have been gleaned from a variety of sources (both published and unpublished as documented in **Appendices 1** and **2** respectively). Given the antiquity of the bulk of the data (c.1700 of the records date from the 1800s to the 1950s) and the lack of accurate geographical references (only c.1500 records have grid references of varying accuracy (see below and **Appendix 3** for further information) the GIS application of much of the collated data is limited. The bulk of records will not be illustrated in **Figures 1 to 3** due to their lack of grid references.

The database contains information on the following:

- Species Name
- Designated Site Code (NATURA 2000 sites (SACs) or Natural Heritage Areas (NHAs))
- Description of the location of the species
- Altitudinal information (either in feet (ʻ) or metres (m) depending on the antiquity of the record)
- Grid Reference (if provided) – these were assigned an accuracy rating
- Source of data (published or unpublished reference)
- Date of record
- List of associated species (if present)
- Indication of whether the description indicated a single species record, an assemblage of species or a description of habitat cover*
- Any information on substrate or underlying geology

*Given the variability of data sources, records of indicator species have been described either as an assemblage of species, a single species location or as an indication of habitat cover, depending on the quality and source of the data. For example a historical record by Corry (1884), which only contained details of a particular species at a certain altitude on Ben Whisken (Site Code: 000623) was entered as a single plant species location, whereas a description of several arctic-alpine species on a cliff above a corrie lake on Mount Brandon (Site Code: 000375) by Stelfox (1951) was entered as a species assemblage. Where there was a good description of an area of alpine heath (such as that given by Conaghan et. al. (1994) in the NHA Site Card for the Twelve Bens (Site Code: 002031)) this was entered as habitat cover.

Data for all of the above fields in the database was not necessarily contained in the original publication/source for each record and based on the description of the locations given, an appropriate SAC Site Code was assigned to each record using the Discovery and 6″ Mapping on Arc View 3.2.

**GIS**

GIS data sources, which are related to ecological factors that determine the occurrence of siliceous rocky slopes, were used to produce the indicative natural range and potential distribution maps shown on **Figures 1** and **2**. These include:

- Contour lines >350m elevation. Ordnance Survey (1995) – 1:50,000 Discovery Series, 10m contour interval,
- A Digital Terrain Modelling package (2007) generated polygons, which were used to identify areas of potential siliceous rocky slope based on the following criteria:
    - elevation above 350m,
    - upland areas above 350m with a slope > 40º,
    - north and north-east facing slopes with a slope > 40º.

The areas which were identified were further refined to exclude the mountain ranges which are formed of limestones.

Investigation of the polygons created by the DTM indicated that not all slopes, which potentially contain siliceous rocky slope, had been accurately identified (e.g. the north prison of Lugnaquilla within Wicklow Mountains SAC (Site Code: 002122) was not shown) and this was thought to be due to the use of the slope criteria. The use of this data thus has some limitations.

Although the use of recent (2000) digital aerial photographs of Ireland, which were ortho-rectified, was investigated, it became apparent that it was not possible to use these remotely to identify areas of siliceous rocky slope. This is because it is not possible to distinguish it accurately from rocky habitats in mosaics of vegetation of wet heath, dry heath, scree habitats and upland grassland.

## 2.1 Habitat Range

Siliceous rocky slopes which support the habitat are largely restricted to those areas of north and north-east facing slopes (>40º) above 350-450 metres (c.1,200 – 1,500ft) in height and can be found within siliceous mountain ranges. However, siliceous rocky slopes do occur with other aspects. The occurrence of this habitat is ultimately dependent on a number of factors, principally geographical location, aspect, levels of exposure, nature of the solid geology, local erosional features and fluvio-glacial history. The actual range of siliceous rocky slopes habitat as defined in the Habitats Directive Interpretation Manual is unknown in Ireland.

In general a siliceous (alpine) rocky zone on Irish mountains occurs within the altitudinal range above but as you move northwards and westwards, it occurs at increasingly lower levels. From an alpine vegetation point of view, siliceous rocky habitat is usually confined to the north and north-east facing slopes of the mountains though rocky habitat can occur with other aspects. Siliceous rocky habitat is quite localised in upland areas in a few selected parts of Ireland.

**Figure 1** shows that siliceous rocky habitat thus potentially occurs in most of the mountain ranges in Ireland with the exception of the limestone mountains. These siliceous areas are located mainly in the north-west in Counties Donegal and Cavan, in the west (parts of County Leitrim, in Mayo and Galway) and south-west (Counties Kerry and Cork). Apart from these areas, there is a more localised distribution in uplands in the south (Co. Tipperary, Co. Limerick and Waterford), the north-east (Co. Louth) and eastern part (Co. Wicklow) of the country. There is an absence of siliceous rocky habitat in the midlands of Ireland due to the lowland character of the landscape. This habitat thus has a naturally discontinuous range in Ireland as it is restricted by altitude.

**Figure 1** shows the potential natural range of siliceous rocky slopes in Ireland at a scale of 1 : 2,400,000. This map is based on a variety of different data sources.

- Firstly, the locations of north and north-east facing slopes (> 40º) in upland areas >350m in elevation (shown as purple squares).
- In order to overcome the limitations of the DTM model (which did not show all north and north east facing cliffs where siliceous rocky slope is known to exist as described above) all 10km squares, which contain sites (15 SACs) for which siliceous rocky slope is a qualifying interest were also used (shown as pink squares). Note that this included sites which are below 350 m in elevation such as Carlingford Mountain (000453) (**see Appendix 3** for full list of SAC sites with this habitat as a qualifying interest).
- Designated areas, which are located in siliceous areas above 350m, which were identified in the database as containing records of indicator species for the habitat listed in **Table 3** (above), but for which grid references and GIS based data is not available are also shown (as brown squares) – see **Appendix 3 -Table 4**.
- Other designated areas, which were identified in the database, which contain records of indicator species for the habitat, but for which GIS based data is also not available are also shown (as green squares) – see **Appendix 3 - Table 5**.
- Undesignated sites, which were identified in the database which contain records of indicator species for the habitat, but for which GIS based data is not available are also shown (depicted in blue squares) – see **Appendix 3 - Table 5**.
- Finally, sites were identified as potentially containing this rocky habitat on the basis of the occurrence of true obligate species for the habitat (**Table 3**). No extra squares were added for Range.

All of these 10km squares were further refined manually to include areas, which were below 350m in elevation. As can be seen, this habitat has a naturally discontinuous range in Ireland, as it is restricted by altitude and by the location of siliceous geology.

It must be stated, however, that although areas of siliceous rocky slope may occur in these mountain ranges they may not conform to the Habitats Directive definition, as this will depend on the species complement present. In the absence of a dedicated field survey, which will confirm the occurrence of those indicator species this map should be very much viewed as an over-estimation.

## 2.2 Conservation Status of Habitat Range

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the habitat range can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat range extent in the reporting period (a decrease in habitat range greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between current habitat range extent and the Favourable Reference Range (FRR) (if current habitat range is 10% below FRR the habitat range is considered Unfavourable Bad).

An assessment based on the historical range of siliceous rocky habitat indicates that the natural range polygon of the habitat in Ireland as defined (see **Figure 1**), potentially covers 13,400 km² (134 grid cells selected x 100 km²). No specific studies have been undertaken on the conservation status of the habitat range in Ireland during the reporting period making any assessment of the extent or annual decline or otherwise in the habitat range problematic.

In general, the conservation status of the habitat range is deemed **Favourable** as the physical conditions for the presence of siliceous scree slopes are still present and the natural range of the habitat is thus likely to remain unchanged.

The Favourable Reference Range (FRR) is considered the same as the current range.

**Habitat Range Area:** Can be considered as the area of the polygon, which contains all of the grid cells, which contain the habitat, which are defined by the location of potential locations for the habitat and by documented records of indicator species collated in the project database. This potentially covers 13,400 $km^2$ (134 grid cells selected x 100 $km^2$).

**Favourable Reference Range**: This is considered the same as the Habitat Range Area and as described above, i.e. 13,400 $km^2$ (134 grid cells selected x 100 $km^2$).

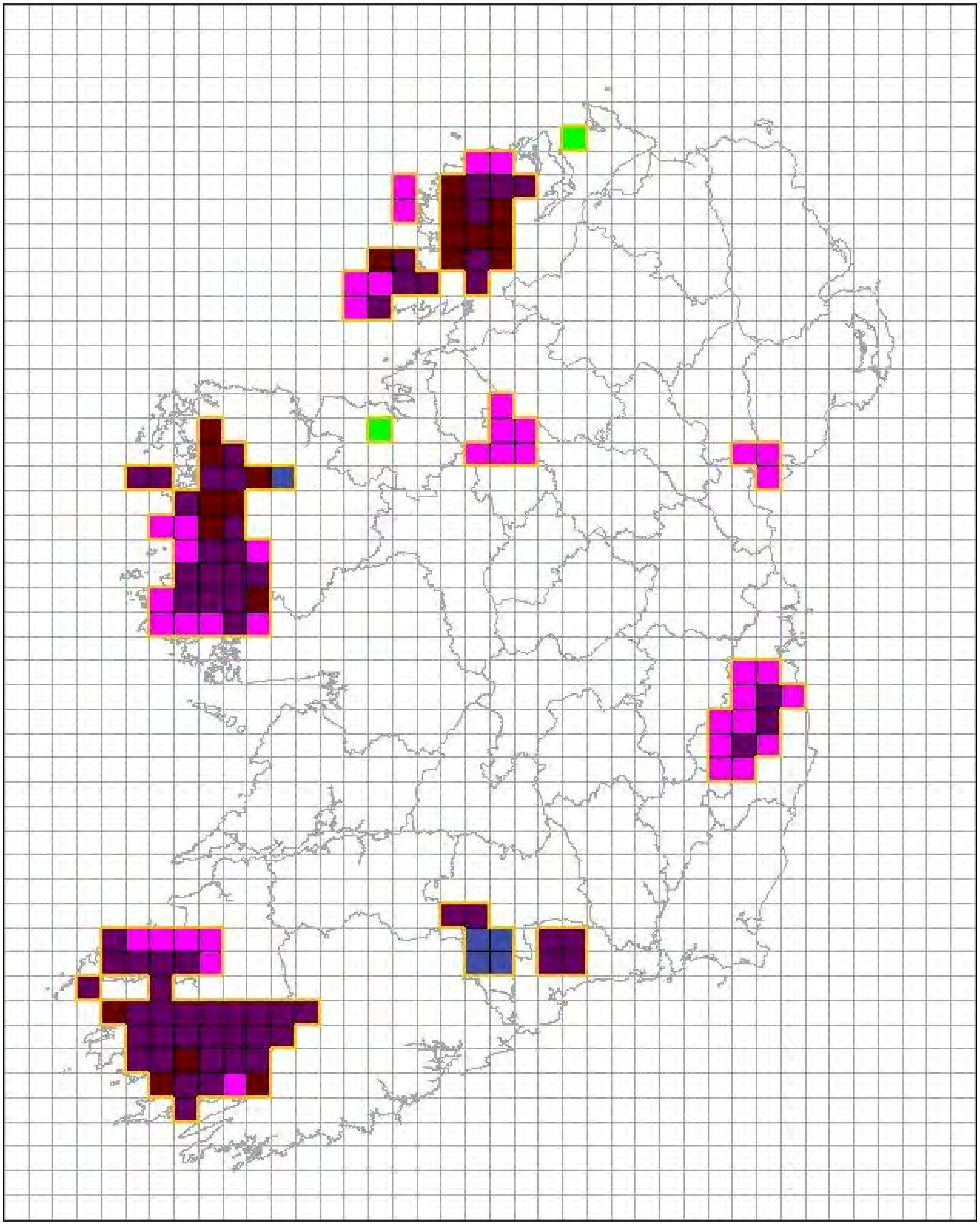


**Figure 1. Map showing the Range and Favourable Reference Range of siliceous rocky slopes in Ireland, on a 10km² basis.** This is based on the locations of north and north-east facing slopes (> 40º) in upland areas >350m in elevation on a siliceous rock (purple squares); the locations outside of this, of designated SAC sites for which siliceous rocky habitat is a qualifying interest (pink squares); designated areas, which are located in siliceous areas above 350m, identified in the database as containing records of indicator species for the habitat listed in **Table 3** (as brown squares); other designated areas, identified in the database, which contain records of indicator species for the habitat (green squares); undesignated sites, identified in the database which contain records of indicator species for the habitat, (blue squares) This map is presented at a scale of 1 : 2, 400,000.

## 2.3 Habitat Extent

***Habitat/Slopes***

It is not possible to quantify the extent of siliceous rocky habitat in Ireland, as there has been no systematic mapping of this habitat. The distribution of the habitat as shown on **Figure 2** is based on the location of north and north-east facing slopes (with a slope >40º) above 350m in elevation in the siliceous mountain ranges where siliceous rocky habitat slopes could be expected. By using the DTM generated polygons for north and north-east facing slopes above 350 m in elevation with a slope > 40º it is possible to produce a very inaccurate estimate of the potential area of siliceous rocky habitat in Ireland. This figure has inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria as described above, whereby areas where siliceous rocky slope is known to occur may not be depicted. These areas are also likely to contain other habitats such as siliceous scree slope, alpine heath or dry and wet heath.

The area of north and north-east facing slopes above 350m in elevation with a slope > 40º as defined using the DTM in areas of siliceous geology is approximately 1,141 ha or 11.41 $km^2$. Note that this figure does not include potential alpine siliceous rocky habitat in areas below 350m such as Carlingford Mountain or sites in the west, in Kerry and Donegal.

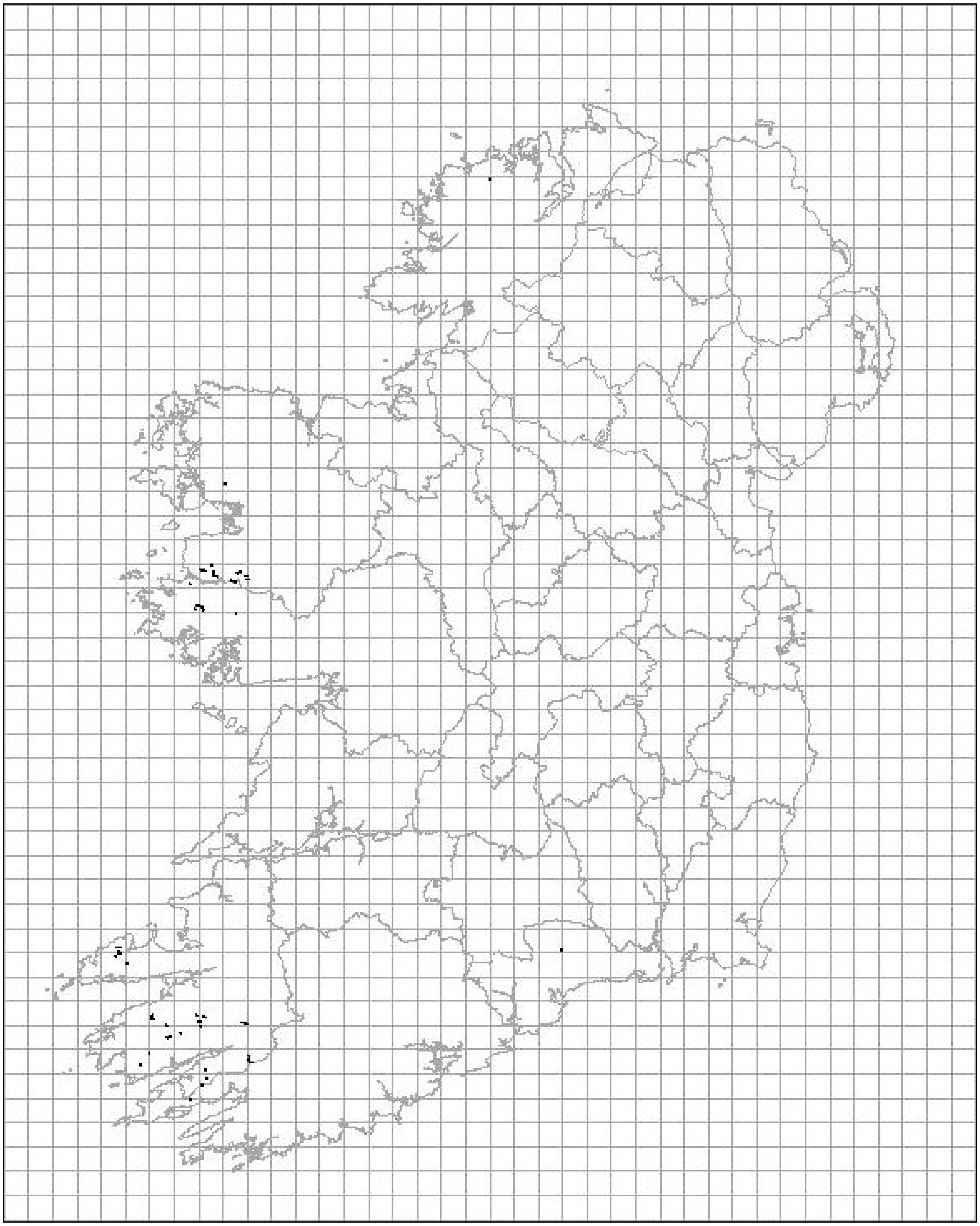


**Figure 2. Map showing the partial potential distribution of siliceous rocky slopes in Ireland based on the locations of north and north-east facing slopes (> 40°) (shown in black) at elevations >350m on siliceous rock types. This map is presented at a scale of 1 : 2, 400,000 and thus many of these areas are not visible at this scale.**

*Species*

The literature review and consultations with experts on siliceous rocky habitat has indicated that whilst the presence of indicative obligate arctic-alpine species within known sites is reasonably well documented for certain documented mountain ranges, this information cannot be used to determine the precise extent of the habitat either within a site or on a previously undesignated mountain range. In the absence of a national survey, the best attempt that could be made to determine extent was to utilise the rare, threatened and scarce plant data, which gives accurate point locations of obligate arctic-alpine species (**Table 3**) coupled with altitudinal information to indicate likely areas of siliceous rocky habitat.

The principal sources of recent information pertaining to the location and distribution of siliceous rocky habitat species, which included grid references* include:

- National Parks & Wildlife Rare, Threatened and Scarce Plant Databases,
- Rare, Threatened and Scarce Plant County Survey Reports,
- County Floras – many of the locations of indicator species were manually assigned to either a $10km^2$ or $1km^2$ grid based on the descriptions of locations detailed in these publications,
- National Rare and Threatened Bryophyte Surveys,
- Published papers with records of indicator species, which were assigned to either a $10km^2$ or $1km^2$ grid square,
- Unpublished field records of one of the principal authors of this report (Dr. Curtis) and other NPWS staff,

The data collated by the Botanical Society of the British Isles was not used for the following reasons:

- typically the mountain summits were not surveyed during the Atlas 2000,
- the data, which are presented, is available only on a 10km basis and at that scale does not indicate 'effort 'i.e. whether a plant was no longer recorded from a location, or that, the location was not surveyed,
- the Atlas data are not fully accurate for the Irish context (many of the records were incorrectly gridded, while others were assigned to the wrong year classes. This was despite detailed corrections from NPWS, which were not corrected).

*These data sources listed provided data in a wide variety of levels of mapped accuracy, which ranged from an accuracy of:

- 1m or 10m (recent county rare or threatened plant/bryophyte surveys),
- 100m (unpublished field records),
- $1km^2$ square grids (County flora records),
- $10km^2$ square grids (older publications or historical records of rare or threatened plant species).

These records were thus assigned an accuracy rating (relative to the nearest metre) in the database and were then plotted in Arc View 3.2 using an appropriate visual scale. This data was used coupled with other criteria listed below to indicate the likely extent of the habitat.

The key species used to try to determine an indicative extent of **siliceous rocky slopes** in Ireland are the 'true alpine' or obligate species species for the habitat listed in **Table 3.**

Records for these species are available at an accuracy of a 10km square, a 1 km square, at 100m and at 1m and a map of the indicative extent/locations of siliceous rocky habitat is presented in **Figure 3**. Note that there is overlap between these species and the true alpines of other upland habitats such as 8120, 8210, 8110 and 4060. Where these occur on Limestone Mountains these records have been ignored, as they would otherwise skew the data.

There were 160 species records available at this accuracy level, 62 of which were single species records (shown as orange points) and 98 of which are species assemblage records (shown as green points). Records of habitat cover were excluded as these are more likely to represent areas of alpine heath (4060).

The presence of calcicole species in this habitat such as *Cardaminopsis petraea* in the Galtee Mountains (Site Code: 000646), or *Polygonum viviparum* on Mount Brandon (Site Code: 000375), which would be strongly associated with limestone habitats such as those found at Ben Bulben (Site Code: 000623), is indicative of areas of cliff, which have been metamorphosed in the past and, which are slightly more mineral rich than the adjoining siliceous areas, as described above in **Section 1.1.**

To produce a map showing anything other than an indicative extent/location is rendered difficult because the available information relating to the occurrence of this habitat is based on plant species location rather than habitat extent. The areas of siliceous rocky habitat are often located within a mosaic of other habitats including heaths, grassland and scree, and so it is difficult to assume a minimum area where the alpine plant species occur. In addition large areas of upland habitats in Ireland remain unsurveyed.

The **accurate** mapping of the extent of siliceous rocky habitat of the montane to snow levels (8220) as defined in the Habitats Directive Interpretation Manual has not been possible.

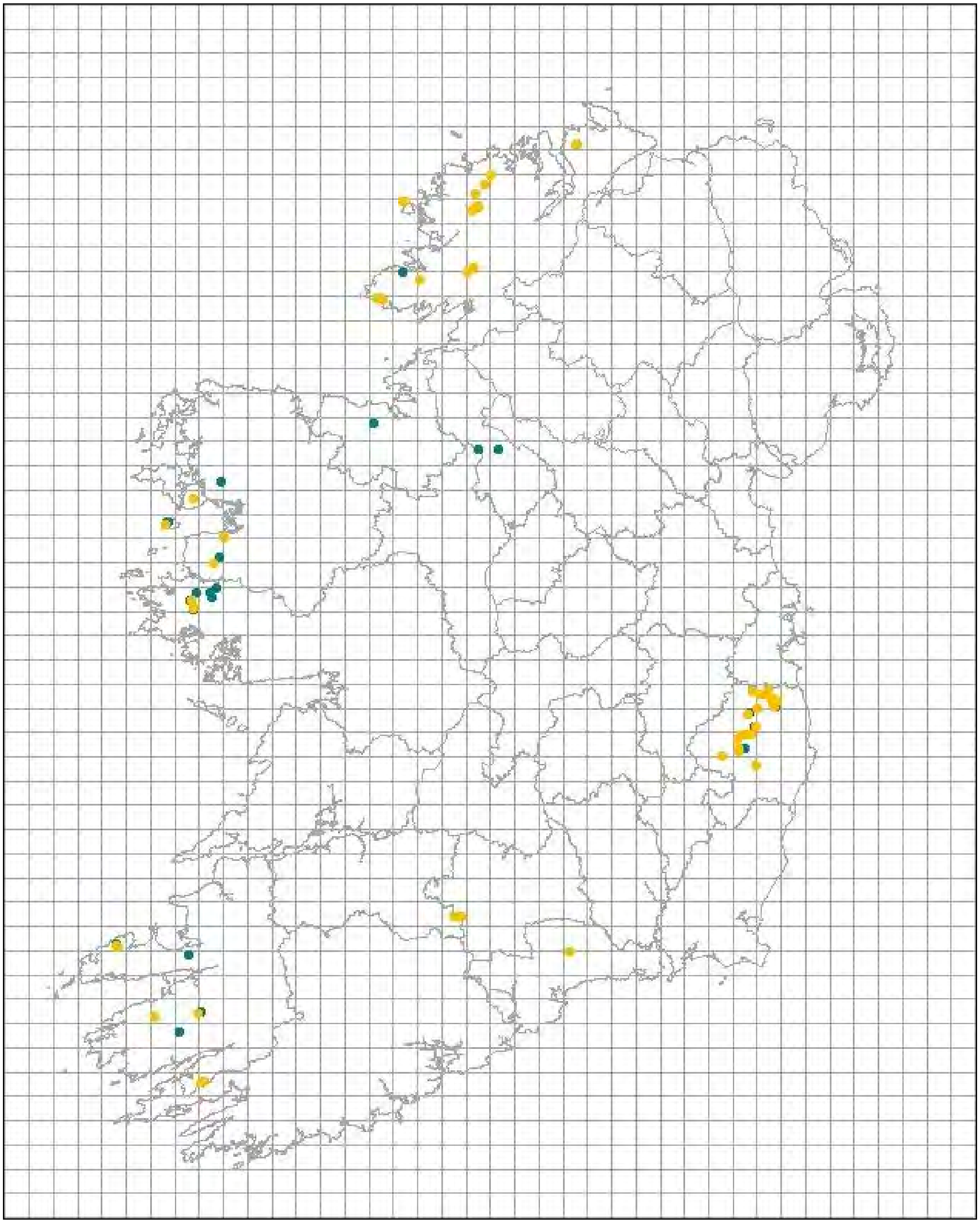


**Figure 3. Map showing the indicative extent/location of siliceous rocky slopes in Ireland based on the distribution of the sixteen true obligate alpine species for the habitat (Table 3) for which accurate grid references were available. There were 160 species records available at this accuracy level, 62 of which were single species records (shown as orange points) and 98 of which are species assemblage records (shown as green points). This map is presented at a scale of 1 : 2, 400,000.**

Given the following, a decision was taken by NPWS to calculate/estimate the area using best expert judgement:

- the area calculated relates to the entire siliceous resource with a certain slope and above 350m. It does not take into account that other alpine habitats may also be present in the same area.
- the area of 1,141 ha may on the one hand be an under-estimate of the relevant slopes as not all are picked up by DTM
- that the same area may be an under-estimate as the habitat has been recorded below 350 m
- that time did not allow for an examination of locations of steep ground/cliffs against geology and aerial photographs
- the lack of any systematic survey of this habitat in the recent or distant past
- The CORINE data base was consulted in an effort to calculate the area of bare rocks as defined by CORINE. However, bare rocks of e.g. Wicklow or Hungry Hill did not show up, and similarly for other areas, possibly because CORINE mapped at the scale of 25 ha.

**Calculation/estimation of area based on DTM figure, using best expert judgement.**.

**Table 4 Estimation of area of Siliceous Rocky Habitat in Ireland**

| | |
|---|---|
| Area covered by DTM on north and north-east facing slopes > $40^0$ > 350 m for siliceous geology – under estimate | 11.41 $km^2$ |
| NPWS assumes that circa 20% of the siliceous geology throughout the country (11.41 $km^2$) supports calcareous or metamorphosed strata, therefore 80% can be said to be siliceous and potentially. suited to supporting the habitat. | 9.128 $km^2$ |
| Of the estimated 9.128 $km^{2,}$ NPWS assumes that 60% is vegetated so 40% possibly consists of bare scree and rocky habitat. | 3.6512 $km^2$ |
| Of this estimation, NPWS further assumes that bare rocky ground is greater in area than scree in ratio 60:40 | 2.19 $km^2$ |
| As the entire DTM may be an underestimate and as siliceous slopes below 350 m have been recorded as supporting the habitat, increase this figure to 2.00 $km^2$ | 2.0 $km^2$ |

This best expert judgement figure can be improved upon following a dedicated survey.

## 2.4 Conservation Status of Habitat Extent

According to the General Evaluation Matrix (Annex E - Explanatory notes Article 17 Habitat Directive) the assessment of the conservation status of the extent of a habitat can be carried out in two different ways. The first method consists of assessing the annual variation in the habitat extent in the reporting period (a decrease in habitat extent greater than 1% per year is deemed Unfavourable Bad). The second is based on the relation between current habitat extent and the Favourable Reference Area (FRA) (if current habitat extent is 10% below FRA the habitat extent is considered Unfavourable Bad).

As mentioned previously the current extent of the habitat is **Unknown though a best expert judgement is provided**. The significance of the land use and activities on the extent of this habitat are not clearly understood due to lack of survey data. Any over-grazing impacting activities in so remote a habitat are deemed to be less significant than similar impacts on the wet heath and blanket bogs of the uplands. However, overgrazing by sheep is known to have damaged extensive areas of upland habitats.

The Commonage Framework Plan did not isolate upland exposed rocky slopes or screes as a habitat type within the survey and it is therefore not possible to use any of the data from this survey in accurately identifying the level of grazing damage to siliceous rocky habitats. A gross measure of the levels of grazing damage to those sites, which contain siliceous rocky habitats that are located within areas of commonage indicates that approximately 74% of the land has some levels of damage. Given the high levels of damage to other habitats in these commonage areas the impact of grazing is likely to have negatively impacted on siliceous scree. Overgrazing is known to have had a deleterious effect on this habitat in certain sites such as Derryclare Mountain in Connemara, Co. Galway (Site Code: 002031), Mount Brandon in Co. Kerry (Site Code: 000375) and parts of the Macgillicuddy's Reeks in Kerry (Site Code: 000365) (Dr Curtis pers. obs.).

The loss of the intrinsic suite of species may have led to a reduction in the area of the habitat. Mining and tourism related activities are also deemed to be threats to the alpine habitats. It is recognised that all of these impacting activities may play a role in damaging the habitat. As it is not known whether there has been a loss in habitat area or not, but it is known that there are damaging impacts which may have impacted on the area, a ranking of **Unfavourable-Inadequate** scoring is given.

**Area covered by the habitat:** The accurate extent of siliceous rocky habitat in Ireland is **Unknown. However an estimate of 2.00 km²** has been calculated.
**Favourable Reference Area:** Though the area is calculated using best expert judgement, it is nonetheless felt that, in this instance, there has been a decline in area within the reporting period (1950s to 2006) due to impacting activities. Loss of habitat equates with loss of specific species and not the loss of actual rock. The extent of the loss is unknown but is not considered to be > 10%. Favourable Reference Area is considered to be **Unfavourable Inadequate** as it is perceived to be > the current estimated area.

The conservation status of the habitat extent is deemed **UnFavourable-Inadequate** and the trend is negative due to impacting activities. Favourable Reference Area is considered to be **Unfavourable Inadequate** as it is perceived to be > the current estimated area. The period for this trend is 1950s to the present. Further survey with more accurate information before the next reporting cycle may indicate a more Favourable Assessment.

# 3 STRUCTURES AND FUNCTIONS

## 3.1 Structures and Functions of the Habitat

Satisfactory data on habitat quality and habitat change trends are lacking for this habitat in Ireland.

An increase in the intensity of impacting activities on the habitat has occurred since the 1950's in Ireland. This increase has been due mainly to the overstocking of sheep in the uplands, which results in slippage, erosion, loss of species and loss of habitat. The Commonage Framework Plan did not identify upland exposed rocky slopes as a habitat type within the survey and it is therefore not possible to use any of the data from this survey in accurately identifying the level of grazing damage to siliceous scree slopes. A gross measure of the levels of grazing damage to those sites, which contain siliceous rocky slope that are located within areas of commonage indicates that approximately 74% of the land has some levels of damage. Given the high levels of damage to other habitats in these commonage areas, the impact of grazing and trampling is likely to have negatively impacted on siliceous scree slopes.

A secondary impact is due to an increase in leisure activities in the uplands notably hill walking, mountaineering, rock climbing and para-gliding. Hill walking and rock climbing may cause trampling and erosion of the rocky and scree slopes habitat and ultimately the loss of the few species that characterise this Annex I habitat. Quarrying of rocky areas poses another threat.

### 3.1.1 Conservation Status of Structures and Functions of the Habitat

The variation in the conservation status of the structure and functions of siliceous rocky habitat cannot be quantified. Overgrazing has altered the quality of the habitat in the Mweelrea/Sheefry/Erriff Complex (Site Code: 001932) and The Twelve Bens (Site Code: 002031). The leisure activities detailed above may have altered the quality of the habitat in localised areas (notably on sites which are popular hill walking and mountaineering areas such as The Twelve Bens (002031) and Macgillicuddy's Reeks in Co. Kerry (000365) and that of the Wicklow Mountains (002122) very close to a large urban centre.

Due to the lack of information, the conservation status of structure and functions of the habitat is **Unknown** though the trend is negative due to the pressures described above. However according to NPWS, given that the habitat structure is intact in many of the more remote areas and given that damage by grazing is not deemed to be as severe on rocky habitats as it is on blanket bog and wet heath, an assessment **of Unfavourable Inadequate** is appropriate.

## 3.2 Typical Species

Siliceous rocky habitat is characterised by some species, which are truly alpine in nature and occur in this habitat due to their altitudinal requirements. As described, many of these species are common to other **Annex I** upland habitats: Siliceous rocky habitat also contains a number of other species, which may be found in other associated habitats and at lower elevations (these are termed Facultative species). These have been listed in **Table 3.**

### 3.2.1 Conservation Status of Habitat Typical Species

An accurate assessment of the conditions of typical siliceous rocky habitat species cannot be carried out in the absence of a specific field monitoring program. However, the assessment of the condition of the structures and functions of the habitat based on impacting activities and the influence of these activities on the typical species of the habitats will let us ascertain the conservation status of the latter. Furthermore, a decline in the habitat's structure and functions as mentioned previously already indicates a decline in the species typical of the habitat. The conservation status of habitat structures and functions is thus regarded as **Unfavourable Inadequate** for this habitat. As habitat quality and typical species are so interdependent, it can be suggested that an Unknown status would be appropriate but an **Unfavourable Inadequate** conservation status can also be inferred for Typical Species.

## *4 IMPACTS AND THREATS*

The main damages influencing the siliceous rocky habitat in Ireland based on best expert opinion are as follows:

**Table 4. Damaging activities affecting siliceous scree, main ecological effects and future trends.**

| Damage type (EU Code) | Main ecological effects | Likely future trends of damage |
|---|---|---|
| **Outdoor recreation** **(501, 530, 610, 622, 624, 720)** | Erosion of habitat and loss of species. | Future incidence uncertain. Risk greatest in popular walking areas or close to urban areas, e.g. Wicklow and Connemara Mountains (002122 and 002031). |
| **Overgrazing** **(142)** | Where very severe, complete removal of indicator species occurs with very poor prospects for recovery. | Intensity set to decline when destocking recommendations are implemented. |
| **Mining and extraction** **(390)** | Removal of siliceous scree and loss of species and habitats associated with it. | Increasing level of quarrying due to increased demand for rock materials for construction or the cement industry. |
| **Air Pollution** **(702)** | Acidification. | Potential loss of ion exchange and subsequent loss of species. At a pH, lower than 3 most species are unlikely to survive. |

## 4.1 Overgrazing

Overgrazing by sheep is one of the damaging activities affecting siliceous rocky habitat and this has been observed in several locations such as Derryclare Mountain in Connemara, Co. Galway (Site Code: 002031), Mount Brandon in Co. Kerry (Site Code: 000375) and parts of the Macgillicuddy's Reeks in Kerry (Site Code: 000365) (Dr Curtis pers. obs.), but no quantitative data is available on this impact.

A revised and subsequently amended Rural Environment Protection Scheme (REPS) was introduced in May 1999. As a result, degraded commonage areas were assessed and managed according to a specific management tool – "The Commonage Framework Plan (CFP)" surveyed and assessed the condition of most commonage areas in the Republic of

Ireland. In order to facilitate the restoration of these areas the Plan recommends a destocking level for each commonage or site surveyed. Within the scheme, damage is assessed according to a 6 point scale ranging from U (undamaged) to S* (very severely damaged) and each point on this scale has an associated destocking level. In addition to mapping the extent and severity of grazing damage within commonages, the habitats occurring within these areas was also indicated but unfortunately upland rocky habitats and screes were not identified. However, as detailed in section 3.2 above approximately 74% of the lands, which contain siliceous scree slopes that are located within commonage areas have some levels of damage.

**Grazing Trend**

Stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (FAPRI-Ireland Partnership 2003). The Rural Environment Protection Scheme (REPS) and National Farm Plan Scheme also aim to address a reduction in over-grazing levels. While this will be beneficial for overgrazed areas for an initial period, over the long term it could result in sites being abandoned, which may lead to habitat change or loss through vegetation encroachment. The implementation of these three schemes should reduce damage on siliceous rocky habitat caused by farming activities. To date the results of the implementation of measures recommended by these schemes is unknown. However, there has been monitoring now for two years through re-visiting the commonages.

## 4.2 Quarries

Quarries are a known historical threat to siliceous rocky slopes as documented by the location of the quarry on the lower slopes of Muckish Mountain (001179), Co. Donegal and Wicklow Mountains (002122).

**Quarrying Trend**

The future trends for quarrying are unknown but if the current economic growth continues in Ireland, there may be increasing pressures on siliceous rocky habitat sites for material for the cement and building industries. However, planning control of quarrying has improved greatly with regard to opening of new quarries and re-opening of old works since the introduction of regulations under Section 261 of the Planning and Development Act 2000.

## 4.3 Outdoor Recreation

Trackway erosion of upland habitats such as alpine heath, wet heath, dry heath, screes and rocky slopes, caused by tourist use of popular walking routes has been highlighted as a problem in Ireland since the beginning of the 1990s. Problems with erosion of upland habitats are for example associated with The Wicklow Way (002122) walking route and along popular routes in the Connemara National Park but the impact of these routes on areas of rocky habitat is unknown. Tracks are clearly visible in some areas of siliceous rocky slopes such as on The Twelve Bens (002031). The increase in popularity of hill walking in Ireland in recent years is likely to result in more pressure on sensitive upland habitats such as siliceous rocky slopes. The ease and speed of access to the most remote areas of our mountain ranges has increased with the arrival of ATVs and scrambler bikes.

**Outdoor Recreation Trend**

Trackway erosion is considered an increasing threat to siliceous rocky slopes. There is a similar increase in the threat as a result of increased ownership of ATV's and Four Wheel Drive vehicles and accessibility to upland areas. Hill walking continues to increase as a popular recreation in Ireland and our mountains are actively promoted to visiting walkers.

### 4.4 Site Inspection Form results

Regional NPWS Management is responsible for patrolling designated sites and enforcing relevant legislation (e.g. Habitats Directive 92/43 EEC or the Wildlife Act). NPWS Conservation Rangers are required to summarise information collected on the integrity of sites within their areas during the course of their duties. They are given the responsibility for reporting the information required under the Site Inspection Reporting (SIR) programme. Reporting is carried out on a three yearly cycle that began in 1998.

There are no reported activities on this habitat in the period 1998 – 2003.

## 5. *FUTURE PROSPECTS*

### 5.1 Negative Future Prospects

Siliceous rocky slopes have undergone a negative impact in the last fifty years principally as a result of overgrazing and leisure activities. Whilst over-grazing is an impact which can be resolved through management agreements with landowners (see Positive Future Prospects below) other impacts such as acidification and damage from walkers and increased recreational access to the mountains resulting in trampling has also become an increasing problem, which is less easily managed.

### 5.2 Positive Future Prospects

**Single Farm Payment (SFP)**

As already noted, stocking rates of livestock in Ireland in general are predicted to decrease in the future due to the decoupling of livestock stocking rates from EU subsidies and the introduction of a Single Farm Payment (SFP) (FAPRI-Ireland Partnership 2003). As long as the market value of hill sheep remains low, there is little incentive for farmers to maintain large flocks in the uplands.

Payment under the SFP requires the farmer to keep lands in "Good Agricultural and Environmental Condition"

**The Rural Environment Protection Scheme (REPS)**

REPS is an EU funded scheme for environmentally sensitive farming, introduced in 1994, which includes incentives to reduce stocking densities within proposed NHAs, SACs and on those land designated as degraded (overgrazed) by the Department of Agriculture, Food and Forestry.

The positive impact of this scheme for siliceous rocky habitat conservation is dependent on several factors such as the uptake of REPS by farmers with large flock numbers in overgrazed areas. A reduction on the stocking density as a result of the implementation of the Commonage Framework Plan recommendations should reduce the impact associated with sheep grazing on areas of rocky habitat.

**National Farm Plan Scheme (NFPS)**
The NPWS launched a new 5 year National Farm Plan Scheme (NFPS) in February 2006 for landowners who are not in REPS but with designated areas (SACs, SPAs) and commonage. This follows on from the requirements of the EU Natural Regulations and the Wildlife (Amendment) Act, 2000. The scheme allows the Department to pay farmers and landowners for losses incurred through restrictions caused by the designation of lands as a SAC or a SPA or to pay for certain actions, which are of benefit to nature and are agreed in a Farm Plan.

In the particular case of siliceous rocky slopes and other upland habitats, the NFPS provides the following recommendations:

- Stocking density rates must be set down by a planner.
- The location of feeding points to reduce heavy grazing, trampling, poaching and erosion problems should be regulated.
- The use of fertilisers and herbicides and water pollution should be also regulated.

The NFPS prohibits the following practises including: in-filling or rock removal; creation of new tracks or paths; The implementation of the Plan should reduce damage to siliceous rocky slopes caused by farming activities, particularly overgrazing. Its success obviously depends on the farmers' participation.

## 5.3 Overall Habitat Future Prospects

Several schemes (e.g. SFP, REPS, NFPS) address the recovery of large areas of degraded habitat. A national survey of upland habitats to accurately survey and classify upland habitats such as siliceous rocky slopes is required. This will provide information to determine the requirements for the conservation of the habitat.

However, a series of impacting activities (i.e. overgrazing, trampling, mountaineering and recreational activities) continue to threaten the habitat both in designated and undesignated sites. In the absence of a field survey, the threats to the habitat are not accurately quantified but it is deemed that the habitat is still moderately threatened and slowly declining. While future prospects are encouraging, the long-term viability is not assured, and thus it is assessed as likely to be **Unfavourable Inadequate.**

# *6 OVERALL ASSESSMENT OF HABITAT CONSERVATION STATUS*

The habitat conservation status of the four main attributes has been assessed as follows:

- The **Favourable Reference Range** (FRR) is estimated to be 100% of the historical habitat range and is thus **Favourable**. The Natural Range for this habitat potentially covers 13,400 $km^2$ (134 grid cells selected x 100 $km^2$), (see **Figure 1**).
- The **Extent** of siliceous rocky slopes habitat has decreased, though exact figures for the decline are not available. The extent of the habitat is deemed Unknown though NPWS have estimated an area of 2.0 $km^2$. The trend is negative due to overgrazing and increasing leisure activities in the uplands. Therefore the current area is considered to be less thatn the Favourable Reference Area. **This results in Unfavourable – Inadequate.**

- An Unknown - but likely to be **Unfavourable Inadequate (U1)** assessment is given to the habitat **Structures and Functions** based on the increase in impacting activities and expert opinion.
- The habitat's **Future Prospects** are overall deemed to be Unknown - but likely to be **Unfavourable Inadequate (U1)** - due to pressure from impacting activities (e.g. trampling, leisure activities and overgrazing).

Thus, considering the assessment for the four main attributes for this habitat the overall **Conservation Status** for siliceous rocky slopes is Unknown - but likely to be **Unfavourable Inadequate (U1).**

# *7 Appendices*

## *8 APPENDIX 1. PUBLISHED SOURCES OF DATA ON SILICEOUS ROCKY HABITAT* (this information is now contained in the form at the front of this document).

# *9 APPENDIX 2. UNPUBLISHED SOURCES OF DATA ON SILICEOUS ROCKY HABITATS*

**Unpublished sources of data on siliceous rocky habitat in Ireland.**

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## *10 APPENDIX 3. SILICEOUS ROCKY HABITAT DISTRIBUTION MAPPING*

There has been no recent inventory or mapping of the national siliceous rocky habitat resource in Ireland. For the purposes of this survey an extensive literature review of both published and unpublished material was undertaken and records documenting the occurrence of the indicator species of siliceous rocky habitat as listed in **Table 3** in the main body of the report were collated in a *MS Access* **Upland Habitats Database**. This database contains records of the obligate and facultative alpine species of the five Annex I upland habitats (4060, 8110, 8120, 8210, 820) in Ireland and was designed specifically for the purposes of this report.

The database contains information on the following:

- Species Name
- Designated Site Code (NATURA 2000 sites or Natural Heritage Areas)
- Description of the location of the species
- Altitudinal information (either in feet (') or metres (m) depending on the antiquity of the record)
- Grid Reference (if provided) – these were assigned an accuracy rating
- Source of data (published or unpublished reference)
- Date of record
- List of associated species (if present)
- Indication of whether the description indicated a single species record, an assemblage of species or a description of habitat cover*
- Any information on substrate or underlying geology

* Given the variability of data sources, records of indicator species have been described as either an assemblage of species, a single species location or as an indication of habitat cover, depending on the quality and source of the data. For example a historical record by Corry (1884), which only contained details of a particular species at a certain altitude on Ben Whisken (Site Code: 000623) was entered as a single plant species location, whereas a description of several arctic-alpine species on a cliff above a corrie lake on Mount Brandon (Site Code: 000375) by Stelfox (1951) was entered as a species assemblage. Where there was a good description of an area of alpine heath (such as that given by Conaghan *et. al.* (1994) in the NHA Site Card for the Twelve Bens (Site Code: 002031)) this was entered as habitat cover.

Data for all of the above fields in the database was not necessarily contained in the original publication/source for each record and based on the description of the locations given an appropriate Site Code was assigned to each record using the Discovery and 62" Mapping on Arc View 3.2.

The **Upland Habitats Database** currently holds c.4,500 records of obligate and facultative alpine species of all Annex I upland habitats (i.e. 4060, 8110, 8120, 8210 and 8220) which have been gleaned from a variety of sources (both published and unpublished as documented in **Appendices 1** and **2** respectively). Given the antiquity of the bulk of the data (c.1700 of the records date from the 1800s to the 1950s) and the lack of accurate geographical references (only c.1500 records have grid references of varying accuracy (see below for further information) the GIS application of much of the collated data is limited. Full reference should be made to the **Upland Habitats Database** for lists of records for sites and locations/descriptions of indicative alpine species for habitats as the bulk of records will not be illustrated in **Figures 1 to 3** due to their lack of grid references. When reviewing these records of species one needs to be cognisant of the fact that very few of them are uniquely indicative to a particular habitat (e.g. *Polygonum viviparum* (a true alpine species) is found in four of the Annex I upland habitats (8110, 8120, 8210 and 8220)) so records of this species cannot be used to indicate the presence of any single habitat. These species have been identified as being characteristic in the absence of a dedicated field survey of these habitats. On completion of such a survey phytosociological classification and analysis may provide clearer definitions for these habitats in an Irish context.

Several new potential locations for siliceous rocky habitat in addition to those known designated sites for, which siliceous rocky habitat is a qualifying interest (see **below**) were identified in this manner following the literature review. Some of these sites were already designated as SACs but siliceous rocky habitat was not listed as a qualifying interest, others were existing NHAs and others were undesignated sites.

**Table 3 Appendix 3. Designated sites for, which siliceous rocky slope is a qualifying interest.**

| **Site Code:** | **Site Name:** | **Designation:** |
|---|---|---|
| 000093 | CAHA MOUNTAINS | SAC/NHA |
| 000111 | ARAN ISLAND (DONEGAL) CLIFFS | SAC/NHA |
| 000189 | SLIEVE LEAGUE | SAC/NHA |
| 000375 | MOUNT BRANDON | SAC/NHA |
| 000453 | CARLINGFORD MOUNTAIN | SAC/NHA |
| 000584 | CUILCAGH - ANIERIN UPLANDS | SAC/NHA |
| 000646 | GALTEE MOUNTAINS | SAC/NHA |
| 001179 | MUCKISH MOUNTAIN | SAC/NHA |
| 001932 | MWEELREA/SHEEFFRY/ERRIFF COMPLEX | SAC/NHA |
| 001952 | COMERAGH MOUNTAINS | SAC/NHA |
| 002008 | MAUMTURK MOUNTAINS | SAC/NHA |
| 002031 | THE TWELVE BENS/GARRAUN COMPLEX | SAC/NHA |
| 002122 | WICKLOW MOUNTAINS | SAC/NHA |
| 002185 | SLIEVE MISH MOUNTAINS | SAC/NHA |
| 002243 | CLARE ISLAND CLIFFS | SAC/NHA |

**Table 4 Appendix 3. SACs (designated) and NHAs*, which contain areas of upland habitat at elevations > 350m with N and NE facing slopes > 40° and which potentially contain siliceous rocky slopes as derived from the digital terrain model or indicator species based on the literature review, but that do not list siliceous rocky slopes as a qualifying interest.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 000190 | SLIEVE TOOEY/TORMORE ISLAND/LOUGHROS BEG BAY | SAC/NHA |
| 000365 | KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S REEKS AND CARAGH RIVER CATCHMENT | SAC/NHA |
| 000483 | CROAGH PATRICK | NHA |
| 000485 | CORRAUN PLATEAU | NHA |
| 000534 | OWENDUFF/NEPHIN COMPLEX | SAC/NHA |
| 000735 | MAUMTRASNA MOUNTAIN COMPLEX | NHA |
| 001059 | HUNGRY HILL BOG NHA* | NHA |
| 001342 | CLOONEE AND INCHIQUIN LOUGHS, URAGH WOOD | SAC/NHA |
| 001873 | DERRYCLOGHER (KNOCKBOY) BOG | SAC/NHA |
| 001879 | GLANMORE BOG | SAC/NHA |
| 001881 | MAULAGOWNA BOG | SAC/NHA |
| 001955 | CROAGHAUN/SLIEVEMORE | SAC/NHA |
| 002046 | OWENDOO AND CLOGHERVADDY BOGS | NHA |
| 002047 | CLOGHERNAGORE BOG AND GLENVEAGH NATIONAL PARK | SAC/NHA |
| 002268 | ACHILL HEAD | SAC/NHA |
| 002301 | RIVER FINN | SAC/NHA |

* Only those NHAs, which have NHA in the Site Name, are currently designated.

**Table 5 Appendix 3. Additional sites, which potentially contain siliceous rocky slope habitat based on the presence of indicator species that were not, identified using the Digital Terrain Model.**

| Site Code: | Site Name: | Designation: |
|---|---|---|
| 000120 | BULBIN MOUNTAIN | NHA* |
| 001669 | KNOCKALONGY AND KNOCKACHREE CLIFFS | NHA/SAC |
| 002687 | BLUESTACK MOUNTAINS | Undesignated |
| 006003 | KNOCKMEALDOWN MOUNTAINS | Undesignated |
| 006004 | NEPHIN MOUNTAIN | Undesignated |
| 006009 | COMMON MOUNTAIN, ARDARA, CO. DONEGAL | Undesignated |
| 006015 | BLUESTACK MOUNTAINS (LAVAGH MORE) | Undesignated |

* Only those NHAs, which have NHA in the Site Name, are currently designated.

There are extensive areas of potential locations for this habitat type within these sites, which have been identified using this process for which no field data exists. These areas require urgent site survey and could form the basis of further additional qualifying interests for the site or for designation as potential NHAs for the habitat.

# 11 APPENDIX 4. OTHER SOURCES OF DATA

## A. Commonage Framework Plans – Department of Agriculture & Food and the National Parks and Wildlife Service (NPWS).

The Department of Agriculture & Food and the NPWS have produced the Commonage Framework Plans (CFPs) and NHA/SAC/SPA stocking and damage assessments. These plans crudely describe the habitats, condition of the land use and plant species found in each sub-unit of each agricultural unit. Depending on the condition of the land, a % de-stocking is recommended and a time-frame suggested for recovery of the land.

Common ownership of large areas of unfenced heath and bog land is the principal type of land ownership in the western peatland and upland areas of Ireland. Thus, up to 80% of all land in Connemara and west Mayo is commonage (O'Connor, 2000). According to the maps produced by the CFP the overall extent of commonage land in Ireland is approximately 438,000ha. Unfortunately, it is not possible to use this dataset to determine the extent or area of siliceous rocky slopes in Ireland as this habitat was not identified in the report. In addition, the mapping of habitats was done at a crude level and the main mapping criterion was damage level and not habitat type.

The CFPs thus can only be used to provide an indication of the damage status of habitats (including siliceous rocky habitat) on commonage land, and this was crudely used to ascertain the conservation status of structure and functions of this habitat.

## B. NPWS Enquiries Database

This is a comprehensive NPWS internal database, which includes data on designated sites and habitats contained within them. This database was used to confirm the sites for, which siliceous scree slope was a qualifying interest.

## C. Habitat Assignment Project (NPWS, 2006)

This desktop project was undertaken by NPWS and the main aim was to identify and list the habitats listed in the Annex I of the Habitats Directive (92/43/EEC) which were reported within a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, Aerial photographs, NGO proposals, etc.

## *12 APPENDIX 5. COMMONAGE FRAMEWORK PLANS DATA*

The CFPs mapped the extent and severity of grazing damage within agricultural sub-units. The criteria use to assess the level of damage and the resultant destocking levels is given below (**Table 1**). In addition, the habitats occurring within these areas were also mapped. The following habitats were recognised during the Commonage Framework Plan surveys and their symbols are indicated within brackets:

| | | | |
|---|---|---|---|
| (I) | Blanket bog | (II) | Wet Heath |
| (III) | Dry Heath (includes maritime) | (IV) | Upland grassland |
| (V) | Other habitats | (VI) | Improved grassland |
| (VII) | Dune | | |
| (VIII) | Unimproved wet grassland | | |
| (IX) | Unimproved dry grassland | | |
| (X) | Fen/Marsh/Swamp | | |
| (XI) | Saltmarsh | (XII) | Beach/Shingle/Reef/Shore |
| (XIII) | Limestone Pavement / Grassland | (XIV) | Limestone Pavement (>75%) |
| (XV) | Scrub | | |
| (XVI) | Permanent open water (turlough) | | |

As can be seen there is no specific category given for siliceous scree slope.

**Criteria for the assessment of damage and the resultant destocking levels (Conaghan, 2001).**

| **Damage category** | **Condition of vegetation/amount of bare soil** | **Suggested destocking level** |
|---|---|---|
| Undamaged (U) | Vegetation not grazed or only very lightly grazed. No bare ground present. | 0% |
| Moderate to undamaged (MU) | <5% bare ground. Grazing usually evident, but damage only just detectable. | 30% |
| Moderately damaged (MM) | <5% bare ground. Signs of damage intermediate in intensity between MU and MS. | 50% |
| Moderate to severely damaged (MS) | <5% bare ground. Damage widespread and obvious. | 65% |
| Severely Damaged (S) | >5% bare ground. Damage due to grazing obvious and widespread. | 85% |
| Very Severely Damaged (S*) | >10% bare ground with abundant evidence of high grazing levels. | 100% |

Commonage lands, which are likely to contain siliceous rocky habitat either on its own or as a mosaic with other habitats, were mapped during the CFP. A broad-brush review of this data indicates that 74% of the lands in commonage within sites, which contain siliceous rocky habitat, show some degree of damage.

## 13 APPENDIX 6. GLOSSARY

ALTITUDE - Vertical height above sea level.

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for, which SACs have to be designated.

BLANKET BOG – Bogs, which carpet the landscape, following the underlying topography. They can cover extensive areas along the west coast and on uplands throughout the country.

CALCAREOUS –Rich in calcium, Lime loving.

CALCAREOUS ROCKY SLOPES – these are areas of exposed rock, which are typically found on the north and north-east facing slopes of mountains of calcareous origin, i.e. limestone mountains. These slopes are typically >40º, and are found at elevations above 350m. Calcareous rocky slope vegetation is also found in mountain ranges, which are siliceous in origin. These are typically areas of cliff, which have been metamorphosed in the past and, which are slightly more mineral rich than the adjoining areas. The true alpine species for this habitat includes – *Alchemilla alpina, Alchemilla glaucescens, Arenaria ciliata, Asplenium viride, Cardaminopsis petraea, Deschampsia caespitosa ssp. alpina, Epilobium alsinifolium, Euphrasia frigida, Oxyria digyna, Phegopteris connectilis, Poa alpina, Polygonum viviparum, Polystichum lonchitis, Salix phylicifolia, Saussurea alpina, Saxifraga hartii, Saxifraga nivalis, Saxifraga oppositifolia, Saxifraga rosacea, Silene acaulis, Thalictrum alpinum.*

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CORINE - Information and mapping system, developed within the context of the Commission of the European Communities biotope project, which is used as a tool for the description of sites of importance for nature conservation in Europe. It catalogues recognisable communities of flora and fauna. The primary objective of this catalogue is to identify all major communities whose presence contributes to the conservation significance of a site. Included in this list of communities are interesting but rare natural or near-natural communities as well as the more widespread semi-natural ones.

DEHLG - Department of Environment, Heritage and Local Government

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions, which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for, which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within, which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in, which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive, this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms, which are all influenced by the underlying geology.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the "health" quantity or quality of a habitat or species.

MOSAIC - Used to describe habitats that occur together and cannot easily be mapped separately.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which, the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats, which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

QUALIFYING INTERESTS – The habitat(s) and/or species for, which an SAC or SPA is designated.

REPS - Rural Environment Protection Scheme. This is an Agri-Environmental programme, which seeks to draw up agreements with farmers, according to the type of farming, landscape and features on the land. The overall objectives of REPS are to achieve: the use of farming practices, which reduce the polluting effects of agriculture by minimising nutrient loss- an environmentally favourable extensification of crop farming, and sheep farming and cattle farming; - ways of using agricultural land, which are compatible with protection and improvement of the environment, the countryside, the landscape, natural resources the soil and genetic diversity; - long-term set-aside of agricultural land for reasons connected with the environment; - land management for public access;- education and training for farmers in types of farming compatible with the requirements of environmental protection and upkeep of the countryside.

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from, which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SACs have also been known as cSACs, which stands for "candidate Special Areas of Conservation", and pcSACs, which stands for "proposed candidate Special Areas of Conservation."

SILICEOUS SCREE – these are areas of scree which are typically found on the north and north-east facing slopes of mountains of siliceous origin, but they may occur on other aspects also, particularly in the northern counties of Ireland. These slopes are typically >40$^{o}$, and are found at elevations above 350m. The true alpine species for this habitat includes – *Cryptogramma crispa*, *Oxyria digyna*, *Polygonum viviparum*, *Salix herbacea* and *Vaccinium vitis-idaea*.

SILICEOUS ROCKY HABITAT – these are areas of rocky slope, which are found on north and north-east facing siliceous slopes with a slope >40$^{o}$, at elevations above 350m. The true alpine species for this habitat includes – *Cardaminopsis petraea, Deschampsia caespitosa* ssp. *alpina, Euphrasia frigida, Festuca vivipara, Minuartia recurva, Oxyria digyna, Phegopteris connectilis, Poa alpina, Polygonum viviparum, Salix herbacea, Saussurea alpina, Saxifraga hartii, Saxifraga rosacea, Saxifraga stellaris, Thalictrum alpinum, Vaccinium vitis-idaea.*

SPAs - Special Protection Areas for Birds are areas, which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.

# 8220 Siliceous rocky slopes with chasmophytic vegetation

| National Level | |
|---|---|
| **Habitat Code** | 8220 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |
| **Biogeographic level** | |
| **Biogeographic region** | Atlantic (ATL) |
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| | ▪ Fitzgerald, R. D. (1955). Report of the autumn meeting in Ireland. *Transactions of the British Bryological Society.* Vol. II. 1952 - 1955. P. 125 - 128.<br>▪ Galweggy, S. and F. Winder. (1998). Distribution of flowering plants on the cliffs of Coumshingaun, Co. Waterford (H6). *Irish Naturalists' Journal.* Vol. 26. No. 3/4. P. 132 - 135.<br>▪ Gilbert, O. L. and A. M. Fryday. (1996). Observations on the lichen flora of high grounds in the west of Ireland. *Lichenologist.* Vol. 28. No. 2. P. 113 - 127.<br>▪ Goodwillie, R. (1972). A preliminary report on areas of scientific interest in Co. Sligo. *An Foras Forbartha, Dublin.*<br>▪ Goodwillie, R. (1978). Areas of scientific interest in Co. Leitrim. *An Foras Forbartha, Dublin.*<br>▪ Goodwillie, R. (1979). Field survey of Clare Island cliffs. *An Foras Forbartha, Dublin.*<br>▪ Green, P. R. (2005). The highest plant species in Co. Waterford (V.C. H6). *Irish Botanical News.* No. 15.<br>▪ Hart, H. C. (1881). IXI - On the Botany of the Galtee Mountains, Co. Tipperary. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. III. - Science. P. 392 - 402.<br>▪ Hart, H. C. (1882). Notes on mountain plants in Kerry. *Journal of Botany.* 20. P. 174 - 176.<br>▪ Hart, H. C. (1883). XCI - Report on the flora of the mountains of Mayo and Galway. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. III - Science. P. 694 - 768.<br>▪ Hart, H. C. (1884). IXXIX - Report upon the botany of the Macgillicuddy's Reeks, Co. Kerry. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. II - Science. P. 573 - 593.<br>▪ Hart, H. C. (1884). XV - Notes on the plants of some of the mountain ranges of Ireland. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. IV - Science. P. 211 - 251.<br>▪ Hart, H. C. (1885). XXXVI - On the botany of the River Suir. *Scientific Proceedings of the Royal Dublin Society.*<br>▪ Hart, H. C. (1885). XXI - Report on the flora of south-west Donegal. *Scientific Proceedings of the Royal Irish Academy.* Ser. II. Vol. IV - Science. P. 443 - 469.<br>▪ Hart, H. C. (1886). Further report on the flora of southern Donegal. *Scientific Proceedings of the Royal Irish Academy.* Ser. II Vol. IV - Science. P. 568 - 569.<br>▪ Hart, H. C. (1891). On the range of flowering plants and ferns of the mountains of Ireland. *Scientific Proceedings of the Royal Irish Academy.* Ser. III. Vol. I. P. 512 - 570.<br>▪ Hodd, T. (1997). In search of alpine plants on the northern slopes of Mangerton Mountain, South Kerry (v. c. 1). *Irish Botanical News.* No. 7: 23-27.<br>▪ Kertland, M. P. H. (1955). The Botanical Society of the British Isles - Field Meeting at Dunfanaghy, Co. Donegal, June 1955. *Irish Naturalists' Journal.* Vol. XI. P. 349 - 350.<br>▪ Kirby, N., Lockhart, N. and D. Synnott. (1980). Bryological observations at Gleniff, Co. Sligo (H28). *Bulletin of The Irish Biogeographical Society.* No. 4. P. 30 - 32.<br>▪ Moran, B. (1992). Report on DNFC field trip to Co. Sligo. *The Dublin Naturalist's Field Club Newsletter.*<br>▪ Nash, D. (1993). Plant records from North Tipperary (H10). *Irish Naturalists' Journal.* Vol. 24. No. 7. P. 295 - 296.<br>▪ Parnell, J. (1982). Abnormal plants of *Jasione montana.* Irish Naturalist's Journal. Vol. 20. No. 11. Pg 507.<br>▪ Perring, F. H. and S. M. Walters. (1990). Atlas of the British Flora. *BSBI, Wiltshire.*<br>▪ Porley, R. and N. Hodgetts. (2005). Mosses and liverworts. *The New Naturalist Library, HarperCollins.* |

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| Range | |
| Surface area | The Natural Range for this habitat potentially covers 13,400km² (134 grid cells selected x 100 km²). |
| Date | 2007 ; 1800s to 2006. |
| Quality of data | 1 = poor (based on very incomplete data with expert opinion). |
| Trend | Likely to be stable. |
| Trend-Period | 1950 - 2006 |
| Reasons for reported trend | |
| **Area covered by habitat** | |
| Surface area | Unknown though estimated by NPWS to be 2.0 km² |
| Date | 2007 ; 1800s to 2006. |
| Method used | 1 =Mostly based on expert opinion |
| Quality of data | 1 = poor (based on very incomplete data with expert opinion) |
| Trend | Negative. |
| Trend-Period | 1950 – 2006 |
| Reasons for reported trend | 3 = direct human influence ( overgrazing and trampling) |
| Justification of % thresholds for trends | The increase in the intensity of impacting activities are considered to result in losses of this habitat, however the magnitude of the loss is unknown. |
| Main pressures | 142 Overgrazing by sheep<br>390 Mining and extraction activities<br>301 Quarries<br>501 Paths, tracks or cycling paths<br>530 Improved access to the sites<br>610 Outdoor sports and leisure activities<br>624 Mountaineering, rock climbing, speleology<br>702 Air pollution – acidification<br>720 Trampling, overuse |

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| Threats | 142 Overgrazing by sheep<br>501 Paths, tracks or cycling paths<br>530 Improved access to the site<br>610 Outdoor sports and leisure activities<br>624 Mountaineering, rock climbing, speleology<br>702 Air pollution – acidification<br>720 Trampling, overuse |
| ***Complementary information*** | |
| **Favourable reference range** | Favourable, as the Favourable Reference Range is similar to Range for this habitat, potentially covering 13,400 km² (134 grid cells selected x 100 km²) |
| **Favourable reference area** | The precise surface area of siliceous rocky slopes in Ireland is unknown and cannot be accurately determined in the absence of a dedicated field survey to confirm the complement of species present. Nonetheless, a rough estimate has been given by NPWS leading to an assessment of Unfavourable Inadequate. It is felt that Favourable Reference Area is > current area. |
| **Typical species** | Vascular plants within siliceous rocky slopes are described as either obligate (true) alpine species or facultative species (which are those that are also found at lower elevations and in other habitats).<br>**Obligate alpine species:**<br>*Cardaminopsis petraea, Deschampsia caespitosa* ssp. *alpina, Euphrasia frigida, Festuca vivipara, Minuartia recurva*, Oxyria digyna, Phegopteris connectilis, Poa alpina, Polygonum viviparum, Salix herbacea, Saussurea alpina, Saxifraga hartii, Saxifraga rosacea, Saxifraga stellaris*, Thalictrum alpinum, Vaccinium vitis-idaea.*<br>**Facultative species:**<br>*Agrostis canina, Agrostis capillaris, Antennaria dioica, Anthriscus sylvestris, Calluna vulgaris, Cochlearia officinalis (alpina), Crepis paludosa, Cystopteris fragilis, Deschampsia flexuosa, Epilobium angustifolium, Epilobium brunnescens, Festuca ovina, Geum rivale, Huperzia selago, Hymenophyllum tunbrigense, Hymenophyllum wilsonii, Jasione montana, Juniperus communis, Koeleria macrantha, Listera cordata, Luzula sylvatica, Lycopodium clavatum, Meconopsis cambrica, Nardus stricta, Pedicularis sylvatica, Plantago maritima, Ranunculus auricomus, Rhodiola rosea, Sagina subulata, Samolus valerandi, Saxifraga spathularis, Selaginella selaginoides, Silene dioica, Silene uniflora, Solidago virgaurea, Thalictrum minus, Thymus praecox, Vaccinium myrtillus.*<br>**Bryophytes:**<br>*Andreaea alpina, Andreaea rothii, Andreaea rupestris, Bartramia pomiformis, Cynodontium jenneri, Diplophyllum albicans, Grimmia funalis, Grimmia torquata, Gymnomitrion concinnatum, Gymnomitrion corallioides*. |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |

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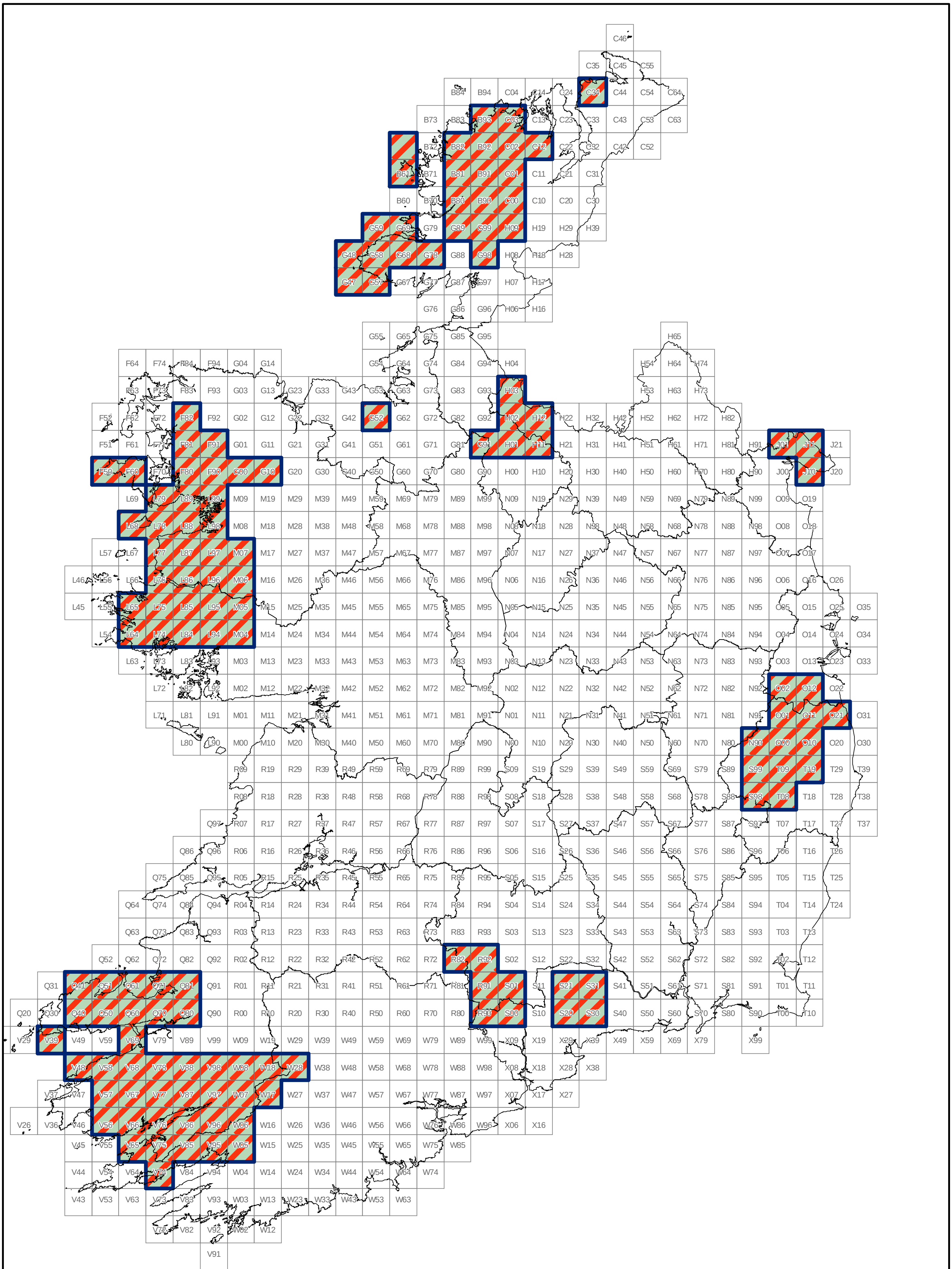
| **Other relevant information** | 1. As this habitat is restricted by altitude, the range does not extend beyond the current known distribution.<br>2. By using the Digital Terrain Model generated polygons for north and north-east facing slopes on siliceous geologies above 350m in elevation with a slope > 40º it is possible to produce a very rough estimate of the potential area of siliceous rocky habitat in Ireland. This figure has inherent inaccuracies in it due to the nature of the Digital Terrain Modelling Criteria, whereby areas where siliceous slopes are known to occur are not depicted. These areas are also likely to contain other habitats such as calcareous and siliceous scree slope, alpine heath or dry and wet heath. The area as defined based on the DTM is approximately 1,141 ha or 11.41 km². It is not possible to accurately determine what percentage of this area corresponds to siliceous rocky slope as opposed to the other habitats listed above. It cannot be accurately determined in the absence of a dedicated field survey to confirm the complement of species present. However, a figure has been **estimated by NPWS using expert judgement,** based on approximate proportions covered by the habitats. |
| **Conclusions**<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | **Favourable** |
| **Area** | **Unfavourable Inadequate** |
| **Specific structures and functions (incl. typical species)** | **Unfavourable Inadequate (U1)** – based on the increase in impacting activities and expert opinion. |
| **Future prospects** | **Unfavourable Inadequate (U1)** – due to pressure from impacting activities (e.g. overgrazing, trampling). |
| **Overall assessment of CS** | **Unfavourable Inadequate (U1).** |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Siliceous rocky slopes with chasmophytic vegetation**

**8220**

Current Distribution (134 cells)
Current Range (134 cells)
Favourable Reference Range (134 cells)
W48 10km grid cells

Date: October 2007

**THIS REPORT WAS PREPARED BY GRACE O'DONOVAN ET AL, RAW CONSULTING. THE DOCUMENT IS STILL IN DRAFT FORMAT.**

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# Preliminary Assessment of Limestone Pavements (8240) in the Republic of Ireland: a Desk Study

| National Level | |
|---|---|
| **Habitat Code** | 8240 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |
| Map | See mapping section of the report |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| Published sources | ▪ Barrington R.M. and Vowell, R.P. 1885 Report on the flora of Ben Bulben & the adjoining mountain range in Sligo & Leitrim. *Proceedings of the Royal Irish Academy*, 2nd series, 4, 493-517.<br>▪ Bohnsack U. and Carrucan P. 1999 *An assessment of farming prescriptions under the rural environmental protection scheme in the uplands of the Burren karstic region, Co. Clare.* The Heritage Council. Kilkenny.<br>▪ Byrne D.S. 2001 *A study of the numbers, diet and effects of cattle and feral goats on the ecology of the Burren National Park, Co. Clare Ireland.* PhD. TCD.<br>▪ Cabot D., Mayes E., Sheppard R. and Grant P. 1989 *Restoration of the Ballinamore and Ballyconnell Canal.* Environmental Impact Statement, Environmental Consultancy Services, Dublin.<br>▪ Corry TH. 1884. On the heights attained by plants on Ben Bulben. *Proceedings of the Royal Irish Academy*, 2nd series, 4, 73-77.<br>▪ Curtis T.G.F. 1983 *Proposed Nature Reserve at Lough Fingall, Co. Galway*. Nature Reserve Schedule, Wildlife Service, Dublin. Unpublished.<br>▪ Drew, D., Jones, G.Ll. and Kelly, J.G. 2001. *The karst heritage of the Republic of Ireland.* (Ed. Parkes, M.A.) Geological Survey of Ireland.<br>▪ Drew D. (1996) Agriculturally induced environmental changes in the Burren Karst, Western Ireland. *Environmental Geology* 28; 137-144.<br>▪ Drew, D. and Magee E. 1994 Environmental implications of land reclamation in the Burren, Co. Clare: a preliminary analysis. *Irish Geography* 27; 81-96.<br>▪ Dwyer R. 2000 *Protecting Nature in Ireland. The NGO SAC shadow list.* The Heritage Council, Kilkenny.<br>▪ ERM Ireland Ltd. 2003 *Landscape Character Assessment Co. Clare.* The Heritage Council.<br>▪ Gilbert O.L. 1970 *Dryopteris villarii.* Biological Flora of the British Isles. *Journal of Ecology* 58, 301-14.<br>▪ Ivimey-Cook R.B. and Proctor M.C.F. 1966 The Plant Communities of the Burren, Co. Clare. *Proceedings of the Royal Irish Academy* 64B: 211-301.<br>▪ Keane S. and Walsh T. 1995 NHA Internal Report to National Parks and Wildlife Service, Dublin.<br>▪ Kelly D.L. and Kirby N. 1982 Irish Native woodlands over limestone. In; (Jim White Ed.) *Studies on Irish Vegetation*. Royal Dublin Society. pp. 181-197.<br>▪ Kirby E.N. & MacGowran B.A. 1979 *A vegetation survey of the proposed National Park in the Burren, Co. Clare.* Unpublished report to the National Parks and Monuments Branch of the OPW, Dublin.<br>▪ McGough H.N. 1984 *A report on the grasslands and closely related vegetation types of the Burren region of western Ireland: a preliminary report.* National Parks and Wildlife Service, Dublin.<br>▪ Majs F. 2003 *Nitrogen cycling for outdoor wintering of dairy cows and characterisation of leachate from stockpiled manure.* Thesis. University of Minnesota.<br>▪ O'Criodain C. 1992 *Conservation of Grassland Sites of Scientific Interest in Ireland*. Internal Report to National Parks and Wildlife Service, Dublin.<br>▪ O'Donovan G. 1987 *Ecosystem dynamics of limestone grasslands in the Burren National Park, Co. Clare.* PhD Thesis, TCD. |

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| | ▪ Thorn R.H. and Coxon C. 1992 Hydrogeological aspects of bacterial contamination of some western Ireland karstic limestone aquifers. *Environmental Geology* 20; 65-72.<br>▪ Traffic International. 1999 *On Stony Ground: an investigation into the trade in water-worn limestone between the United Kingdom and the Republic of Ireland.* A report for The Heritage Council & The Countryside Agency.<br>▪ Vincent P. 1995 Limestone Pavements in the British Isles: A Review. *The Geographical Journal*, Vol. 161,<br>▪ Ward S.D. and Evans D.F.1976 Conservation assessment of British limestone pavements based upon floristic criteria. *Biological Conservation*, 9, 217-233.<br>▪ Webb D.A. and Scannell M.J.P. 1983 *Flora of Connemara and the Burren*. Cambridge University Press.<br>▪ Williams P.W. (1966). Limestone pavements with special reference to Western Ireland. *Transactions of the Institute of British Geographers*, No. 40. 155-172<br>▪ Willshaw K. 2005 *Shattered Stone: an investigation into the sale of water-worn limestone in the UK*. A report by the Limestone Pavement Action Group, based on market research by ADAS, for the Countryside Agency.<br>▪ Wilmot A. 1979 An ecological survey of the ferns of the Burren, Co. Clare, Eire. *Fern Gazette* 12, 9-28.<br>▪ Webb, S. and Glading P. 1998 The Ecology and Conservation of Limestone Pavement in Britain- British Wildlife. 10:.103-113.<br>▪ Restoration projects:<br>▪ Coillte Teoranta http://www.woodlandrestoration.ie/<br>▪ EU Burren LIFE 'Farming for Conservation' http://www.burrenlife.com/the_project.php |
| | |
| **Range** | Limestone pavement has a stronghold along the western seaboard centred on Cos. Clare and Galway. However it extends in scattered fragments as far north as Donegal, as far east as Co. Westmeath and as far south as Killarney. |
| Surface area | 7400 sq km. This area also overlaps with other Annex I habitats such as *Juniperus communis* formations and Alpine and boreal heaths (4060) on calcareous substrates. |
| Date | 3/2007 |
| Quality of data | 3 = good |
| Trend | Negative (slight) |
| Trend-Period | 1993 – 2006 |
| Reasons for reported trend | 3 = direct human influence (removal of pavement, overgrazing, undergrazing, development) |
| **Area covered by habitat** | |
| Distribution map | See Maps in the report and GIS |
| Surface area | The actual extent of Limestone Pavement using remote sensing data is 363 sq km |
| Date | 3/2007 |
| Method used | 2 = based on aerial photographs (2000), satellite imagery (2000/2001), existing GIS (1996-2000)<br>3= ground based survey |
| Quality of data | 3 = good |
| Trend | Negative; 106ha within designated sites, net loss of 0.33% over a 14 year period (0.02% per annum) |
| Trend-Period | 1990's - 2006 |
| Reasons for reported trend | 3 = direct human influence (pavement removal, development, agricultural improvement, grazing cessation) |
| Justification of % thresholds for trends | Increase in the intensity of impacting activities (e.g. removal of pavement, grazing cessation) more severely since the 1990's indicate this negative trend. |

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| Main pressures | 390 Rock disturbance / removal<br>152 Scrub removal<br>141 Grazing cessation<br>171 Stock feeding<br>403 Dispersed habitation<br>500 Communication networks<br>690 Leisure & Tourism<br>740 Vandalism<br>301 Quarrying |
| Threats | 141 Grazing cessation<br>390 Rock disturbance / removal<br>171 Stock feeding<br>850 Modification of hydrographic function |
| ***Complementary information*** | |
| **Favourable reference range** | 7400 sq km |
| **Favourable reference area** | 364 sq km |
| **Typical species** | **Limestone pavement**<br>Vascular plants*: Sesleria albicans, Geranium sanguineum, Rubia peregrina, , G. robertianum, Rosa pimpinellifolia, Teucrium scorodonia, Briza media, Gentiana verna, Dryas octopetala, Coryllus avellana, Prunus spinosa, Rhamnus cathartica, Juniperus communis, Calluna vulgaris, Taxus baccata, Hedera helix, Viola reichenbachiana, Thymus praecox, Crataegus monogyna, Aphanes arvensis, Arabis hirsuta, Saxifraga hypnoides, Antennaria dioica, Rosa pimpinellifolia, Asperula cynanchica, Adiantum capillus-veneris, Cystopteris fragilis, Dryopteris filix-mas, D. affinis, Asplenium trichomanes, A ruta-muraria, Phyllitis scolopendrium, Ceterach officinarum, Epipactis atrorubens.*<br>*Mosses and lichens;.Breutelia chrysocoma, Neckera crispa.* |
| **Other relevant information** | |
| **Conclusions**<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Unfavourable Inadequate (U1) |
| **Specific structures and functions (incl. typical species)** | Unfavourable Inadequate (U1) |
| **Future prospects** | Unfavourable Inadequate (U1) - continued pressure from impacting activities (e.g. pavement removal, scrub encroachment, development) still high. |
| **Overall assessment of CS** | Unfavourable Inadequate (U1) |

# A desk study to assess the condition of Annex I habitat; Limestone Pavements (8240)

### *1.1 Overview of whole study*

The scope of this study was to assess the condition of the Annex I habitat, Limestone Pavement. All possible sites were considered, not just those which are protected by a designation. Some of these are taken from a shadow list of sites drawn up by NGOs (Dwyer 2000). The area of exposed limestone pavement was accurately assessed using GIS techniques, so that limestone pavement occurring outside of designated areas was also detected. 1993 was taken as the baseline from which change is to be monitored (i.e. after the Natural Heritage Areas (NHAs) had been surveyed for boundary demarcation).

Results are presented as lists of sites containing each habitat, its area, % cover relative to its area on the site and its condition where possible. Damaging operations are noted following discussions with the local rangers and use of the SIR (Site Impact Records) forms and are ranked according to severity.

Limestone pavements are closely associated with two other Annex I habitats; *Juniperus communis* on calcareous substrates (5130) and arctic-alpine heath on calcareous substrates (4060). Appendix 1 shows the current SAC designations and other sites where the three Annex I habitats the co-occur.

### *1.2 Introduction*

Limestone pavement of glacial origin occurs in only 4 countries within the EU; the UK, Ireland,Sweden and Estonia. Ireland has the greatest coverage of 36,300ha with the UK having around 3000ha. Limestone pavements are classed as a priority Annex I habitat under the Habitats Directive. They are defined as outcrops of rock, typically horizontal or gently inclined with a few steeply inclined. The surface has been eroded over millenia by water to create blocks of limestone called clints and crevices known as grikes. The vegetation in grikes is unusual as it is composed of woodland and shade species along with plants of rocky habitats, e.g. *Phyllitis scolopendrium and Adiantum capillus-veneris*. In the UK, some rare species are particularly associated with, or confined to, limestone pavement (Ward & Evans 1976, Gilbert 1970, Webb & Glading 1998), e.g. *Dryopteris villarii,* but this is not the case in Ireland. Most species in Irish limestone pavements are also associated with calcareous grassland with perhaps the exception of *Adiantum capillus-veneris and Epipactis atrorubens*. Grazing pressure has an impact on the flora of limestone pavements and where it is heavy the flora will be confined to the grikes. Grikes greater than 60cm deep have the best flora due to the increase in the number of niches (Silvertown 1983).

Several other types of habitats may form on limestone pavement such as heath, calcareous grassland, scrub and woodland (*Corylo-Fraxinetum, Prunetalia spinosae*). Kelly and Kirby (1982) described both seral and climax *Corylus* communities over limestone in the Burren and commented that the scrub was kept low in places by exposure to wind and poor edaphic conditions.

### *1.3 Limestone pavement – history and evolution in Ireland*

Limestone pavement can only occur on limestone bedrock which has been affected by glaciation. The stripping away and scouring of soil and vegetation leaves the familiar exposed limestone that we have such excellent examples of in Ireland today. The most extensive limestone pavement in the British Isles occurs in the Burren /East Galway area (Williams 1966). The structure of limestone pavement depends on the purity of the limestones itself, the best being carboniferous limestone – a very dense and massive type, of which much of the Burren is composed. The 'clints' referred to are the slabs of pavement demarcated by intervening fissures formed by solution called 'grikes'. It is thought that the familiar clints and

grikes form under a soil and vegetation cover but this can vary according to the nature of the soil. If it is acidic in nature, then acidic water will permeate down and find weaknesses in the limestone which will form grikes. However, if the soil cover is not acidic, then the pavement can remain intact and protected until it is exposed by other factors such as glaciation when the slow formation of grikes along weaknesses in the limestone will commence. Examples of both of these types can be found in the Burren complex. The quality of the pavement is also affected by the dip of the limestone and its interaction with the substrate. The greater the angle of dip, the poorer the quality of the pavement formed. If the dip is >45 degrees pavement will not form. The most impressive pavement occurs if both the dip and the substrate is horizontal. If pavement is inclined but the substrate remains horizontal, then an arched or inclined pavement results.
Horizontal strata outcropping on a hillside forms terraces which are common in Western Ireland. The stepped pavements of the Burren are a consequence of differential resistance of the beds produced by variations in jointing, bedding and purity of the limestone. The limestone consists of alternating pure and impure, poorly cemented beds. The direction of the last glaciation, from the north-east, also affected pavement formation: more highly eroded hillsides with little terracing occur on the north-east side of hills compared to more stepped limestone on south-facing sides of hills (Williams 1966).

The range and types of pavement in the Burren need to be mapped and classified to ascertain which sorts of pavement are more a risk than others and a management plan put in place to protect the most vulnerable types.

### *1.4 Ireland and Britain compared*

There are several differences between limestone pavements in Ireland and Britain:

- Latest estimates of areal extent put the area of limestone pavement in Britain at about 3,000 hectares (Simon Webb, Natural England, pers. comm.). By comparison, in Ireland 22,500 hectares lie within SACs according to Natura 2000 data. The actual total area is unknown but may be as much as 31,822 hectares within SACs and 36,300ha if areas outside of SACs are included.

- There is no definitive overview of Irish limestone pavements from a floristic point of view.

- All English limestone pavements are now protected by Limestone Pavement Orders under the Wildlife and Countryside Act 1981 which bans stone removal. This followed on from the definitive floristic survey of British limestone pavements by Ward and Evans (1976), which for the next two decades formed the basis of limestone pavement conservation policy, particularly in England where the majority of the British examples occur. Only limestone pavements lying within protected areas receive any form of safeguard in Ireland, leaving substantial areas outside such areas unprotected, despite this being a priority habitat under the European Habitats Directive.

- While Limestone Pavement Orders in England have put a stop to the stone extraction trade, some 9,000 tonnes per annum of water-worn limestone for use in landscaping was estimated to be extracted from Irish limestone pavements in an under-cover investigation (Traffic International 1999). In a more recent questionnaire-based report (Willshaw 2005), extraction from Ireland is still of this magnitude. The rock sells to garden centres in SE England and elsewhere for €175.00 a tonne. Examples of active destruction of limestone pavement for agricultural reclamation, house building and sale of rockery stone came to light during this three month desk study.

### *1.5 Limestone pavement designations*

#### 1.5.1 SACs designated primarily for limestone pavement

Appendix 2 shows the Natura 2000 sites selected primarily for Limestone Pavement. It is suggested that Barrigone is reclassified, perhaps as a species-rich calcareous grassland, and that limestone pavement is omitted as a habitat of European significance at Lough Derg NE Shore and Lough Ree. Whilst it may be there, its occurrence is so small that it can only be considered to be of academic interest (Stephen Ward pers. comm.).

### 1.5.2 Other sites containing limestone pavement

Appendix 3 show sites other than SACs with limestone pavement present. Appendix 4 refers to sites known to have pavement present but are not currently documented in paper form. The actual area of pavement within these sites is quite small or is unknown.

### 1.5.3 Notes by Dr Stephen Ward on all sites

Notes on each of the sites with significant amounts of limestone pavement on them have been extracted from NPWS files by Dr Stephen Ward. These include information on conservation status and any damaging operations present. Personal comments by S. Ward are added in coloured text. This is presented in Appendix 5.

# 2 Mapping of limestone pavements from remote sensing and other GIS data sets

### 2.1 Introduction

Limestone pavement can be easily seen on aerial photos and satellite imagery where it is exposed. However, where it is not exposed i.e. under scrub or woodland, it is difficult to estimate by this measure. Exposed limestone pavement that is not contained within designated areas is also mapped using imagery, aerial photos and Natura 2000 maps.

### 2.2 Methodology

The approach to the mapping of the limestone pavements took place in two phases;

- Location of potential sites from a study of SAC records, classification of Landsat TM imagery and definition of likely areas from the Irish Forest Soils and Geological Survey data.
- Visual inspection of the year 2000 orthophotos and onscreen digitizing of areas recognized as limestone pavement.

### 2.3 Data Sources

The following GIS data sources have been used to compile maps for the occurrence of limestone pavement;

- Corine 2000 land cover
- Irish Forest Soils (IFS; 1996)
- Geological Survey of Ireland solid geology
- Geological Survey of Ireland Karst Heritage sites
- SAC records and digital boundaries
- Landsat Thematic mapper satellite imagery (2000)
- Ordnance Survey of Ireland aerial orthophotography (2000)
- Burren scrub mapping data (Heritage Council 2006)
- Burren habitat mapping (Parr *et al.* 2006)

The evidence of limestone pavements was recorded in the GIS for each data set and summary distribution and range prepared for 10km squares.

### 2.4 SAC Records

An inspection of the Natura 2000 SAC records identified 34 areas where limestone pavements were recorded during field surveys (Appendix 1). These are mapped and used to overlay other maps of limestone pavement derived from other sources.

### 2.5 Landsat TM and aerial photos

Cloud-free Landsat TM imagery is available for Ireland from 2000/2001. A supervised classification was performed on the imagery based upon visual interpretation of training areas from both imagery and aerial photos (Fig. 1). Limestone pavements were recognized as two classes of bare limestone and a class of sparsely vegetated limestone in the Burren area (Fig. 2). There was no accuracy assessment of the classification as it was used purely to guide the subsequent visual interpretation of the aerial photography.

**Fig. 1 Training areas used for classification of limestone pavement in Sligo from aerial photographs (2000).**

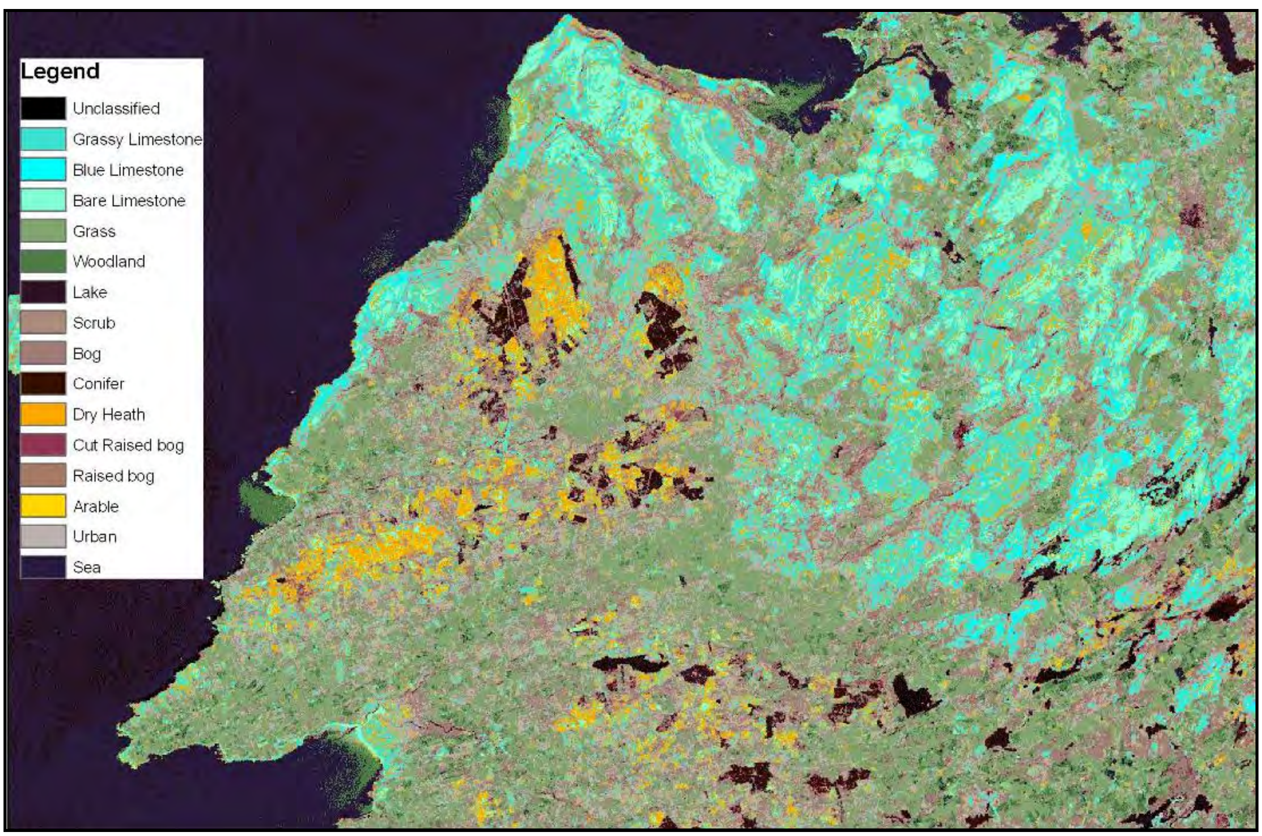


**Fig. 2 Supervised classification of Landsat 7 TM (2000/2001)**

### 2.6 Irish Forest Soils

The Irish Forest Soils record parent material for soils and sub-soils. The sub-soils have a class of calcareous rock and this was used to select areas of potential limestone pavement (Appendix 7). The calcareous rocks sub-soils class appears to include limestone pavement and thin soils over limestone bedrock. Thus the class is not a definitive guide to limestone pavements.

### 2.7 Geology

The solid geology was analysed to select areas of pure carboniferous limestones as these were thought to comprise most of the limestone pavements. Much of the Irish midlands are underlain by these rocks (Appendix 8) and whilst the class is not very useful in finding limestone pavements, it does provide a check against any areas of bare rock mapped from the aerial photographs. The karst heritage areas data set were of less use, but all sites were inspected with the aerial photography. Most of the features in the karst database are sinks, resurgences, cave entrances, dolins or turloughs.

### 2.8 Statistics

The actual area of Limestone pavement is calculated as 363 sq km using aerial photographs and ancilliary datasets. Intersecting the areas interpreted for limestone pavements with the SAC boundaries shows that not all areas of limestone pavement are within SACs (Fig. 3).

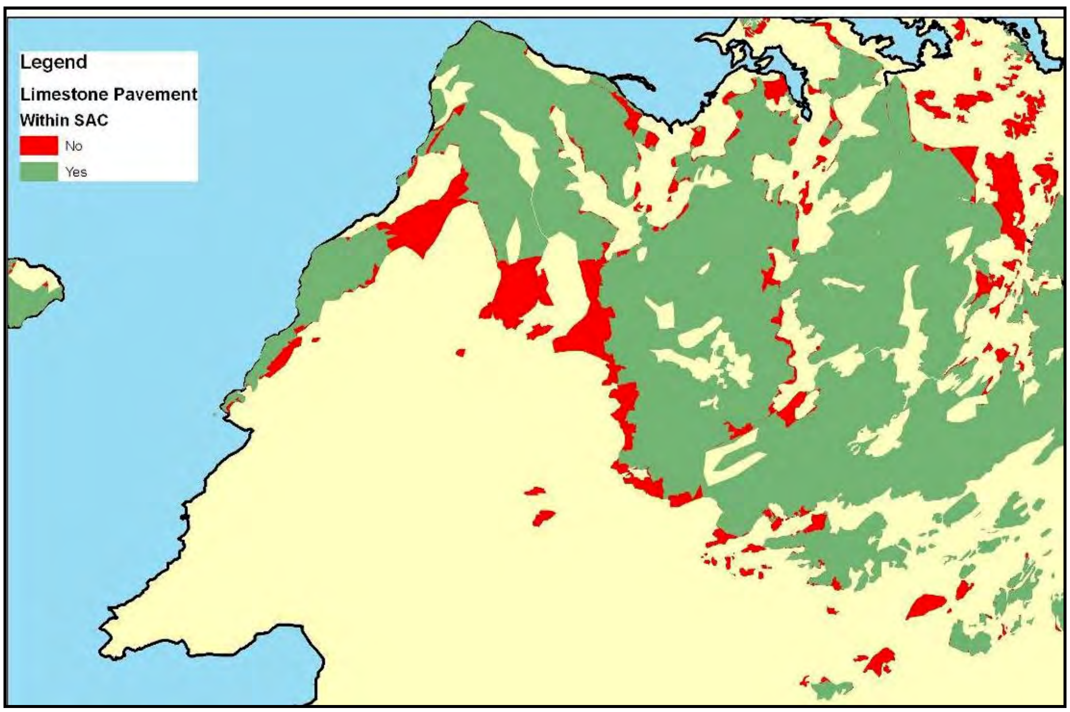


**Fig. 3 Limestone pavement found within SACs in the Burren area (green) and outside SACs (red)**

# *3* Range and Surface Area

Range is the area over which a species or habitat is usually found. For the purposes of this exercise, range is taken to be the outer limits of the overall area in which a habitat is found at present. It can be considered as an envelope within which areas actually occupied occur, as in many cases not all the range will actually be occupied by the habitat. The range for limestone pavement is 7400 sq km. The areas occupied are therefore a sub-set of the range. The range is considered connected if there are less than two 10Km squares between actual occurrences. Surface area is therefore defined as the actual area occupied by the habitat. Based on 10Km squares, this has been calculated as 6000 sq km. Based on actual area calculated from remote sensing, it is 363 sq km.

### *3.1 Distribution and Range*

The occurrence of limestone pavements is shown in Fig. 4. This is derived from a visual assessment of aerial photography (2000).

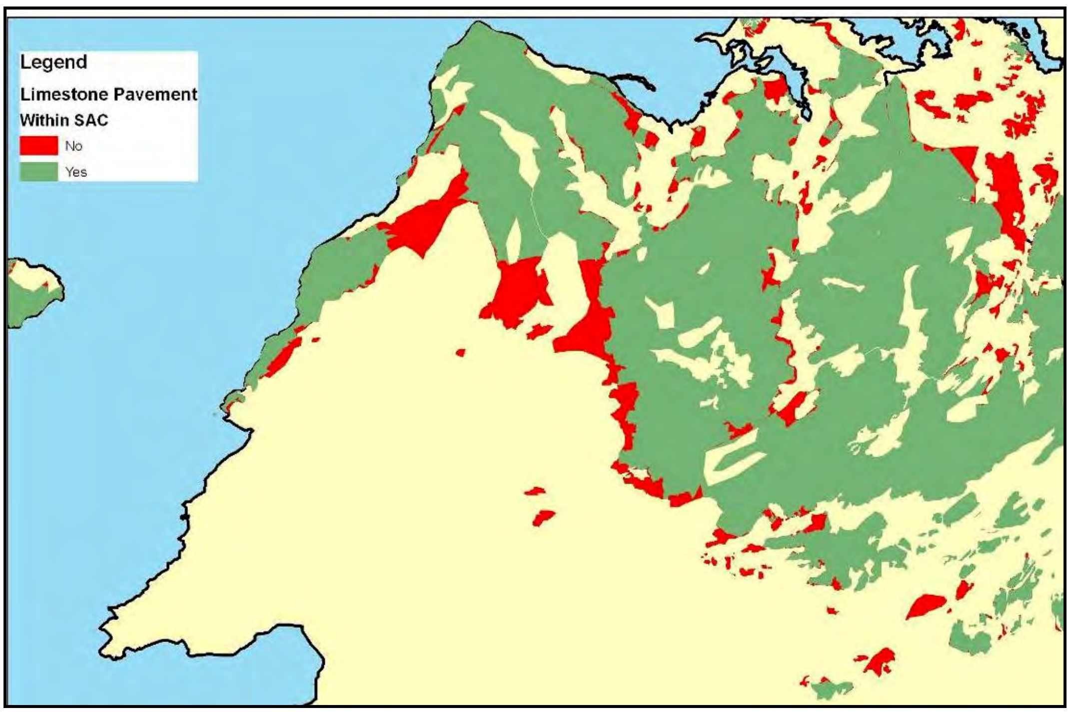


**Fig. 4 Occurrence of limestone pavement in red by visual interpretation of aerial photographs (2000)**

The area and distribution of limestone pavement at the level of 10km squares is shown in Fig. 5:

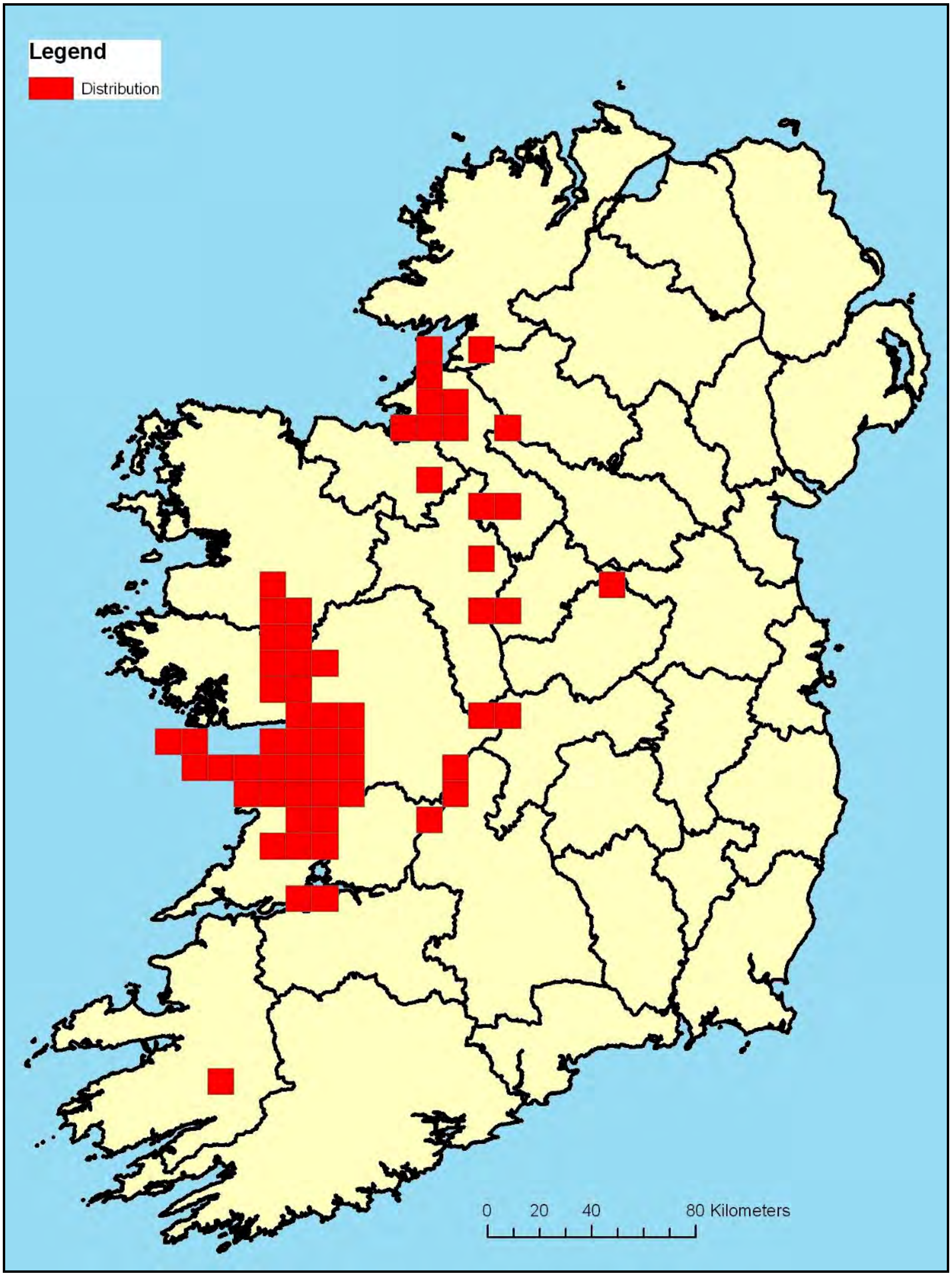


**Fig. 5 Limestone pavement distribution by 10Km squares**

The area of limestone pavement within 10km cells is shown in Fig. 6 and the full range in Fig. 7. The range is calculated as 7400 sq km. The majority of limestone pavement occurs in the west of Ireland in Cos. Clare and Galway:

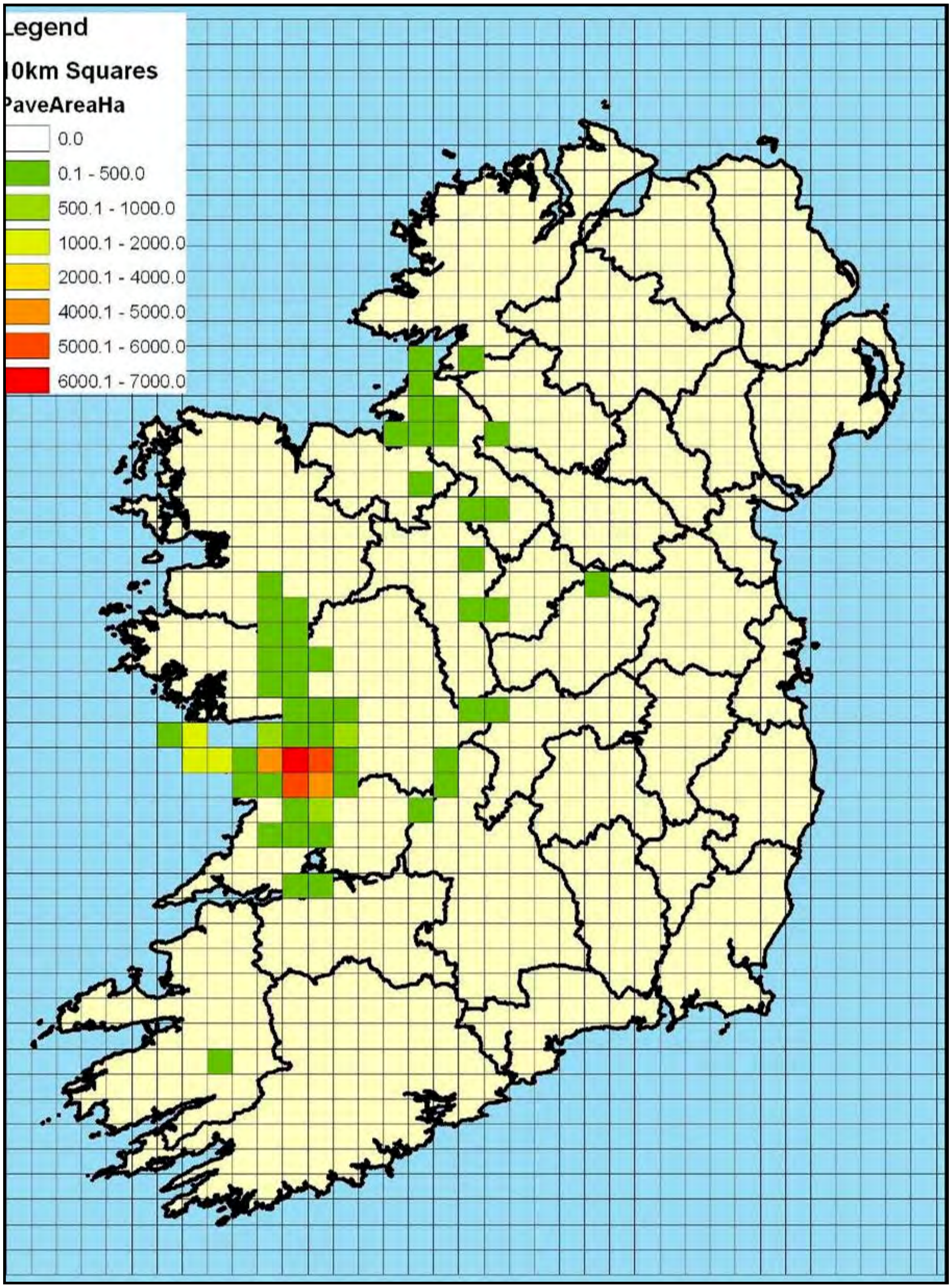


**Fig. 6 Area of limestone pavement in hectares per 10Km square.**

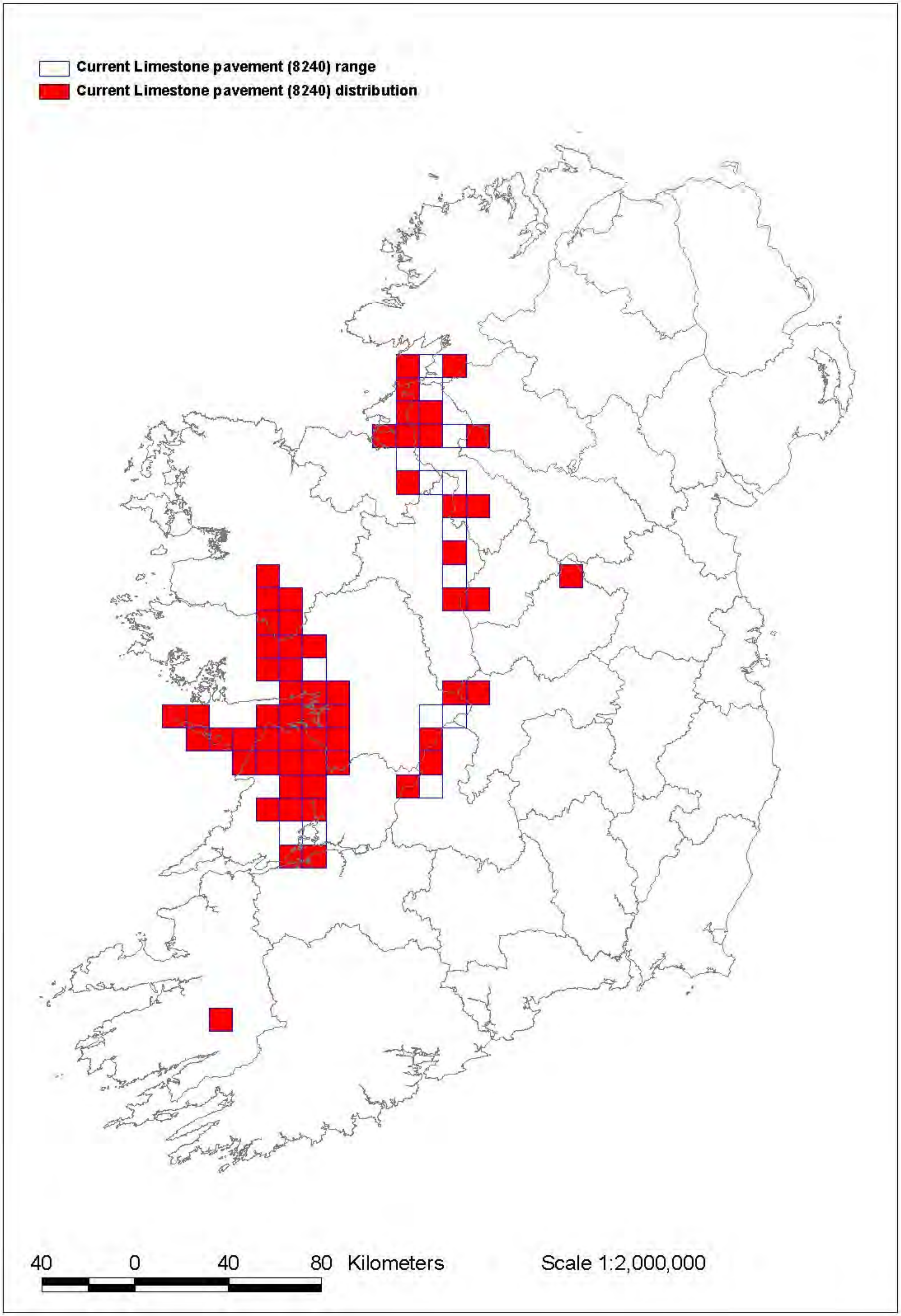


**Fig. 7 Range of limestone pavement by 10Km squares.**

The actual area of limestone pavement in Ireland has been calculated as 36,300ha. This is derived from reported areas in Natura 2000 forms (22,000ha; Table 1) combined with coverage mapped from aerial photos and satellite imagery. Data from remote sensing showed that there were 31,822ha within SACs/NHAs and 4,478ha outside of designated areas. The desk study alone, without reference to aerial photos or satellite imagery, also showed that there were approximately another 5,000ha outside of SAC designated areas (Table 1).
Appendix 8 shows the geological extent of limestone bedrock throughout Ireland but much of this is covered by soil and vegetation. However, it shows the outer boundaries of limestone where pavement might occur. Table 1 shows the number of limestone pavement sites designated in Ireland and these are ranked by area. Percentage cover of pavement is calculated for each site. The top three sites with an area >2,000ha are in the Burren, Co. Clare. Sites with an area between 1,000ha and 100ha in area are to be found in the Aran Islands and elsewhere in Galway. Those sites covering an area <100ha are scattered throughout Ireland as small pockets within larger areas of grassland and woodland. These reach their most northerly station in Ballintra in Co. Donegal and their most easterly stations in the Hill of Mael and Rock of Curry in Westmeath. Their most southerly outcrop occurs at Killarney National Park. (An area of limestone pavement under scrub formerly occurred further south near Kenmare, but this has all been destroyed by housing in the last 30 years (J. Cross pers. Comm)). The most westerly sites are the Aran Islands, Inis Mor, Inis Oirr and Inis Meann. Limestone pavement occurs in conjuction with other habitats such as rivers (Moyree River system, Co. Clare, Shannon Callows, Co. Offaly), lakes (Lough Fingall, Co. Galway) and turloughs (Coole-Garryland, Co. Galway).

**Table 1 Limestone pavement sites ranked by area (ha), showing percentage cover within sites and estimated relative surface area**

| SAC No. | **SAC name** | **% of site** | **Area of Limestone Pavement (ha)** | **Relative surface as % of Limestone Pavement of estimated national total (37,800 ha) A: >15%; B: 2-15%; C 0-2%** |
|---|---|---|---|---|
| 1926 | **East Burren** | **61** | **11,500** | **A** |
| 54 | **Moneen Mountain** | **66** | **4047** | **B** |
| 20 | **Black Head - Poulsallagh** | **35** | **2451** | **B** |
| 213 | **Inish Mor** | **63** | **1488** | **B** |
| 212 | **Inis Meain** | **63** | **500** | **C** |
| 1774 | **Lough Carra / Mask** | **3** | **400** | **C** |
| 1275 | **Inis Oirr** | **68** | **378** | **C** |
| 57 | **Moyree River** | **57** | **272** | **C** |
| 1271 | **Gortnandarragh** | **90** | **258** | **C** |
| 297 | **Lough Corrib** | **1** | **206** | **C** |
| 606 | **Lough Fingall** | **35** | **193** | **C** |
| 19 | **Balllyogan Lough** | **30** | **114** | **C** |
| 268 | **Galway Bay** | **<1** | **100** | |
| 32 | **Dromore Woods & Loughs** | **9** | **78** | **C** |
| 252 | **Coole-Garryland** | **5** | **44** | **C** |
| 432 | **Barrigone** | **73** | **43** | **C** |
| 479 | **Cloughmoyne** | **51** | **42** | **C** |
| 16 | **Ballycullinan Lough** | **17** | **32** | **C** |
| 2244 | **Ardrahan Grassland** | **16** | **30** | **C** |
| 216 | **RSC=Clorehane Wood** | **<1** | **30** | **C** |
| 979 | **Corratirrim** | **20** | **23** | **C** |
| 115 | **Ballintra** | **32** | **22** | **C** |
| 191 | **St John's Point** | **2** | **11** | **C** |

| | | | | |
|---|---|---|---|---|
| 242 | **Castletaylor** | **7** | **7** | **C** |
| 440 | **Lough Ree** | **not significant** | **10s of sq metres** | **C** |
| 16 | **Ballycullinan Lough** | **?** | **?** | **C** |
| 19 | **Ballyogan Lough** | **?** | **?** | **C** |
| 2241 | **Lough Derg: NE shore** | **not present** | **nil** | **C** |
| 594 | **Briarfield Turlough** | **not significant** | **nil** | **C** |
| 681 | **Hill of Mael & Rock of Curry** | **not significant** | **nil** | **C** |
| 959 | **Killough Hill** | **not significant** | **nil** | **C** |
| 1011 | **Fisherstreet pavement** | **?** | **?** | **C** |
| 1288 | **Knockmaa Hill** | **not significant** | **nil** | **C** |
| 1626 | **Annaghmore Lough** | **not significant** | **nil** | **C** |
| 2068 | **Carricknahorna Lough & L Gorman** | **not significant** | **nil** | **C** |
| 2211 | **Commons of Carney** | **not significant** | **nil** | **C** |
| ? | **Lough Scur** | **not significant** | **nil** | **C** |
| | **Total ha** | | **22,023 excl Ballycullinan & Ballyogan - another 5,000 ha outside (S.D. Ward)** | |

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### *3.2 Trend in the range*

The range of limestone pavement appears to be relatively stable at the moment, although there are some threats at its outer limits with scrub encroachment (Ballintra, Co. Donegal), pavement removal (Cloughmoyne, Co. Mayo) and quarrying (Barrigone, Co. Limerick). Because of this, a negative trend is reported.

### *3.3 Conservation status of the habitat range*

This is based upon analysing change in range over the reporting period. There have been some reports of damage to limestone pavement at its outer ranges, but these appear to be very small.

### *3.4 Trend in area*

Documentary and empirical evidence indicates that the area of bare pavement is definitely decreasing, although it is very difficult to put an accurate figure on this decline. Parr *et al.* (2006) estimated from satellite imagery that scrub cover over limestone in the Burren area is as high as 14%, although much of this affects grassland as well as pavement. From figures provided by the local rangers up to 2003, a total of 106ha have been damaged within designated areas since this type of recording began. As the overall total area of pavement recognised within designated areas is 22,000ha, based on the Natura 2000 forms, this represents a 0.48% loss since 1993. If the calculation is based on the area of pavement derived from remote sensing within designated areas, then this figure is 0.33% However, this is based on the original estimated area of pavement being correct and does not include damage to pavement outside of designated areas. Therefore the trend is reported as decreasing.

### *3.5 Conservation status of the habitat area*

Given the recent reports on limestone pavement destruction and removal within and outside SACs, figures suggest a small change in habitat extent (0.02% per annum). However, this figure is probably quite a bit larger due to activities outside of SACs going unreported.

Limestone pavement cannot be restored or replaced, so this trend is quite a serious one and therefore the conservation status is Unfavourable Inadequate.

# 4 Damaging operations

Damaging operations were recorded from existing data sets for SACs containing limestone pavement (Appendix 9), from SIR records (Appendix 10) and by discussion with rangers who update this record on a regular basis (Table 2). Some casual field work associated with this study also brought current damage of Limestone Pavement to light inside and outside of designated areas (Table 3). Results are presented in Figs. 8-12, Tables 2-3 and Plates 1-7.

### *4.1 General observations on all damaging operations*

The owner/occupier is most often responsible for the damage (Fig. 8). Agricultural operations and development are the principal acitivities responsible for these changes, some of which are caused by statutory bodies (Fig. 9). The majority of the impacts are negative (Fig. 10). The area affected by the operations are mostly small but some are greater than 10ha and one is as much as 50ha (Fig. 11).

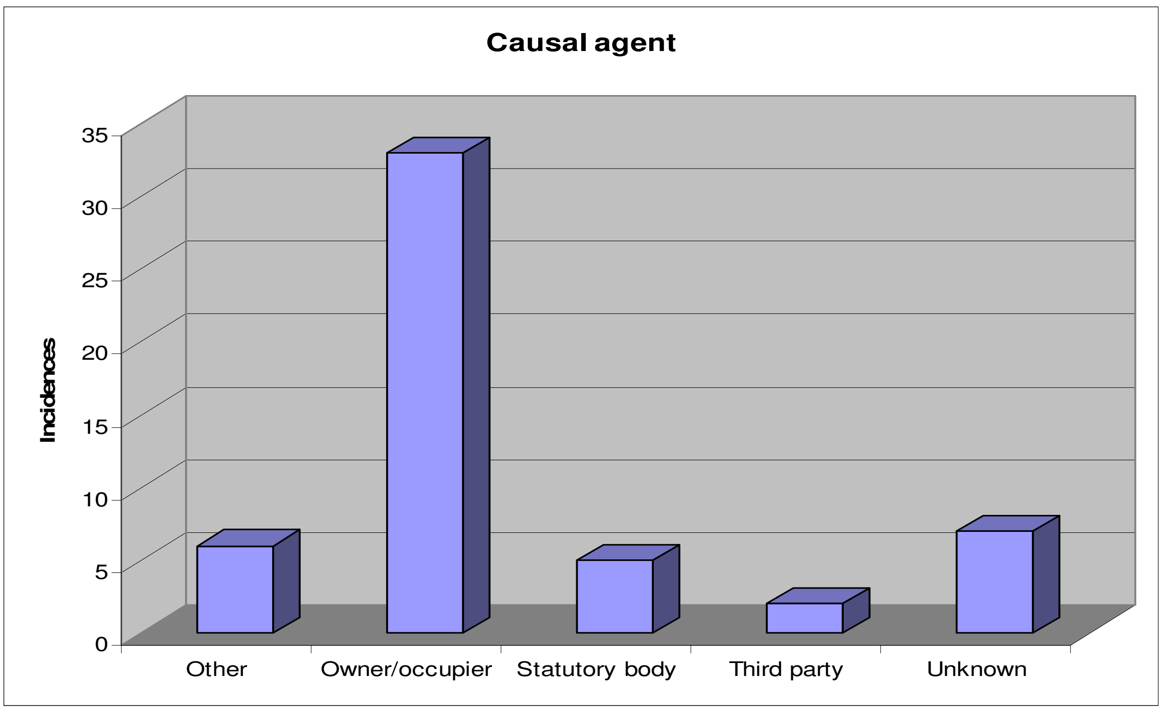


**Fig. 8 Causal agents of all damaging operations on limestone pavement site**

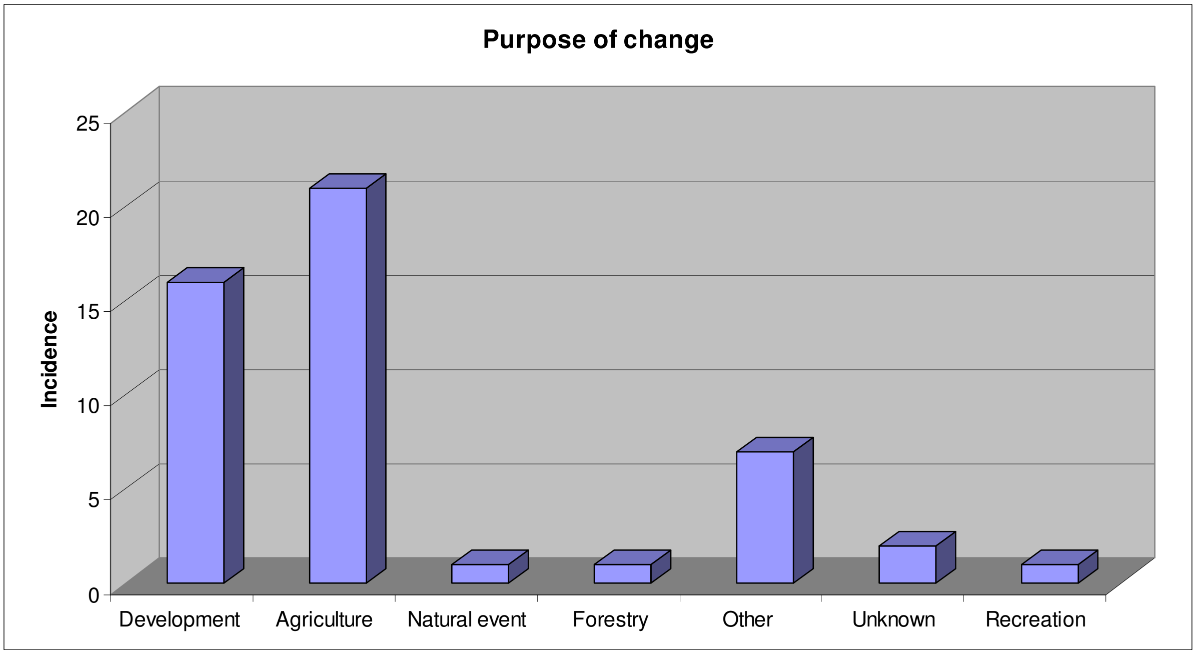


**Fig. 9 Purpose of change for all damaging operations**

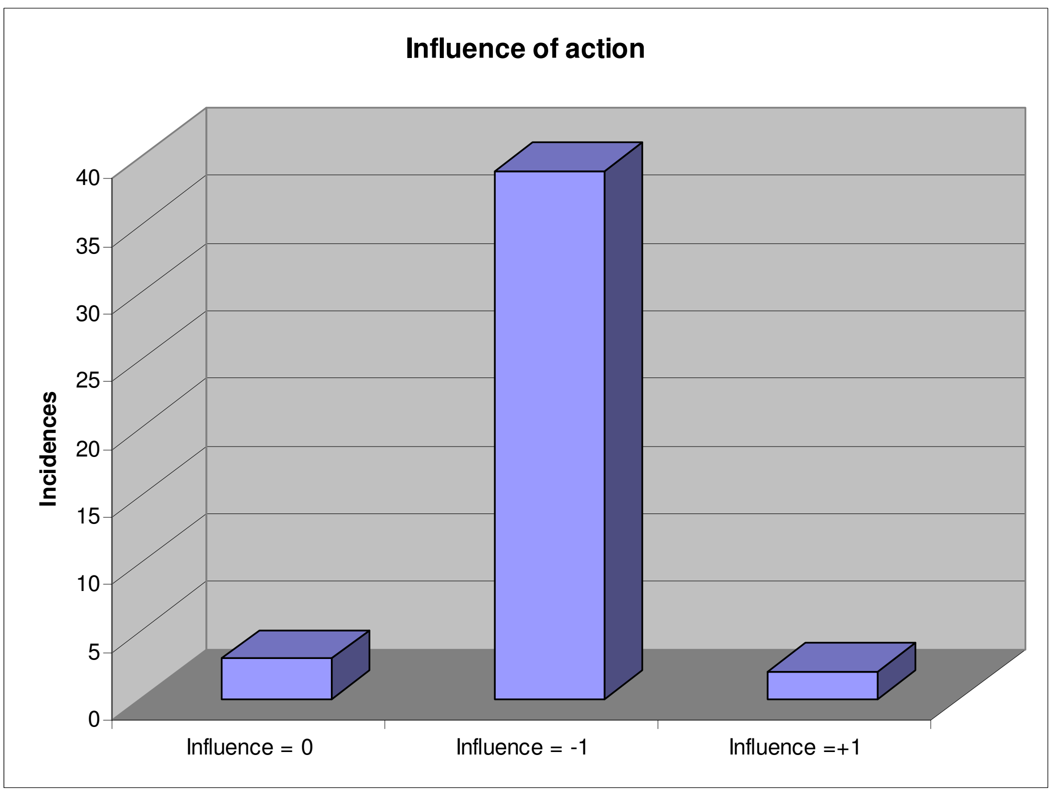


**Fig. 10 Influence of the action. Scores relate to incidences of negative, positive or actions with no appreciable influence on limestone pavement integrity.**

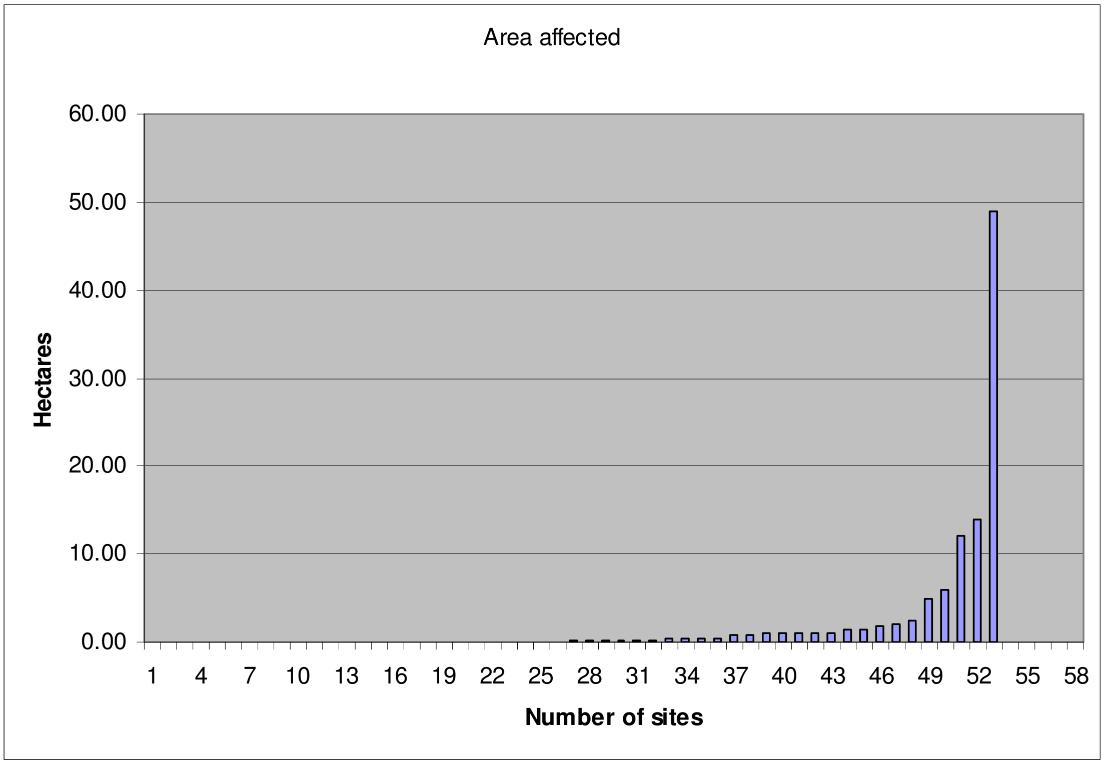


**Fig 11. Area affected by all damaging operations (hectares). Sites are ranked in terms of increasing area impacted.**

## Specific observations

### 4.1.1 Limestone pavement removal

Limestone pavement removal  is the most frequent damaging operation (10 incidences; 4.73ha). Most of the reported removal was related to agricultural activity (Plates 1 and 2) but some was related to development (Plate 3, Appendix 10) with a recent report of extraction of pavement for sale to England (Table 2). Because there is no specific law preventing removal of limestone pavement in Ireland, apart from notifiable actions in designated areas, much limestone is removed opportunistically in Ireland to feed the UK market since the Limestone Pavement Order passed into law in the UK.

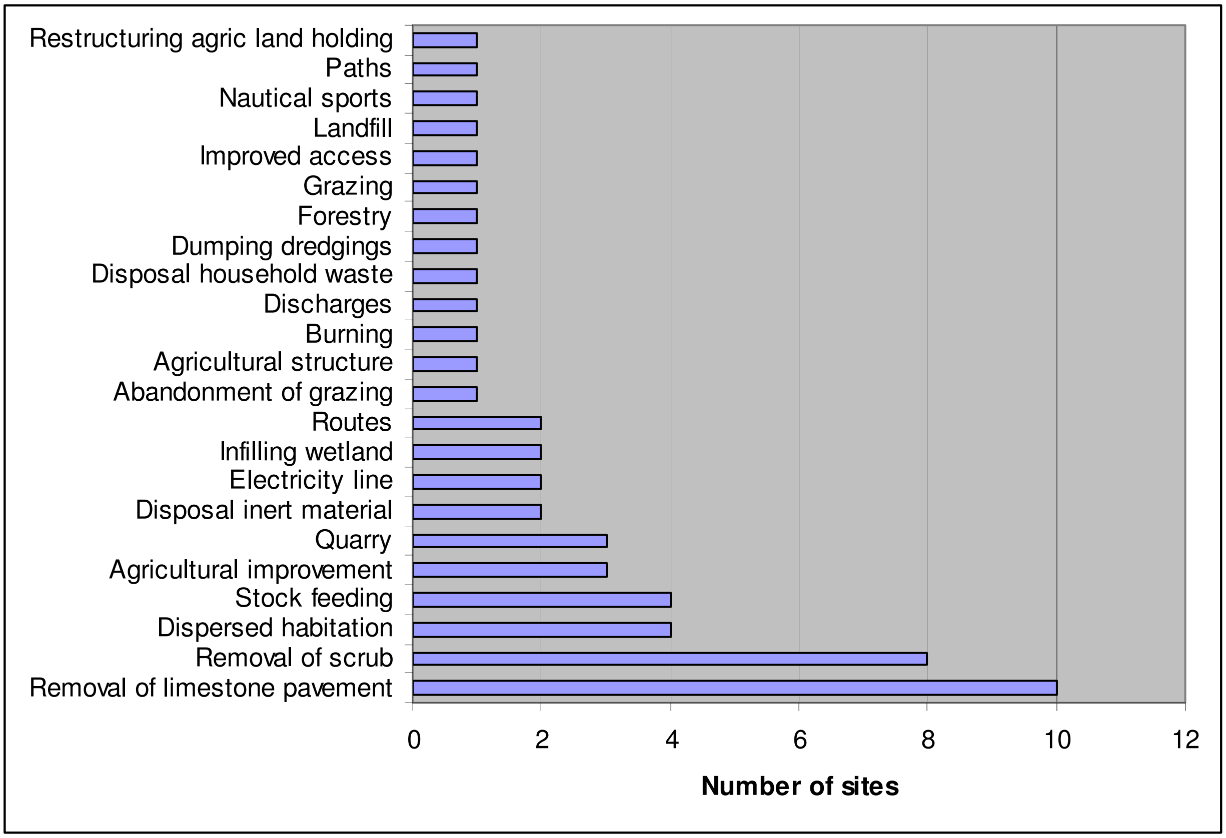


**Fig 12 Damaging operations to limestone pavement ranked by type and number of sites on which they occurred**

### 4.1.2 Scrub removal

The second most frequently recorded damaging operation on limestone pavement is scrub removal (Fig. 5, 8 incidences; 10.7ha). It is not possible from the data available to say how scrub removal was carried out – whether it was by hand or by bulldozer: while the former may be beneficial by increasing the area of open pavement, the latter is invariaby destructive. This can be as a result of agricultural activity or as part of a development scheme (Plate 4). Most of the incidences (7) were related to agricultural activity (Appendix 10).

### 4.1.3 Cessation of grazing

Abandonment of grazing has led to scrub encroachment and is perceived as a problem especially in the Burren (see Plate 7). Rates of increase as high as 4.4% have been reported between 2000 and 2005, using time series analysis of, Quickbird imagery (The Heritage Council 2006). Change from 1995-2000 using aerial photographs showed a lower rate of change with a 1.6% increase and from 1975-1995 the rate of incease was 1.3%. This rate of increase in scrub cover over a relatively short period of time is quite dramatic and appears to be exponential in recent times. Given the rates of scrub removal reported (section 4.2.2) versus the probable rates of expansion of scrub over pavement, the latter is probably much higher than the former, but it is difficult to come up with a more accurate assessment at this time.

Under the Habitats Directive, limestone pavement is recognised as a mosaic of open and closed (scrub-covered) communities. There is strong historical evidence to indicate that scrub cover has waxed and waned over time, so the challenge from the conservation management perspective is to achieve a satisfactory balance. It is difficult to define a 'satisfactory balance' but it could be argued that the present balance is satisfactory but that a further increase in scrub cover poses a threat and that it needs to be controlled (expert opinion from NPWS).

#### 4.1.4 Agricultural activities

Destruction of pavement for land reclamation for agriculture has been documented in the past in the Burren (Drew and Magee 1994). Reasons for the continuing clearance of limestone pavement for agriculture (Tables 2-3, Plates 1-3) may be that land covered in rock does not qualify for single-farm payment under the CAP, i.e. there may have been an oversight in cross-compliance whereby the EU is inadvertently stimulating the destruction of a priority habitat under the Habitats Directive (Parr pers. comm.). There may also be cultural reasons – limestone pavement of itself is perceived negatively:converting it from exposed rock to pasture is seen as good practice. Hundreds – possibly thousands – of hectares have been reclaimed in this way over the decades and was State-aided some 30-40 years ago; the impact of this is still visually very evident. Programmes such as the Rural Environment Protection Scheme (REPS) and the EU BurrenLIFE 'Farming for Conservation' provide a positive incentive which needs to be developed further.

#### 4.1.5 Other activities

Other damaging activities are related to access (paths, electricity pylons), leisure and tourism (e.g. vandalism; Plate 6) and development, e.g.quarrying, dumping, discharges, landfill, housing development (especially on the outskirts of towns and villages (Plate 4).

**Table 2. Recent observations of condition of SACs selected for limestone pavement from discussion with rangers (2006)**

| No. | Name | Condition |
|---|---|---|
| 2244 | **Ardrahan** | • **No damage to report – Gerry Higgins, NPWS** |
| 115 | **Ballintra** | • **Scrub occluding the pavement – ongoing - despite being cattle grazed; c. 3 years ago, the farmer cleared some scrub mechanically, damaging the exposed limestone in the process – Tim Roderick, NPWS** |
| 432 | **Barrigone** | • **Scrub encroachment is ongoing occluding as much as 30% of the site; lightly grazed by horses; NPWS had offered to buy part of site, but came to nothing – Stefan Jones, NPWS** |
| 20 | **Black Head Poulsallagh** | • **Visitor damage – ongoing – manifested in the building of 'mini-dolmens' & pushing glacial erratics off their pedestals – Stephen Ward, personal observation** <br> • **Significant upgrading of access for agriculture; some farmers seek consent, others do not. It is hoped EU Burren LIFE will establish best practice for track construction on such land – Penny Bartlett,** |

| | | |
|---|---|---|
| | | **NPWS** |
| 242 | **Castletaylor** | • **No damage to report – Gerry Higgins, NPWS**<br>• **afforested sector is being restored by EU Coillte LIFE** |
| 216 | **Clorehane Wood[1]** | • **No damage to report - Colm Malone** |
| 479 | **Cloughmoyne** | • **Unauthorized removal of limestone blocks for sale and export to England 2006; person doing removal has now bought the sector of land from which removal has taken place – John Higgins, NPWS** |
| 252 | **Coole-Garryland** | • **Ranger on sick leave; unable to speak to anyone as to whether there is any recent damage – Stephen Ward** |
| 979 | **Corratirrim** | • **Heavily overgrazed by sheep - John Matthews NPWS** |
| 32 | **Dromore Woods and Loughs** | • **Site a staffed NNR. I have assumed that ownership of land / presence of staff on site will have deterred any removal of limestone – Stephen Ward.** |
| 1926 | **East Burren** | • **Includes Attyslany: afforested; restoration by EU Coillte LIFE** |

| | | |
|---|---|---|
| 1271 | **Gortnandarragh** | • **Surface removal of rock in a quarrying operation which predates planning consent – ongoing - – Gerry Higgins, NPWS**<br>• **Comparison of aerial photographs from 1973 and 1992 shows scrub continuing to invade a major sector of the pavement – ongoing – Stephen Ward** |
| 213 | **Inishmore** | • **Small-scale extraction for domestic and agriculture – not much unauthorised – Penny Bartlett, NPWS** |
| 212 | **Inis Meáin** | • **Small-scale extraction for domestic and agriculture – not much unauthorised – Penny Bartlett, NPWS** |
| 1275 | **Inis Óirr** | • **A prosecution in June 2006 for unauthorised reclamation (removal or rock, import of sand, reseeding) has served as a strict warning to the islanders against such practice; the farmer concerned was fined €1,800**<br>• **Small-scale extraction for domestic and agriculture – not much unauthorised– Penny Bartlett, NPWS** |
| 1774 | **Lough Carra / Mask** | • **Major damage caused by installation of 2km pipeline by Co. Co. for a water-skiing club** |

[1] Part of River Shannon Callows SAC.

| | | |
|---|---|---|
| | | • **includes Clonbur: afforested; restoration by EU Coillte LIFE** |
| 297 | **Lough Corrib** | • **Localised clearance of pavement for construction of piers and moorings bays - results in widespread destruction of pavement – ongoing – perhaps as many as 40 cases in last 6 years – Gerry Higgins & John Higgins, NPWS** |
| 2241 | **Lough Derg: NE shore** | • **No significant amount of pavement** |
| 606 | **Lough Fingall** | • **No damage to report – Gerry Higgins, NPWS** |
| 440 | **Lough Ree** | • **No significant amount of pavement** |
| 54 | **Moneen Mountain** | • **Visitor damage – ongoing – manifested in the building of 'mini-dolmens' – Stephen Ward, personal observation**<br>• **Rock extraction does not appear to be a problem now – probably due to good level of awareness that it is not allowed – Penny Bartlett, NPWS** |
| 57 | **Moyree River** | • **NPWS prosecution pending for clay dumping over 6ha of pavement – Sinéad Biggane, NPWS** |
| 191 | **St John's Point** | • **No change – Tim Roderick, NPWS** |

**Table 3. Locations of recent ongoing damage to limestone pavements outside designated sites (2006).**

| NGR | Location | Damage |
|---|---|---|
| Land to the west of the minor road running between R34865.90136 & R34857.89814 Straddles OS 52 & 58 | In the vicinity of Ballyteige E / Teermulmoney, Moyree | Agricultural clearance. The map shows the area as being wooded; a few slim ash trees have survived. The field contains large mounds of clints, probably taken up over the winter 2006/7 as the whole scene is still very raw with fresh scratch marks on boulders etc. Cattle are present on site and there are feeders to contain big-bale silage. The field comes as a visual shock – **Plate 1**. Area reclaimed: several hectares. |
| M34691.06125 | Land to the NE of the New Line Road at Cappaghmore | Agricultural clearance. The land comprises a field which is in part limestone pavement and in part improved grassland grazed by cattle – **Plate 2.** An area of pavement has been taken up during 2006/7; the clints are piled to one side, as is juniper scrub, the leaves of which are still green – **Plate 3**. Area reclaimed about 0.25 ha. |
| M34575.07193 | Cappagh Beg / Moy | Clearance for house building – **Plate 4**. |

| | | |
|---|---|---|
| & M34525.07289 | KINVARRA | The NGRs are just two spot examples out of many in this vicinity. |
| M35526.07206 | Land to the S of the minor Cappagh Beg road | Stockpile for possible sale / export – **Plate 5**. |
| M150.103 | South of Black Head | Vandalism – displacement of limestone boulder from pedestal on which it sat since it was deposited by the ice – **Plate 6.** |
| - | Illustrative of a widespread problem | Hazel scrub invading pavement[2] – **Plate 7.** |

[2] *Assessment of Landscape Change & Effects on Archaeology & an Assessment of Habitat Survey in the Burren, C. Clare,* 2006*,* prepared for the Heritage Council by ERA-Maptec Ltd in association with Wildworks Ltd, Sharon Parr & Christine Grant

*Plate 1 Limestone clearance near Ballyteige*

*Plate 2 Agricultural clearance, cappaghmore*

*Plate 3 Agricultural clearance, Cappaghmore including Juniper*

*Plate 4 Clearance for House building, Kinvara.*

*Plate 5 Stockpiling for sale/export? Cappaghbeg*

*Plate 6 Vandalism south of Black Head*

*Plate 7 Hazel scrub invading pavement.*

# 5 Complementary Information

## 5.1 Flora

There are no particular plant species confined to limestone pavements in Ireland, except perhaps *Epipactis atrorubens*, which is widespread in the Burren, *Helianthemum nummularium*, which occurs on one site in Donegal and *Gymnocarpion robertianum* on one native site in Mayo. However some species are regularly associated with pavement such as *Sesleria albicans, Rubia peregrina* and *Adiantum capillus-veneris*. Other species commonly found assocated with limestone pavements are *Geranium sanguineum, G. robertianum, Helianthemum canum, Rosa pimpinellifolia, Teucrium scorodonia, Briza media, Gentiana verna, Dryas octopetala, Coryllus avellana, Prunus spinosa, Rhamnus cathartica, Juniperus communis, Calluna vulgaris*, *Taxus baccata, Hedera helix, Viola reichenbachiana, Thymus praecox, Crataegus monogyna, Aphanes arvensis, Arabis hirsuta*, *Saxifraga hypnoides, Antennaria dioica, Cystopteris fragilis*, *Dryopteris filix-mas, D. affinis, Asplenium trichomanes, A ruta-muraria, Phyllitis scolopendrium,* and *Ceterach officinarum.* This combination of species is unique. Several Red Data species (e.g. *Calamagrostis epigejos* and *Viola hirta*) are also to be found with limestone pavement at particular sites, especially at the edges of its range, and this strengthens the case for their overall protection.

Scrub and woodland form part of the natural mosaic found over limestone pavement (Interpretation Manual of European Union Habitats 2003). Scrub on pavement is usually denser than on deeper soils and is seen as a transition between open and wooded pavement. This transition area is often the most species-rich and therefore it is valuable in its own right (http://www.limestone-pavements.org.uk/manage.shtml). Scrub and woodland over limestone pavements is also considered important in oceanic areas for its rich epiphyte flora as stated in the UK BAP for limestone pavements (http://www.ukbap.org.uk/).

In the Burren, young scrub with open canopy and low cover value (< 10%) increases moss diversity on pavements. Even young scrub may have hazel glove fungus (*Hypocreopsis rhododendri*), a rare oceanic species which grows mainly on dead hazel stems. In terms of more established hazel scrub (e.g. 30 years old), an Atlantic lichen community of note, known as the *Lobarion,* and containing species such as *Degelia plumbea, Pannaria rubiginosa, Nephroma laevigata, Sticta sylvatica, S. fuliginosa, S. limbata, Peltigera collina, Lobaria pulmonaria* are not uncommon. Scrub on pavement is sometimes more diverse than on grassland as the encroachment is slower, with more holly, ash, rowan and whitebeam than in established hazel woods (Parr pers comm.).

### 5.1.1 Conservation status of Habitat typical species

A decline in the habitat structure and function will result in loss of many of the above species, particularly as a result of fertiliser application and scrub encroachment. It is known that NPK applications will reduce the presence of such sensitive species as *Sesleria albicans* and *Dryas octopetala* (O'Donovan 1987) over a time period as short as one year. If pavement is removed altogether then the grike flora will disappear with the loss of such species as *Rubia peregrina* and *Adiantum capillus-veneris*.

## 5.2 Favourable reference range

The favourable reference range is that area in which all significant ecological variations of the habitat are included for a given biogeographical region and is sufficiently large to allow the long term survival of the habitat. The range of limestone pavement that contains all the significant variations of the habitat is currently 7400 sq km. The losses at the edge of the range due to the unquantifiable scrub encroachment are not extensive enough to qualify as a loss in range. These losses are small areas within larger complexes and pavement still exists in the vicinity. According to expert opinion from NPWS, the Range equals the Favourable Reference Range and is stable.

### *5.3 Favourable reference area*

This has been defined as the total reference area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type. This should include areas for restoration or development of those habitat types for which the present coverage is insufficient to ensure long-term viability. As limestone pavement is primarily a geological feature, it would appear at first glance that this habitat would not be under threat as it is so extensive in Ireland. However, there has been no dedicated survey of the types of limestone pavement present or the associated flora. Pavement removal and/or damage has been recorded within designated areas over the reporting period and some areas of pavement are being occluded by scrub expansion.While this does not eliminate the pavement it changes its character, often with the loss of species of bare pavement. The favourable reference area is considered to be 36,400ha or 364 sq km.

# *6* Conclusion

### *6.1 Specific structures and functions*

#### 6.1.1 Structures

The geological structure of limestone pavement in Ireland is good in the absence of any data to the contrary.

#### 6.1.2 Functions

Bare limestone pavement is an inhospitable habitat for plants, especially in periods of drought. Grikes provide a sheltered and humid microclimatesuitable for many ferns (Wilmot 1979), mosses, lichens and higher plants (Silvertown 1983), particularly remnants of woodland flora. Solution hollows and runnels on the surface of the clints provide mini-habitats for colonisation by algae, mosses and ultimately higher plants (Byrne 2001). Limestone pavement also provides a substrate for scrub and woodland cover which also supports associated oceanic bryophytes and lichens, some of which are rare. These functions are presumed to be intact.

Cessation of grazing has resulted in scrub expansion which is apparently accelerating (The Heritage Council 2006). This will alter the function of the existing bare pavement by changing its floral and faunal communities. This need not necessarily be considered as a negative change of function, but it depends on whether the change in flora associated with scrub expansion is considered to be less valuable.

Another function of limestone pavement is groundwater protection due to the filtering action of water through its karst structure. Immoderate use of fertilisers, pesticides and herbicides or excessive grazing may result in groundwater contamination. Some work has been carried out in Ireland on this topic (Thorn and Coxon 1992; Drew 1996) and while this was perceived as a problem in the past, it appears to be less so now due to the reduction in the use of silage clamping over limestone (Drew 1996) and reductions of fertiliser application imposed under REPS (Bohnsack and Carrucan 1999). Another concern is the effect of the inputs from cattle excreta into groundwater arising from feeding stations on thin soils over bedrock. Of most concern are nitrates, ammonium, phosphates and microorganisms (Majs 2003). (Fig.12).

- Because of possible negative affects of livestock on groundwater the conservation status of structures and functions is considered to be Inadequate.

### *6.2 Future prospects*

#### 6.2.1 Negative future trends

Negative future trends include:

- ongoing damage to limestone pavement – particularly removal to supply the garden trade.
- clearance for agriculture and development, both within and outside designated areas
- Changes in grazing pressure, both over- and under-grazing
- Stock feeding resulting in pollution

#### 6.2.2 Positive future trends

There are two initiatives partly funded by the EU LIFE which aim to restore existing pavement to favourable conservation status.

- **The Burren EU LIFE Project** aims to develop a new model for the sustainable agricultural management of the priority habitats in the Burren. This includes, *inter alia,* scrub removal over limestone and changes in feeding regimes to encourage browsing. This should help to restore pavement and calcareous grassland and reduce the risk of water pollution
- **The Coillte EU-LIFE Project** is restoring priority woodland habitats in Ireland between 2006-2009. This project targets the restoration of 550.8ha of priority woodland habitat types which have been variously impacted by human activities. Woodland on limestone pavement comprises the majority of the area with 393ha to be restored. Limestone Project sites are shown in Table 4.
- .

Overall future trends are considered to be Inadequate.

Table 4 Limestone project sites for restoration

| Site | SAC | Coillte Forest | SAC name | County | Area |
|---|---|---|---|---|---|
| 1 | 1774 | Clonbur[3] | L Carra-Mask | Galway / Mayo | 292.9 ha |
| 2 | 1926 | Attyslany | E Burren | Clare | 67.1 ha |
| 7 | 0242 | Castletaylor | Castletaylor | Galway | 32.8 ha |
| Total | | | | | 392.8 ha |

### *6.3 Overall assessment of conservation status*

- The Favourable Reference Range of 74,000km2 is **Favourable**
- The current habitat extent is 363km2 or 49% of the FRR. Unlike other habitats the extent is dictated by the geology which cannot be changed. There has been a slight decrease in area and therefore the it is assessed as **Unfavourable Inadequate.**
- The habitat structures and functions are considered to be **Unfavourable Inadequate**.
- The future prospects are considered to be **Unfavourable Inadequate.**

Thus, as two of the habitat’s attributes are Unfavourable Inadequate, the overall conservation status for Limestone Pavement is **Unfavourable Inadequate**.

[3] Clonbur is a demonstration site – interpretative display board to be provided to inform visitors of background, objectives, actions and expected results.

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# Appendix 1 List of sites ranked by site code containing three associated Annex I habitats, the County they occur in and their designation status

| Site code | Site name | Juniper | Limestone pavement | Alpine & Boreal Heaths | County | Status |
|---|---|---|---|---|---|---|
| 16 | Ballycullinan Lake | | X | | CLARE | pSAC |
| 19 | Ballyogan Turlough | | x | | CLARE | SAC |
| 20 | Black Head - Poulsallagh | X | X | X | CLARE | p/tSAC |
| 32 | Dromore Woods and Loughs | | X | | CLARE | p/tSAC |
| 54 | Moneen Mountain | X | X | X | CLARE | p/tSAC |
| 57 | Moyree River System | | X | | CLARE | p/tSAC |
| 115 | Ballintra | | X | | DONEGAL | p/tSAC |
| 191 | St. John's Point | | X | | DONEGAL | p/tSAC |
| 197 | West of Ardara Maas Road | X | | | DONEGAL | p/tSAC |
| 212 | Inishmaan Island | | X | | GALWAY | p/tSAC |
| 213 | Inishmore Island | | X | X | GALWAY | p/tSAC |
| 216 | River Shannon Callows | | X | | GALWAY OFFALY ROSCOMMON TIPPERARY WESTMEATH | p/tSAC |
| 238 | Caherglassaun Turlough | | X | | GALWAY | SAC |
| 242 | Castletaylor | X | X | X | GALWAY | p/tSAC |
| 252 | Coole-Garryland | X | X | | GALWAY | p/tSAC |
| 268 | Galway Bay | | X | | GALWAY | SAC |
| 297 | Lough Corrib | | X | | GALWAY MAYO | p/tSAC |
| 322 | Rahasan Turlough | | X | | GALWAY | SAC |
| 432 | Barrigone | X | X | | LIMERICK | p/tSAC |
| 440 | Lough Ree | | X | | ROSCOMMON LONGFORD WESTMEATH | p/tSAC |
| 479 | Cloughmoyne | | X | | MAYO | p/tSAC |
| 594 | Brierfield Turlough | | X | | ROSCOMMON | NGO pSAC Gp 2 |
| 606 | Lough Fingall | X | X | X | GALWAY | p/tSAC |
| 623 | Ben Bulben, Gleniff and Glenade Complex | X | | X | SLIGO LEITRIM | p/tSAC |
| 681 | Hill of Mael & Rock of Curry | | X | | Westmeath | NGO pSAC Gp 2 |
| 849 | Spa Hill & Clomantagh Hill | | X | | SLIGO LEITRIM | SAC |
| 894 | Clorhane Wood | | X | | OFFALY | NGO pSAC Gp 2 |
| 959 | Killough Hill | | X | | TIPPERARY SOUTH | NGO pSAC Gp 2 |
| 979 | Corratirrim | | X | | CAVAN | p/tSAC & NGO pSAC Gp 2 |
| 1011 | Fisherstreet Pavement & Caves | | X | | CLARE | NGO pSAC Gp 2 |
| 1271 | Gortnandarragh | | X | | GALWAY | p/tSAC |
| 1275 | Inisheer Island | | X | | GALWAY | p/tSAC |
| 1288 | Knockmaa Hill | | X | | GALWAY | NGO pSAC Gp 2 |
| 1321 | Termon Lough | | X | | GALWAY | SAC |
| 1626 | Annaghmore Lough | | X | | ROSCOMMON | NGO pSAC Gp 2 |
| 1656 | Bricklieve Mountains & Keishcorran | | x | | SLIGO | SAC |
| 1665 | Easky River | | X | | SLIGO | NGO pSAC Gp 2 |
| 1774 | Lough Carra/Mask Complex | | X | | MAYO GALWAY | p/tSAC |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1788 | **Turloughcor** | | **X** | | **GALWAY** | **?** |
| 1926 | **East Burren Complex** | **X** | **X** | **X** | **CLARE GALWAY** | **p/tSAC** |
| 2068 | **Carricknahorna Lough** | | **X** | | **DONEGAL** | **NGO pSAC Gp 2** |
| 2211 | **Commons of Carney** | | **X** | | **Tipperary** | **?NHA** |
| 2236 | **Island Fen** | **X** | | | **OFFALY** | **p/tSAC** |
| 2241 | **Lough Derg, North-East Shore** | **X** | **X** | | **GALWAY TIPPERARY** | **p/tSAC** |
| 2244 | **Ardrahan Grassland** | **X** | **X** | **X** | **GALWAY** | **p/tSAC** |
| 2294 | **Cahermore Turlough** | | **X** | | **GALWAY** | **SAC** |
| 2074 | **Slyne Head** | **X** | | | **GALWAY** | **SAC** |
| 2708 | **Ballindooley Hill** | | **X** | | **GALWAY** | **NGO pSAC Gp 1** |
| 0 | **Doughiska & Curragrean** | | **X** | | **GALWAY** | **NGO pSAC Gp 1** |
| 0 | **Grange East** | | **X** | | **GALWAY** | **NGO pSAC Gp 1** |
| 2709 | **Hill south of Coteenty** | | **X** | | **GALWAY** | **NGO pSAC Gp 1** |
| 0 | **Laurclavagh** | | **X** | | **GALWAY** | **NGO pSAC Gp 1** |
| 0 | **Turloughgarve** | | **X** | | **GALWAY** | **NGO pSAC Gp 1** |
| 0 | **Lough Scur** | | **X** | | **LEITRIM** | **?** |

## Appendix 2. Extent of limestone pavement within SACs selected for it

| No. | Name | % of site | Pavement area (ha) | Comment[4] |
|---|---|---|---|---|
| 2244 | **Ardrahan** | **16** | **30** | |
| 115 | **Ballintra** | **32** | **22** | |
| 432 | **Barrigone** | **73** | **43** | **not 'limestone pavement' - limestone outcrops** |
| 20 | **Black Head - Poulsallagh** | **35** | **2,451** | |
| 242 | **Castletaylor** | **7** | **7** | |
| 216 | **Clorehane Wood[5]** | **<1** | **30** | |
| 479 | **Cloughmoyne** | **51** | **42** | |
| 252 | **Coole-Garryland** | **5** | **44** | |
| 979 | **Corratirrim** | **20** | **23** | |
| 32 | **Dromore Woods & Loughs** | **9** | **78** | **National Nature Reserve** |
| 1926 | **East Burren** | **61** | **11,500** | **• largest area<br>• includes Keelhilla NNR** |
| 1271 | **Gortnandarragh** | **90** | **258** | **highest % pavement** |
| 213 | **Inishmore** | **63** | **1,488** | |
| 212 | **Inis Meáin** | **63** | **500** | |
| 1275 | **Inis Óirr** | **68** | **378** | |
| 1774 | **Lough Carra / Mask** | **3** | **400** | |
| 297 | **Lough Corrib** | **1** | **185** | |
| 2241 | **Lough Derg: NE shore** | **-** | **-** | **not significant** |
| 606 | **Lough Fingall** | **35** | **193** | |
| 440 | **Lough Ree** | **-** | **10s sq ms** | **not significant** |
| 54 | **Moneen Mountain** | **66** | **4,047** | |
| 57 | **Moyree River** | **57** | **272** | |
| 191 | **St John's Point** | **2** | **11** | |

[4] For fuller explanation, see site accounts in Appendix 3.
[5] Part of River Shannon Callows SAC.

## Appendix 3. Other sites containing limestone pavement

| No. | Name | % of site | Pavement area | Comment |
|---|---|---|---|---|
| 594 | **Brierfield Turlough** | **?** | **?** | **a small area** |
| 2708 | **Ballindooly Hill** | **?** | **?** | **proposed by NGOs for addition to Lough Corrib SAC** |
| 2068 | **Carricknahorna & Lough Gorman** | **?** | **?** | **limestone pavement adds to the diversity of the site** |
| 2211 | **Commons of Carney** | **?** | **?** | **a small area** |
| 2709 | **Coteenty Hill** | **?** | **?** | **north part of hill** |
| - | **Doughiska & Curragrean** | **21-50** | **?** | **open pavement** |
| 1011 | **Fisherstreet pavement** | **?100** | **?** | • **a fine example of pavement**<br>• **add to East Burren SAC** |
| - | **Grange East** | **21-50** | **?** | **a 'significant' area** |
| 681 | **Hill of Mael & Rock of Curry** | | | **some limestone pavement on both hills** |
| 959 | **Killough Hill** | **?** | **?** | **Immediately adjacent to an active deep quarry – 1993 file note then refers to 'last remaining, undisturbed limestone pavement' which may not now be extant.** |
| 1288 | **Knockmaa Hill** | **?1** | **?** | **pavement; Burren-type flora** |
| - | **Lauraclavagh** | **?** | **?** | **one of most important areas – Cilian Roden to NPWS** |
| - | **Lough Scur** | **?** | **?** | **small area** |
| 1788 | **Turloughcor** | | | **small area W of Doolough on Galway-Headford road** |

# Appendix 4. Other sites containing limestone exposures / pavement but with no accompanying documentation

| No. | Name | % of site | Pavement area | Comment |
|---|---|---|---|---|
| 461 | **Ardkill Turlough** | **3** | **-** | **3% limestone exposure** |
| 1403 | **Arroo Mountain** | **1.4** | | **undulating plateau of Carboniferous limestone** |
| 996 | **Ballyvaughan Turlough** | **20** | **4** | **frequent limestone outcrops** |
| 1001 | **Cahercalla Wood** | **?** | **?** | **pers. comm., Mike Wyse Jackson, NPWS** |
| 480 | **Clyard Kettle Holes** | **?** | **?** | **ditto** |
| 2435 | **Crockhauns / Keelyboy Bogs** | **?** | **?** | **pers. comm., Tim Roderick, NPWS** |
| 2303 | **Dunmuckrum Turloughs** | **?** | **?** | |
| 38 | **Inchicronan Lough** | **?** | **?** | **very small** |
| 299 | **Lough Cutra** | | | **pers. comm., Mike Wyse Jackson, NPWS** |
| 612 | **Mullygollan Turlough** | | | **ditto** |
| 318 | **Peterswell Turlough** | | | **ditto** |
| 525 | **Shrule Turlough** | | | **ditto** |
| 1322 | **Turlough Monaghan** | | | **ditto** |
| 71 | **Turloughgullaun** | | | **ditto** |
| 365 | **Killarney National Park** | | | **Seen from aerial photos (2000)** |

# Appendix 5 - Explanatory Notes by Dr Stephen Ward re 8230 Limestone Pavements

**Ardrahan, Co. Galway** (?December 1998)
SAC: 2244
NGR: M.445.130 (Sheet 52)

***Representivity***
This site contains a relatively small, but fine, example of limestone pavement. The limestone pavement occurs as a mosaic with other habitats, including calcareous grassland, alpine heath and scrub. The limestone pavement is mainly of the smooth type. In many areas the flat limestone surfaces support alpine heath with *Dryas octopetala, Arctostaphylos uva-ursi* and *Juniperus communis*. Elsewhere, limestone pavement supports a species-rich calcareous grassland with a diverse range of calcicole and calcifuge flora typically associated with the Burren. Common species present include *Sesleria albicans, Thymus praecox, Carex pulicaris, Briza media, Succisa pratensis* and *Calluna vulgaris*.

Some pockets of *Corylus avellana* scrub have developed over limestone pavement with lesser amounts of *Prunus spinosa, Pteridium aquilinum* and *Crataegus monogyna*.

Overall the site represents a good example of limestone pavement mosaic with Juniperus communis scrub, alpine heath and calcareous grassland.

***Relative surface***
The area of limestone pavement is difficult to estimate owing to its overlapping into other habitats. An estimate of **30 ha.,** based on the mapping exercise and aerial photographs, including both bare pavement and scrub covered areas, along with a certain amount of Juniper heath and alpine scrub covered pavement is included. Relative Surface: **C** rating.

***Conservation Status***
Degree of conservation of **structure:** owing to the low intensity agriculture being practiced at this site, this habitat is well conserved and reasonably intact. Although **some of the limestone pavement has been bulldozed and improved for agriculture through scrub and rock removal**, there are still many good intact areas remaining.
Ranking **II**: well conserved.

Degree of conservation of **function: agricultural improvement with rock and scrub removal and subsequent fertilisation are the main damaging operations** affecting the limestone pavement. Some reclamation activity in recent years has reduced the scientific importance of some of the areas. Overall, the remaining habitat is functioning well.
Ranking **II**: good prospects.

The combination of these two ratings results in an **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
The limestone pavement occurs in close association with alpine heath, calcareous grassland and Juniper scrub. In parts, the habitat is threatened by land reclamation. Much of the remaining habitat is being managed in the traditional manner of winter grazing and does not appear to be under threat. Rating **B**: good value.

**Ballintra, Co. Donegal** (?August 1995)
NGR: G.928.688 (Sheet 11)
115

***Representivity***
The limestone pavement was given an **A** rating for Representivity because it is the only known Irish location for the protected *Heliathemum nummularium*. The habitat also exhibits a good example of shattered pavement and associated species of rich calcareous grassland. It is lone of the most northerly outposts of typical limestone flora.

***Relative surface***
The national cover of limestone pavement is **30,000 ha**. it covers **32%** of the site or **22 ha.** Relative Surface **C**.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **II** because its structure is well conserved with many intact, though small examples of open pavement interspersed with species-rich limestone grassland. Populations of the protected *Helianthemum nummularium* were recorded in July 1995 (Curtis, pers. comm.). There is some scrub and woodland encroachment onto the pavement.

The degree of conservation of **function** has been given a rating of **II** because the prospects of conservation are good with discussions in progress about site acquisition and the imminent cessation of quarrying. **Continued scrub encroachment will lead to a loss of scientific interest unless suitably managed**.

Conservation Status for Limestone Pavement **B**: good.

***Global Assessment***
Limestone pavement was assigned a rating of **B** for Global Assessment because it is afforded some protection through the Flora Protection Order 1987 which protects the RDB species *Helianthemum nummularium*. The habitat is privately owned and actively mined. Discussions re acquisition by NPWS are in progress (i.e. this was the case in 1995; recent enquiry within NPWS confirm that this acquisition came to nought). Once quarrying has ceased and a balanced grazing regime is in place, conservation of the habitat is ensured.

***Reference***
Curtis, T.G.F., Bassett, J.A. & McGough, H.N. 1985. *The present status and ecology of* Helianthemum nummularium *in Ireland*. Irish Naturalists' Journal, Vol 21., No. 12, pp 515-519.

***File note***
*During the **SAC review meeting** of 22nd November, C.O.Críodáin expressed the view that, of the limestone pavements in the area, that at Ballintra (site 115) is more important than that at at St. John's Point (site 191).*
*Aileen O'Sullivan, 29th November 1996.*

**Barrigone, Co. Limerick** (August 1995)
432

8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **73%** of the site or **43 ha.**

***Representivity***
Given a **B** rating for Representivity because, although the type of limestone habitat at this site is not typical of Limestone Pavement as described by the Habitats Dve 92/43/EEC, the presence of the protected plant *Viola hirta* adds greatly adds greatly to the scientific interest. The habitat at this location has been classified as Limestone Pavement in the criteria used to select a provisional list of SACs for Ireland**. Limestone pavement has not been recorded at this site** (Goodwillie 1972; O'Criodain 1992; Keane et al. NHA survey 1994). **There is no "Limestone Pavement" formation but rather limestone outcrops** with associated species-rich calcareous grassland. A small pocket with *Juniperus communis* scrub was recorded, adding to the overall diversity. The substrate, bedrock, microclimate and maritime influence contribute to a specific and substantial range of plants including *Plantago maritima*. It is an isolated example of this habitat found in NW County Limerick.

***Relative surface***
The national cover of limestone pavement is **30,000 ha.** There are **43 ha.** of this habitat at this site, so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **II** because the presence of an **active quarry** at the centre of the site has reduced the original area of the habitat. Parts of the habitat are under-grazed with the result that there is **scrub encroachment** while poaching was detected in other areas.

The degree of conservation of **function** has been given a rating of **II** because of **potential future loss of the habitat to further quarrying by Roadstone**. The present absence of a managed grazing regime will result in a reduction of scientific interest through a combination of poaching and scrub encroachment. The habitat was afforded some degree of protection under the Flora Protection Order 1987, due to the presence of the protected plant *Viola hirta*.

The combination of these two ratings results in an **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **C** for Global Assessment because it has very little existing legal status and is under possible threat of extended quarrying by Roadstone. The site is afforded some degree of protection under the Flora Protection Order 1987, due to the presence of the protected plant *Viola hirta.* Conservation possibilities would be easy.

***References***

Keane, S. & Walsh, T. 1995. NHA Internal Report to National Parks & Wildlife Service, Dublin.

O'Criodain, C. 1992. *Conservation of Grassland Sites of Scientific Interest in Ireland*. Internal Report to National Parks & Wildlife Service, Dublin.

**Blackhead / Poulsallagh, Co. Clare** (January 1997)
20

***Representivity***
The large size, intact nature and diverse range of limestone pavement formations including smooth, shattered and blocky types, combine to form an excellent example of this limestone habitat. The interstitial vegetation forms a complex mosaic of different communities including calcareous grassland, heath and scrub which is typical of this habitat. The species-rich calcareous grassland plays host to certain Arctic Alpine species such as *Gentiana verna* and *Dryas octopetala* which occur in close proximity to Mediterranean species such as *Neotinia maculata*. These species, and the abundant cover of Sesleria albicans combine to form a unique assemblage of vegetation communities strictly confined to the Burren region in Co. Clare.

At Poulsallagh, the limestone pavement is excellently developed where it forms flat sheets which extend right down to sea-level, an interesting mix of maritime plants alongside Arctic and Alpine species are found here, adding greatly to the ecological interest of this site. The maidenhair fern *Adiantum capillus-veneris* is locally frequent in the limestone crevices at Poulsallagh and Blackhead. This Mediterranean species has a limited distribution Ireland and is notably rare outside the Burren and the Aran Islands.
Ranking **A**: excellent.

***Relative surface***
The area of limestone pavement is difficult to estimate owing to its gradation into other habitats. An estimate of **2451 ha**., based on mapping from aerial photographs, including both bare pavement and scrub covered areas, is considered reasonable.
Class Interval **B**: 2-15%.

***Conservation Status***
(i) Degree of conservation of structure: the structure of this habitat is well conserved with many large, intact expanses of open limestone habitat interspersed with species-rich limestone grassland, heath and scrub. Localised scrub removal and land reclamation activities were recorded during the NHA survey at Lisheenagh to the SE of the site and from the Ballyryan area to the SW.
Ranking **I**: excellent.

(ii) Degree of conservation of function: low agricultural intensity coupled with the upland location of much of the habitat favour conservation. Continued scrub removal and land reclamation activities will lead to a loss of scientific interest at the site unless suitably managed.
Ranking **II**: good.

Conservation Status Synthesis: Ranking **A**: excellent.

***Global Assessment***
A large expanse of well developed and varied limestone paving. Occurs in close association with other grassland and heath habitats. This habitat is in multiple private ownership and is not afforded any legal status. **The habitat is threatened by land reclamation activities, fertilisation and inappropriate grazing regimes.** The future prospects appear good as there is a management plan for the area currently in progress (Burren Management Plan under the Department of Arts, Culture and the Gaeltacht).

Ranking **A**: excellent.

***Geological interest***
Drew et al. (2001) list Poulsallach, which lies within Blackhead to Poulsallagh SAC, as a site of international importance for its limestone exposures (ref. no. IGH1-6). *Reference*: Drew, D., Jones, G.Ll. & Kelly, J.G., edited by Parkes, M.A. 2001. *The Karst Heritage of the Republic of Ireland.* Geological Survey of Ireland.

**Castle Taylor, Co. Galway** (October 1996)
SAC no.: 242
NGR: M.456.152

***Representivity***
Limestone pavement occurs predominantly in the NW sector in close association with heaths, calcareous grasslands and scrub. Limestone also occurs in the area classified as turlough. Some limestone outcropping is also likely to occur beneath the woodland and scrub in the eastern sector of the site.

The area is an example of the Ardrahan limestones – an outlier of the Burren which extends to near Craughwell. The limestone occurs mainly as scattered boulders with no extensive areas of flat bare paving[6]. Curtis and McGough surveyed the area in 1981 and recorded typical species of the habitat. The area was again surveyed by the NHA team in 1995. A fairly rich flora occurs with many of the species of the Burren recorded. Species include: *Geranium sanguineum, G. robertianum, Rosa pimpinellifolia, Teucrium scorodonia, Briza media* and the rarer species such as *Gentiana verna* and *Dryas octopetala.* In addition, to the open areas, there is scrub, with *Coryllus avellana, Prunus spinosa, Crataegus monogyna* and *Rhamnus cathartica*.

The total area of limestone is small, even when compared to other limestone outliers such as at Lough Fingall. Nevertheless, it is a good example and is in good condition.
Ranking: **B** good.

***Relative surface***
The area of limestone pavement is estimated at **7 ha**. Relative Surface: **C**.

***Conservation Status***
The degree of conservation of **structure**: the limestone pavement has a fairly typical structure and flora. Ranking **II**: structure well conserved.

The degree of conservation of **function**: the main land use is light grazing which is probably not causing too much damage. It is not known if any of the pavement has been cleared in the past. Overall, the habitat appears to be functioning normally. Ranking **II**: good prospects.

The combination of these two ratings results in an **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
This area is an outlier of the Burren and has a fairly typical flora of limestone pavement, including scarce species. It is small in area but in apparently good condition as regards to structure and functionality. Of particular interest is the close association with other habitats, notably turloughs, grasslands and heaths. The area is in private ownership. Oweing mainly to the small area of the habitat, it is ranked **C**.

***Site Visit***
*Purpose*: site familiarisation as part of contract to RAW Group to assess extent and condition of limestone pavements.
*Access*: into the Gregmore sector at M.454.152, on a forestry road running South from the public road which bisects the site.
*Description*: to the East of the forestry road, clints can be seen.
*Management*: the clints form the floor of a mature coniferous plantation and may owe their survival to afforestation, since numerous examples are to be seen in this sector of Galway where rock exposures of this type have been bull-dozed aside.
Somewhere within this site, 32.8 ha of limestone pavement / woodland are to be restored by Coillte as part of the EU LIFE Nature Programme *Restoring Priority Woodland Habitats in Ireland, 2006-2009*. A Coillte meeting was taking place somewhere on site, there being a Coillte van + 3 cars at the entrance by which I entered. Contact details: *Coillte, Hynes Building, Merchants Road, Galway 091-562129.*

[6] May not be limestone pavement as such ~ *Stephen Ward.*

*Flora*: the clints are completely clothed in bryophytes*.*
*Overall condition*: as observed – poor, but whether I saw the part of the target area for restoration, or whether there are better areas elsewhere on site, I do not know.
*Stephen Ward, 14th February, 2007.*

**Clorhane Wood** ~ part of **River Shannon Callows, Co. Offaly** (2003)
216

A well known area of limestone pavement occurs at Clorhane. This was documented by AFF and also by Dr Mary Tubridy in the Clonmacnoise Heritage Zone study. Also visited by R. Fitzgerald as part of the rare plant survey in 1991 and by Jim Moore during NHA survey 1993.

***Representivity***
This area of limestone pavement is the only known example in Co. Offaly. It is predominantly colonised by mature hazel *Corylus avellana* woodland, with areas of open limestone and calcareous grassland interspersed. *Taxus baccata* occurs at one area. The open limestone pavement comprises bare or moss covered rock or rock with a very thin calcareous soil cover supporting a short grassy turf. The most notable plant in the grassy area is a substantial population of *Orchis morio*, which occurs with such species as *Anthoxanthum odoratum, Briza media, Carex caryophyllea, C. flacca, Lotus corniculatus, Centaurea nigra, Plantago lanceolata*, etc. Ferns associated with cracks in the paving include *Asplenium trichomanes, A. ruta-muraria* and *Polypodium australe*. Bryophytes include *Grimmia acrocarpa* and *Orthotrichum cf. anomalum*. Anthills are common.

The hazel wood is well developed and has herbaceous species such as *Primula vulgaris, Viola riviniana, Oxalis acetosella* and *Geranium robertianum*. It is noted for its luxuriant growth of epiphytic mosses and liverworts, with such species as *Neckera crispa* and *Hylocomium brevirostre.*

This is an important example of limestone pavement outside the main distribution for the habitat. While mostly covered by woodland and scrub, some open areas do occur.
Ranking: **B** good.

***Relative surface***
The area of limestone pavement, including that covered by hazel woodland and scrub, is estimated at **30 ha**. Relative Surface: **B**.

***Conservation Status***
The degree of conservation of **structure**: much of the intact area of pavement and hazel woodland is in good condition and of good quality. However, **parts of the site have been significantly damaged by a coniferous plantation. Also, stone has been removed in the past and is a serious threat. The grazing regime requires study as undergrazing could reduce the diversity of species**. Ranking **II**: good structure.

The degree of conservation of **function**: the core of pavement is of good quality and considered to be functioning well. Other parts of the site have been **severely damaged by forestry, rock removal and scrub clearance**. As part of the sote is owned by the state, future prospects are probably good. Ranking **II**: good prospects.

The combination of these two ratings results in an **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
While small in area, this is an important outlier for limestone pavement. The part that has not been damaged by forestry etc. is of good quality and representative of the habitat. The flora includes scarce species such as *Orchis morio*. *Taxus baccata* is a component of the woodland. Requires a critical review to establish best management practices as, for example, scrub encroachment will reduce diversity.

Assigned a rating of **B** (good value) due to its geographical location.

**Cloughmoyne, Co. Mayo** (January 1996)
SAC: 479
NGR: M.498.220 (in part on both Sheets 38 & 45)

8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **51%** of the site or **42 ha.**

***Representivity***
The Limestone Pavement at this site was given an **A** rating for Representivity because it is the only known Irish location for the protected *Gymnocarpium robertianum* (Flora Protection Order 1987). The habitat also exhibits a good example of shattered pavement and associated species-rich calcareous grassland and heath. The protected plant *Vicia orobus* also occurs – one of nine sites in the country where this plant was recently recorded (Roden 1995). *Juniperus communis* occurs regularly throughout. These species combine to form a unique vegetation community of limited distribution in Ireland.

***Relative surface***
The national cover of limestone pavement is **30,000 ha.** There are **42 ha.** of this habitat at this site, so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **III** due to partial degradation as a result of **clearance of some limestone pavement** and the **application of fertiliser**. However, *Gymnocarpium robertianum* was recorded growing on spoil heaps resulting from reclamation (J Higgins, Wildlife Ranger & M Loftus, Ecologist, NHA report 1995). The natural spread of the unwanted species *Pteridium aquilinum* is also evident within the site.

The degree of conservation of **function** has been given a rating of **III** because the prospects of conservation of this habitat are unfavourable **with reclamation activities currently in progresss** (J Higgins, January 1996). The rare *Gymnocarpium robertianum* is particularly threatened as limestone pavement removal is in progress adjacent to its location and if not terminated immediately the species is facing possible extinction.

The combination of these two ratings results in a **C** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **C** for Global Assessment because although it is afforded some protection through the Flora Protection Order 1987, which protects the RDB species *Vicia orobus* and *Gymnocarpium robertianum*, the habitat is privately owned and is seriously threatened by the ongoing reclamation activities. In order to ensure the future of the habitat and particularly the *Gymnocarpium robertianum*, immediate implementation of the Flora Protection Order 1987 is required.

***Reference***

Roden, C. 1995*. Wood bitter vetch* Vicia orobus *on lake islands and limestone heath in Cos. Galway and Mayo.* Irish Naturalists' Journal, Vol. 25, No. 4, pps 128-134.

***Site visit***
*Purpose*: site familiarisation as part of contract to RAW Group to assess extent and condition of limestone pavements.
*Access*: via green lane running S, commencing M.219.504 (Sheet 38). Walking down this lane, I encountered a local farmer John Joe Garvy (JJG) with whom I had several long chats and who acted as my guide over his sector of the site.

*Description*: I walked up to a high point on the site (M.22266.498370), S of JJG's land. The pavement here had been wrecked by excavator; from conversation with JJG this probably happened in the 1960s. From here, I had a clear view E for a good half mile or more. The scene was largely one of **devastated limestone pavement**, which had been lay in heaps surrounded by bright green pasture on which sheep grazed. Along the S edge of this area lay an area of $\pm$ still intact limestone pavement belonging to Sean O'Connor; I did not enter this part of the site.
*Flora*: the one thing which struck me walking over the very small area of limestone pavement farmed by JJG was the preponderance of prostrate *Juniperus* in addition to *Corylus* etc. JJG told me that '*blue flowers – I don't know their name*' either grow there or used to. I said I guessed he was referring to the spring gentian, but he did not seem familiar with this – which seemed surprising, since he seemed very knowledgeable on many other things.
*Management*: (1) at 222.499, JJG showed me the remains of what he presumed to have been a lime kiln. I had never seen the like before; it comprised a circular depression about 5 ft across, filled with rubble through which protruded a couple of Corylus bushes. The sides were lined with a limestone wall; to the W lay an area of fragmented limestone which JJG assumed to be the remains of limestone broken up for burning. The 'kiln' was sunk into the pavement surface and could only have been emptied by digging it out. (2) JJG's sector is grazed by cattle, although these were not on site during the visit. (3) the greater part of the site is sheep grazed. (4) the site was devastated by limestone pavement being bull-dozed into mounds; according to JJG, this took place some 40 years ago. Presumably *Gymnocarpium robertianum* or *Vicia orobus* still occur, but the main sector of the site is quite intensively grazed by sheep so one wonders how well they are doing. (5) JJG told me the land is now preserved by the State and that he would not be allowed to clear rock now; in any case it would be too expensive / not worth doing (yet farmers elsewhere are still doing this on an extensive scale, e.g. at R.349.898 in the vicinity of Moyree). Further, JJG would not be allowed to sell land for sites.
*Stephen Ward, 18th February, 2007.*

**Coole / Garryland complex, Co. Galway** (January 1996)
SAC: 252
NGR: M.425.035 (Sheet 52)

8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **5%** of the site or **44 ha.**

***Representivity***
The limestone pavement was given an **A** rating for Representivity because of the unusual areas of dwarf *Quercus robur* woodland growing on limestone pavement. This species of *Quercus* does not typically colonise this type of habitat. In addition there are good examples of smooth pavement and associated species-rich calcareous grasslands. In places more unusual heath communities have developed over bare limestone with *Juniperus communis, Sesleria albicans, Calluna vulgaris* and occasional *Taxus baccata* adding greatly to the diversity of this habitat.

***Relative surface***
The national cover of limestone pavement is **30,000 ha**. There are **44 ha.** of this habitat at this site, so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **II** because its structure is well conserved with many intact, though small, examples of open limestone pavement interspersed with species-rich limestone grassland, heath and *Juniperus communis* scrub. The habitat is relatively undisturbed, indicated by the ooccurrence of *Quercus robur* and *Juniperus communis* which are slow colonisers and sensitive to disturbance. There is some scrub woodland encroachment on to the pavement area.

The degree of conservation of **function** has been given a rating of **II** because the prospects for future conservation of this habitat are good. The habitat does not appear to be under serious threat and where it occurs within the Nature Reserve it is afforded a good degree of protection under the management of the NPWS. **The absence of an appropriate grazing regime has resulted in scrub / woodland encroachment and a loss of scientific interest of the habitat. The threat from land reclamation remains where the habitat is located outside the Nature Reserve**.

The combination of these two ratings results in an **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **B** for Global Assessment because does not appear to be under threat. Agricultural intensification in the limestone pavement areas outside the Nature Reserve poses a possible threat to its future conservation as it is in private ownership and is not afforded any legal protection.

**Corratirrim, Co. Cavan** (January 2003)
979
NGR: H.075.365 (Sheet 26)

***Representivity***
This site, while relatively small in area, contains an example of limestone pavement, as well as related calcicole grassland habitats. The site also contains acidic grassland and heath. It is part of an area underlain by Carboniferous limestone which continues into Co. Fermanagh.

The limestone pavement occurs mainly in the central area of the site. Of particular interest is an area of well defined clints and grykes, with a typical pavement flora. The grykes are up to 18 inches deep. Species here include the scarce fern *Cystopteris fragilis*, as well as a range of other fern species (*Dryopteris filix-mas, D. affinis, Asplenium trichomanes, A ruta-muraria, Phyllitis scolopendrium*). Vascular plants include *Hedera helix, Geranium robertianum, Viola reichenbachiana, Thymus praecox* and in places low *Crataegus monogyna*. *Taxus baccata* has a presence but is probably suppressed by grazing. A further area consists of exposed limestone slabs interspersed with shallow soil. Some shattered limestone also occurs. Other species associated with the limestone and limestone grassland include *Sesleria albicans, Briza media, Aphanes arvensis, Arabis hirsuta* (BSBI 1995), *Saxifraga hypnoides* and *Antennaria dioica* (S Reynolds 1996). A good range of orchids is known from the area, including *Platanthera bifolia* and *Orchis mascula*, and the RDB and legally protected *Psuedorchis albida*.

While relatively small in area, it is a good example of limestone pavement and an important outlier in the range for the habitat.
Ranking **B**: good.

***Relative surface***
The area of limestone pavement is difficult to estimate owing to its gradation into other habitats. It is estimated to cover **20%** of the site or **23 ha.**, so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure:** the structure of this habitat appears to be fairly well conserved with the required features and species range present. Grazing may be suppressing the development of some species such as *Taxus*. There is an interesting gradation to other habitats Ranking **II**: well conserved.

The degree of conservation of **function:** appears to be functioning well, with no evidence of such damaging factors as removal of rock or spread of fertilisers. The grazing regime, while not causing significant damage, probably needs to be reviewed. Afforestation has occurred to the south and would be very damaging if it occurred within the site. Ranking **II**: good prospects.

The combination of these two ratings results in a **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
An important outlier for this habitat and the only documented example in Eastern Ireland. While small in area, it contains a fine example of classic clints and grykes. It has a reasonably good limestone flora, including the scarce *Cystopteris fragilis*. There is an interesting diversity of other habitats, including acidic heath and grassland. There are no significant threats though forestry would be very damaging if it occurred. The grazing regime should be reviewed. The limestone habitats continue into N Ireland. Ranking **B**: good value.

***Reference***
Reilly, P. 1996. *Plant records from Co. Cavan (H30).* Irish Naturalist's Journal, 25, 189.

Reilly, P. 2001. *The flora of Co. Cavan.* National Botanic Gardens, Occasional Paper, No. 13, Stationary Office, Dublin.

**Dromore Woods & Loughs, Co. Clare** (January 1996)
32

8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **9%** of the site or **78 ha**.

***Representivity***
The limestone pavement was given a **B** rating for Representivity due to the small but species-rich examples present. The habitat occurs in association with calcareous grasslands, *Corylus avellana / Fraxinus excelsior* scrub, lake shore and fen. Rocky outcrops by the water's edge support calcareous grassland intermixed with scrub which contains a lot of fleshy fruited plants such *as Euonymus europaeus, Rhamnus catharticus* and *Crataegus monogyna*. These soft fruits are important for *Martes martes*, a RDB species which occurs at this site. The habitat supports particularly diverse and interesting invertebrate communities.

***Relative surface***
The national cover of limestone pavement is **30,000 ha**. There are **78 ha**. of this habitat at this site, so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **II** because its structure is well conserved with many intact, though small, examples of open limestone pavement interspersed with species-rich limestone grassland, scrub and fen. Where limestone pavement occurs at the lake edge it supports a particularly diverse flora.

The degree of conservation of **function** has been given a rating of **II** because the prospects of conservation are good as some of the site lies within a designated Nature Reserve. Continued scrub encroachment will lead to a loss of scientific interest unless suitably managed.

The combination of these two ratings results in a **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **B** for Global Assessment because it is afforded a degree of protection as part of it lies within the Nature Reserve. The secluded nature of the location of limestone pavement associated with lake margins and dense scrub adds to the protection of the habitat. However, **where the habitat occurs outside the reserve it is in private ownership and under threat from reclamation as it is not afforded any legal status. Uncontrolled amenity development may pose a problem.**

***Review of Natura 2000 assessment***

*Dromore Wood does not have any special features which would place it above other pavement sites in Clare / SE Galway. At least one of these sites should be dropped for this habitat.*

**East Burren complex, Co. Clare** (February 1996)
1926

***Representivity***
This very large site contains **the most extensive area of limestone pavement in Ireland**. A fine diversity of limestone pavement formations may be seen including smooth, shattered and blocky types.

A broad division may be made between the very extensive, open and exposed areas of the high Burren, where the paving rises to 350 m. at Slieve Carran, and the more intermittent paving of the southern lowlands. In the high Burren, the open pavement areas often have extremely immature soils and on cliffs, screes and pavements they consist largely of pockets containing mixtures of humus and down-washes or wind blown mineral particles. At Mullagh More the Burren's only folding of Carboniferous limestone is seen in the hill itself, while Slieve Carran is a flat-topped mountain of horizontally bedded Carboniferous limestone. In most of the pavement areas, drainage is almost entirely underground.

The limestone pavement occurs as a complex mosaic with other habitats, notably calcareous grassland, various types of heath, and scrub. Turloughs occur scattered throughout the pavement area, while in the southern part of the site extensive wetlands occur in close association with paving.

The flora of the Burren is well known for its unique mix of Arctic-alpine species and Atlantic-Mediterranean species. The vestigial soils of the open pavement areas support a rich flora, with character species such *as Gentiana verna, Dryas octopetala* and *Geranium sanguineum* being common. Hazel scrub is widespread, often occurring with hawthorn and blackthorn in places, notably at Slieve Carran and Glen of Clab.

A host of rare and scarce plants are known from this site: *Potentilla fruticosa, Filipendula vulgaris, Cephalanthera longifolia, Frangula alnus, Neotinia maculata, Helianthemum canum, Adiantum capillus-veneris, Saxifraga hypnoides* and *Minuartia verna*.

In addition to the areas already mentioned, other notable areas of pavement occur at Roo (very extensive areas of broken pavement), Rannagh East and Tulla. Overall, **this site contains the best representation of limestone pavement in Ireland**.

Ranking **A**: excellent.

***Relative surface***
The area of limestone pavement is difficult to estimate owing to its gradation into other habitats. An estimate of **11,500 ha.**, based on mapping from aerial photographs, including both bare pavement and scrub covered areas, is considered reasonable. This represents **38%** of the national total and hence qualifies for an **A** rating.

***Conservation Status***
Degree of conservation of **structure:** the structure of this habitat is well conserved with many intact expanses of open limestone pavement with typical vegetation and interspersed with other habitats (grasslands, heath and scrub). While **some of the limestone paving has been improved for agriculture through scrub and rock clearance**, there are still extensive areas remaining.
Ranking **I**: excellent.

Degree of conservation of **function: agricultural improvement with rock and scrub removal and subsequent fertilisation** is the main damaging operation affecting limestone pavement. The **rate of such activities has accelerated in recent years and has reduced**

**the scientific importance of some of the areas**. Overall, this habitat is functioning well. Ranking **II**: good prospects.

The combination of these two ratings results in an **A** rating for Conservation Status for Limestone Pavement.

### *Global Assessment*

The **largest expanse of this habitat in Ireland**. Excellent diversity is shown in physical features and in vegetation types. Occurs in close association with other grassland and heath habitats, as well as with wetlands. Many rare plants occur. **In parts the habitat is threatened by land reclamation activities, fertilisation and inappropriate grazing regimes**. This habitat is largely in multiple private ownership, although important areas at Mullagh More and Slieve Carran are afforded protection by the National Park and Nature Reserve designations respectively.

Ranking **A**: excellent value.

### *References*

Ivimey-Cook, R.B. & Proctor, M.C.F. 1966. *The Plant Communities of the Burren, Co. Clare*. Proceedings of the Royal Irish Academy 64B: 211-301.

Kirby, E.N. & MacGowran, B.A. 1979. *A vegetation survey of the proposed National Park in the Burren, Co. Clare.* Unpublished report to the National Parks and Monuments Branch of the OPW, Dublin.

Wilmot, A. 1979. *An ecological survey of the ferns of the Burren, Co. Clare, Eire.* Fern Gazette 12, 9-28.

**Gortnandarragh, Co. Galway** (December 1996)
SAC:1271
NGR: M.190.400 (Sheet 45)

Because of its proximity to Lough Corrib, there may be an ecological case to join the two sites.

***Representivity***
Gortnandarragh, although a fairly small site, is one of the largest areas of limestone pavement outside the Burren and supports most of the elements of typical limestone pavement.

The limestone pavement consists of a low, exposed limestone plateau with gently sloping flanks. The open plateau includes shattered pavement in addition to areas with a well developed system of clints and grykes. The characteristic flora includes species such as *Sesleria albicans, Briza media, Ceterach officinarum, Gentiana verna, Asplenium* spp. and scattered dwarf specimens of *Taxus baccata.* There are patches of more healthy vegetation with *Juniperus communis, Calluna vulgaris* and *Rosa pimpinellifolia.* The surrounding slopes of the pavement are covered in scrub dominated by *Corylus avellana.* In places, this grades into *Fraxinus excelsior* woodland over limestone boulders supporting a thick bryophyte layer.

Ranking **A**: excellent.

***Relative surface***
**258 ha.** of limestone pavement - the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure:** this site has a reasonably well conserved structure, with a range of limestone habitats present. However, scrub covers half the pavement area. **When aerial photographs from 1973 and 1992 are compared it is evident that scrub continues to invade the pavement**. Localised degradation has been caused by **quarrying** and **land reclamation**. Ranking **II**: structure well conserved.

The degree of conservation of **function:** scrub is tending to dominate the site due to lack of grazing (although a herd of feral goats is present). The functions of the site could easily be maintained if appropriate grazing levels are introduced and further quarrying and land reclamation are prevented. Ranking **II**: good prospects.

The combination of these two ratings results in a **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
This is a relatively small site compared to the extensive Burren limestone sites. It is important, however, as one of the largest reasonably intact areas of limestone pavement outside the Burren. The close proximity of Lough Corrib adds to its value. The site is privately owned. Ranking **A**: excellent value.

***Site Visit***
*Purpose*: site familiarisation as part of contract to RAW Group to assess extent and condition of limestone pavements.
*Access*: by the public road which bisects the site; in the northern sector where the pavement is not enclosed from the road by stone walls, a walk was taken to the west (between M.19572/40922, via an elbow at 19374/40832 to a large limestone boulder with a cap of white lichen at 19373/40764) and another to the east (between 19582/40598 and 19833/40661) following old grassy access tracks whose original purpose may have been stone removal. The furthest E I walked was to the wall at 19980/40615 from which I could see pavement continuing to outcrop, enclosed by stone walls and with the occasional tree of *Fraxinus* present.
*Description*: an exensive area of pavement, outcropping as numerous scarp / dip slopes, the scarps forming (mostly) low edges facing N, the dips gently inclined to the S. At the foot of the

dip slopes, where the soil is deeper, *Calluna* and *Pteridium* occur, e.g. to either side of public road at 19578/40808 and at 19950/40633).
*Management.* (1) the northern half is open, but appeared to be **ungrazed**. Cattle dung was observed immediately adjacent to the road at 19582/40598, but this could have been from cattle being drifted along the road. Dung of another mammal – probably goat – was observed along the E access track. (2) **scrub invasion** (*Prunus spinosa, Corylus*) is occurring in the relatively open, northern sector. Controlled grazing needs to recommence as a matter of **urgency**. (3) the southern sector comprises **cattle grazed** walled enclosures; a ringfeeder but no livestock occurs E of the road at 19717/40281; a 2nd ringfeeder occurs W of the road – cattle were present here so, rather than disturb them, I took the reading from the highway – the ringfeeder is some 10 metres W of 19682/40286. Even here, where cattle grazing is evidently relatively active, **scrub invasion** is a problem. To the E of the road, the open land gradually becomes occluded with *Corylus*. To the west of the road, there is an enclosed canopy of *Corylus*, the clints are green with mosses, and cattle paths can be made out beneath the canopy and between the clints. (4) **clint removal** had occurred a few metres beyond the feeding area – about 30 metres W of 19663/40225. (5) **harvesting hazel rods** – this is occurring on a small scale at 19466/39671. (6) the interest appears to cease at about M19400/39479 as one walks S along the public road. Thereafter to either side can be seen fields of cleared clints, probably dating from the State-aided clearance schemes of 30-40 years ago, and soon after that one comes to the 'house-in-every-field' + site notices for more that marr the landscape of modern Ireland.
*Stephen Ward, 20th February, 2007.*

**Inishmore, Co. Galway** (September 1996)
213

8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **63%** of the site or **1488 ha.**

***Representivity***
The limestone pavement was given an **A** rating for Representivity owing to the excellent diversity of limestone pavement formations including smooth, shattered and blocky types and the occurrence of many rare and legally protected RDB species in the associated grasslands and heath. The interstitial vegetation forms a mosaic of different communities including calcareous grassland and heath. In places close to the sea, the bare rocky grasslands support the protected RD species *Calamagrostis epigejos* and *Viola hirta.* The former rare plant is known only from four other stations, all in the west or north of Ireland (Webb & Scannell, 1983). The species-rich calcareous grassland plays host to certain Arctic Alpine species such as *Gentiana verna* which occur in close proximity to Atlantic Mediterranean species such as *Neotinia maculata. Sesleria albicans* is usually the dominant grass species with *Thymus praecox, Asperula cynanchica, Antennaria dioica* and *Hieracium pilosella*. Noticable comparisons to the Burren flora include low scrub cover and a strong maritime element with sparse *Plantago maritima, Armeria maritima* and *Crithmum maritimum* growing with *Sesleria albicans* on bare pavement to the south of the Island. These species and the abundant cover of *Sesleria albicans* combine to form a unique assemblage of vegetation communities strictly confined to the Burren and Aran Island regions in Counties Clare and Galway.

***Relative surface***
The national cover of limestone pavement is **30,000 ha**. There are **1,488 ha.** of this habitat at this site, so the Relative Surface gets a **B** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **I** because its structure is excellently conserved with good intact expanses of open limestone pavement interspersed with species-rich limestone grassland and heath. In places the intermittent rocky grasslands support the rare and legally protected plants *Viola hirta* and *Calamagrostis epigejos*. Interesting limestone formations were noted towards the centre of the Island where the pavement is fossil rich and strikingly weathered. There is a noticeable maritime influence on

the flora, resulting in an unusual mix of calcareous grassland and coastal species in association with limestone pavement.

The degree of conservation of **function** has been given a rating of **II** because it is in multiple private ownership and is presently not afforded any legal status. However, some degree of legal protection is in place for this habitat where the rare and protected plants *Calamagrostis epigejos* and *Viola hirta* occur. These species are protected under the Flora Protection Order 1987. **Overgrazing of the pavement areas will result in loss of scientific interest** unless suitably managed.

The combination of these two ratings results in an **A** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **B** for Global Assessment because it is in multiple private ownership and is not afforded any legal status. However, some degree of legal protection is in place for this habitat where the rare and protected plants *Viola hirta* and *Calamagrostis epigejos* occur. These species are protected under the Flora Protection Order 1987. **Limestone pavement is threatened by changing agricultural practices seen throughout the Island in recent years, in particular the absence of artificial fertilisers, low intensity winter grazing and an overall abandonment of farming practices in favour of tourism related enterprises**.

**Inis Meáin, Co. Galway** (October 1996)
212

8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **63%** of the site or **500 ha.**

***Representivity***
The limestone pavement was given an **A** rating for Representivity owing to the excellent diversity of limestone pavement formations and the outstanding variety of rare and protected flora present throughout the interstitial grasslands.

To the north striking sheets of bare limestone are found. Throughout the island, the interstitial vegetation forms a mosaic of different communities including calcareous grassland, orchid-rich calcareous grassland and heath. The species-rich calcareous grassland plays host to certain Arctic Alpine species such as *Gentiana verna*, which occur in close proximity to Atlantic Mediterranean species such as *Neotinia maculata. Sesleria albicans* is usually the dominant grass species with *Thymus praecox, Asperula cynanchica, Antennaria dioica* and *Hieracium pilosella*.

The especially rich limestone grasslands of Inis Meáin support the protected *species Viola hirta* and *Calamagrostis epigejos*. This richness is further increased by the presence of *Carduus nutans,* found occasionally on stony roadsides and waste places. The rare plant *Ajuga pyramidalis* has also been recorded from Inis Meáin.

***Relative surface***
The national cover of limestone pavement is **30,000 ha.** There are **500 ha.** of this habitat at this site, so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **I** because its structure is well conserved with excellent intact expanses of open limestone pavement interspersed with species-rich limestone grassland and heath. Limestone pavement of smooth, shattered and blocky types are all well represented. Interesting limestone formations were noted to the north of the Island, where smooth sheets of strikingly weathered limestone occurs. The interstitial rocky grasslands support high numbers of rare and protected species including *Viola hirta* and

*Calamagrostis epigejos*. The habitat is undisturbed and does not appear to be significantly threatened.

The degree of conservation of **function** has been given a rating of **I.** The low intensity traditional farming practices necessary to maintain the scientific status of this habitat are ongoing throughout the Island and do not appear to be under threat. The habitat is afforded some degree of protection under the Flora Protection Order 1987, due to the presence of the protected species *Viola hirta* and *Calamagrostis epigejos*.

The combination of these two ratings results in an **A** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **A** for Global Assessment because although the site is in multiple private ownership and is not afforded any legal status, the habitat is intact and stable and does not appear to be under any threat. In addition, some degree of legal protection is in place for this habitat where the rare and protected plants *Viola hirta* and *Calamagrostis epigejos* occur. These plants are protected under the Flora Protection Order 1987.

**Inis Óirr, Co. Galway** (October 1996)
1275

8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **68%** of the site or **378 ha.**

***Representivity***
The limestone pavement was given an **A** rating for Representivity owing to the excellent diversity of limestone pavement formations and the presence of the rare and protected plant *Viola hirta*. This species is protected under the Flora Protection Order 1987. Throughout the Island, the interstitial vegetation forms a mosaic of different communities including calcareous grassland, orchid-rich calcareous grassland and heath. The species-rich calcareous grassland plays host to certain Arctic Alpine species such as *Gentiana verna*, which occur in close proximity to Atlantic Mediterranean species such as *Neotinia maculata. Sesleria albicans* is usually the dominant grass species with *Thymus praecox, Asperula cynanchica, Antennaria dioica* and *Hieracium pilosella*. Noticeable comparisons to the Burren flora include low scrub and a strong maritime element with sparse *Plantago maritima, Armeria maritima* and *Crithmum maritimum* growing with *Sesleria albicans* on bare pavement to the south of the Island.

***Relative surface***
The national cover of limestone pavement is **30,000 ha.** There are **378 ha.** of this habitat at this site, so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **I** because its structure is well conserved with excellent intact expanses of open limestone pavement interspersed with species-rich limestone grassland and heath. In places the rocky grasslands support the protected plant *Viola hirta*. Limestone pavement of smooth, shattered and blocky types are all well represented. Apart from some **localised quarrying** this habitat is undisturbed and does not appear to be under threat.

The degree of conservation of **function** has been given a rating of **I.** The low intensity traditional farming practices necessary to maintain the scientific status of this habitat are ongoing throughout the Island and do not appear to be under significant threat. Although not as intensive as Inismore, **a recent increase in tourism** on the Island has resulted in a decrease in the dependence on farming as the main source of income. There is **a danger of abandonment of farming in some places on the Island as a result**.

The combination of these two ratings results in an **A** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **A** for Global Assessment because the habitat is intact and stable and does not appear to be under any significant threat. Although the site is in multiple private ownership, it is afforded some degree of protection under the Flora Protection Order 1987, due to the presence of *Viola hirta*.

**Lough Carra / Mask complex, Co. Mayo & Galway** (July 1996)
1774

***Representivity***
Limestone pavement occurs around the shores of Lough Carra and along the eastern shore of Lough Mask. It varies from bare open paving to paving covered or partly covered with scrub, heath or dry grassland. A feature of the paving is that much of it floods at times.

The limestone pavement has a rich and diverse calcicole flora, including *Geranium sanguineum, G. robertianum, Blackstonia perfoliata, Carlina vulgaris, Erigeron acer, Ceterach officinale, Teucrium scorodonia, Hypericum pulchrum, Rubia peregrina, Briza media, Sesleria albicans, Anacamptis pyramidalis, Ophrys apifera* and *Phyllitis scolopendrium*. Rarer species include *Gentiana verna* and *Dryas octopetala*. Several species, notably Neotinia maculata and Gentiana verna occur at their northern limit of distribution. The areas of scrub are variable in composition and include extensive *Corylus avellana* and *Crataegus monogyna,* with *Rhamnus catharticus, Euonymus, Frangula alnus* and *Fraxinus excelsior*.

***Relative surface***
The area of limestone pavement is difficult to estimate owing to its gradation into other habitats. An estimate of **400 ha.,** based on the mapping exercise and including both bare paving and scrub covered areas, is considered reasonable. Relative Surface: **C** rating.

***Conservation Status***
Degree of conservation of **structure:** the structure of the limestone pavement is varied and the vegetation is well developed and quite diverse.
Ranking **I**: excellent.

Degree of conservation of **function:** there has been **some localised clearing of limestone pavement for agriculture and some areas are somewhat overgrazed**. Generally, however, the pavement is in good order and functioning normally.
Ranking **II**: good prospects.

The combination of these two ratings results in an **A** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
This area is the most northerly extensive area of limestone pavement. It is varied in character and much of it is prone to flooding. It has a diverse flora, including several rare species (*Allium schoenoprasum*). It is closely associated with other habitats, notably dry grasslands and heaths, but also wetland habitats. Some of this habitat would be State owned, the remainder being in private ownership.
Rating **A**: excellent.

**Lough Corrib, Co. Galway** (January 1996)
279

***Representivity***
Low limestone shores surround much of the lough in the lower Corrib basin, where the bedrock consists of Carboniferous limestone with overlying deposits of precipitated marl. The limestone varies from bare open pavement to pavement covered with scrub , heath or dry grassland.

The limestone pavement has a rich and diverse flora, including *Geranium robertianum, G. sanguineum, Carlina vulgaris, Gentiana verna, Thymus praecox, Ceterach officinale, Teucrium scorodonia, Hypericum pulchrum, Briza media, Sesleria albicans* and *Phyllitis scolopendrium.* Several orchid species, notably *Anacamptis pyramidalis, Ophrys apifera, Coeloglossum viride, Epipactis palustris* and *Platanthera chlorantha* occur.

The areas of scrub are variable in composition and include extensive *Corylus* and *Crataegus* scrub, with *Rhamnus catharticus, Euonymus europaeus,* the RDB species *Frangula alnus,* along with *Fraxinus* and *Ilex.* Also present, though occasional, is *Juniperus* and the RDB species *Potentilla fruticosa.* The protected species *Vicia orobus* (Flora Protection Order 1999), is also present on the lough islands and at a number of limestone sites along the shore.

These limestone pavements are variable in character and have most of the key species associated with this habitat.

Ranking **A**: excellent.

***Relative surface***
The area of limestone pavement is difficult to estimate owing to its gradation into other habitats. An estimate of 1% or c. 185 ha., based on the mapping exercise and including both bare paving and scrub covered areas, is considered reasonable.

Class interval **C**.

***Conservation Status***
Degree of conservation of **structure**: the structure is varied and the vegetation is well developed and quite diverse.
Ranking **II**: good.

Degree of conservation of **functions**: there has been some **localised clearing of limestone pavement for agriculture** and some areas are **over-grazed**. The **ongoing activity of the construction of private piers and mooring bays has resulted in the regular destruction of limestone pavement** in many areas. Elsewhere, the pavement is intact and functioning normally.
Ranking **II**: good.

Conservation Status Synthesis **B**: good.

***Global Assessment***
The limestone pavement is varied in character and much of it is prone to flooding. It has a diverse flora, including several RDB species and the protected species Vicia orobus (Flora Protection Order 1987). It is closely associated with other habitats, notably dry grasslands and scrub, along with many marsh and fen habitats.

Ranking **B**: good value.

*The notes below are summarised from the National ASI survey file:*
On the limestone pavement, *Rubus saxatilis* spreads over wide patches and deep clefts. Ferns grow luxuriantly in the shade and small, stunted trees of *Prunus spinosa* and *Juniperus communis* cling to the contours of the rock. *Rosa pimpinellifolia* is abundant.

**Lough Derg: NE shore, Cos. Galway & Tipperary** (May 1998)
2241

***Representivity***
Limestone pavement at the site consists of very minute amounts of limestone outcrops scattered about and limestone slabs at the lake edge. According to the Interpretation Manual, Limestone Pavement consists of regular blocks of limestone known as clints with loose flags separated by a network of vertical fissures known as grikes. This was not seen around this site. Accordingly it is considered that the habitat is present in a **non-significant** manner and is given a **D** rating.

*Extract from Site Synopsis March 2003*
The site only includes the northern shore of the lake from the mouth of the Cappagh River in the north-west to just below Black Lough at the north-eastern shore. The greater part of this site lies on Carboniferous limestone, although there is Old Red Sandstone on the southern shores of the eastern section.

The site is of significant ecological interest, with six habitats listed on Annex I of the E.U. Habitats Directive. Four of these are priority habitats - *Cladium* fen, alluvial woodland, **limestone pavement** and Yew woodland. Other annexed habitats present include alkaline fen and Juniper scrub formations on heath and calcareous grasslands.

Yew (*Taxus baccata*) woods in Ireland are mostly confined to the west of the country. However, a substantial area of Yew is located on limestone at Cornalack, where Yew forms a scrub woodland along the east shore of Lough Derg. Here, Yew is found in association with small amounts of Juniper (*Juniperus communis*), which forms protection against grazing for the young Yew. Other notable species present include, Hawthorn (*Crataegus monogyna*), Hazel (*Corylus avellana*), Holly (*Ilex aquifolium*) Cotoneaster (*Cotoneaster microphyllus*) along with occasional Ivy (*Hedera helix),* Strawberry (*Fragraria vesca*), Bramble (*Rubus fruticosus* agg.) and Wood-sorrel (*Oxalis acetosella*). Elsewhere, small stands of Yew up to 5 m high occur with Spindle (*Euonymus europaeus*), Blackthorn (*Prunus spinosa*), Gorse (*Ulex europaeus*) and Ash (*Fraxinus excelsior*). Due to shading, and in places cattle trampling, the ground flora supports few herbs. However, the bryophyte layer is good with many moss covered rocks present.

Juniper occurs throughout this site in a range of habitats, associated with calcareous grasslands, heath and limestone outcrops. Some of the finest examples of Juniper formations in Ireland occur along the lake edge where upright, bushy Juniper shrubs up to 6 m tall are found. Typically, Juniper forms dense hedges with Ash, Hawthorn, Gorse, Hazel and Bramble and occasional Yew. These tall Juniper shrubs are a unique feature in Ireland, where it is more typically found growing in prostrate form. In places along the lake shore Juniper forms a mosaic with Black Bog-rush and Saw Sedge fen. The best examples are seen at the north and north east of the site. On drier ground above the flood level, Juniper occurs in association with species-rich calcareous grassland with *Sesleria albicans*. An extensive area of this vegetation is seen north of Kilgarvan Quay. Many of the islands also support significant Juniper cover. This is particularly evident on Bounla Island. Juniper generally occurs as fringing vegetation around the islands, which typically have wooded centres. At Cornalack, along the eastern shore of Lough Derg, tall Juniper is found in association with loose limestone rubble with a significant cover of Yew.

Deciduous woodlands are also a notable feature of the site, dominated by Oak (*Quercus* spp.), as at Bellevue, and Hazel/Ash at many of the examples along the north eastern shore. The woodlands along the lake edge at Portumna are Birch (*Betula* spp.) dominated with some Willow (*Salix* spp.), Ash and Hazel.

The only known site in the country for the Red Data Book plant Irish Fleabane (*Inula salicina*) occurs along the lake shore. This plant is legally protected under the Flora (Protection) Order

1999. Other Red Data Book species present within this site are Marsh Pea (*Lathyrus palustris*) and Ivy Broomrape (*Orobanche hederae*).

Landuse within the site is mainly of a recreational nature with many boat hire companies, holiday home schemes and angling clubs located at the lake edge.

The main threats to the quality of the site are … housing and boating development which has resulted in the destruction of lakeshore habitats.

**Lough Fingall complex, Co. Galway** (January 1996)
SAC: 606
NGR: M.417.150 (Sheet 52)

***Representivity***
Limestone Pavement occurs throughout this site, often in close association with other habitats, notably turloughs, calcareous grasslands and heaths. Much of the scrub area is underlain by limestone. The area is an excellent example of the Ardrahan limestones – an outlier of the Burren which extends to near Craughwell. There are examples of both the open bare pavement with grikes and the more shattered type.

The area is noted for its rich and diverse flora, with most of the species of the Burren occurring – including *Geranium sanguineum, G. robertianum, Ceterach officinale, Potentilla erecta, Rosa pimpinellifolia, Teucrium scorodonia, Hypericum pulchrum, Rubia peregrina, Briza media, Sesleria albicans* and *Phyllitis scolopendrium*. Rarer species include *Gentiana verna* and *Dryas octopetala*. In addition to the open areas, there is much scrub, with *Corylus avellana, Prunus spinosa* and *Crataegus monogyna.* Some *Fraxinus excelsior* occurs with the scrub in places.

The total area of limestone pavement is relatively large for an area outside the main Burren region. As it has good diversity and all the typical species for the habitat, it is given a score of **A** for representivity.

***Relative surface***
The area of limestone pavement is estimated at **193 ha.** – this is a minimum figure as it does not include the limestone within turloughs nor areas under scrub - so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure:** the limestone pavement has a typical structure, with on major elements of the expected vegetation missing. The vegetation is also quite varied, depending on local topography. Ranking **I**: excellent.

The degree of conservation of **functions:** although there has been some clearance of limestone in places and there is light grazing throughout the area, the habitat appears to be functioning normally. Ranking **II**: good prospects.

The combination of these two ratings results in an **A** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
This area is an important outlier to the Burren and has a typical flora of limestone pavement including some scarce species. It is fairly extensive in area and is in an apparently good condition as regards structure and functionality. Of particular interest is the close association with other habitats, notably turloughs, grasslands and heaths. A small amount of the site is owned by the State, the remainder being in private ownership. Ranking **A**: excellent value.

***Reference***

Curtis, T.G.F. 1983. *Proposed Nature Reserve at Lough Fingall, Co. Galway*. Nature Reserve Schedule, Wildlife Service, Dublin. Unpublished.

***Site visit***
*Purpose*: site familiarisation as part of contract to RAW Group to assess extent and condition of limestone pavements.
*Access*: via green lane running E from Ballindereen, commencing M.395.151. to 410.156.
*Description*: pavement outcrops to N & S of the green lane, merging with open water / turlough. The pavement surface is bouldery, with much intervening pasture, and probably has relatively little in the way of a deep gryke flora. (Pavement surface not explored.)
*Management*: the green lane is bounded by dry stone limestone walls and the remains of older walls can be seen in the fields. The grassland looks grazed, although no livestock were present during the visit. There are occasional small trees of ash *Fraxinus excelsior*. At the E end of the field to the N there is limited scrub invasion of *Ilex, Corylus* and *Fraxinus*.
*Flora*: not recorded comprehensively due to lack of access. Shrubs noted along the green lane side include: *Ilex, Hedera, Crataegus, Prunus spinosa, Juniperus, Salix, Sorbus aria, Rubia peregrina.*
*Wooded pavement*: at approx 410.158., there is an area of pavement with more tightly packed clints, with deep grikes, from which protrude *Phyllitis scolopendrium*. This area has fairly dense *Corylus* scrub. On the aerial photos, it appears more massive than the pavement to N & S of the green lane.
*Overall condition*: this does not appear to have changed in recent years in terms of exposed rock, i.e. no pavement destruction evident. Hazel scrub *may* be intensifying at 410.158.
*Stephen Ward, 14th February, 2007.*

**Lough Ree, Co. Galway** (January 1996)
440

Limestone pavement was noted at Kilmore, just north of St John's Wood, during the NHA survey and note N229 which reads '*a small area of pavement with abundant bryophytes on the rocks and numerous vegetated grykes*'. This occurs in association with dry grassland and frequent exposed limestone boulders. The area is **hardly visible on an aerial photograph** (see OS 34-7539) and at most could only be measured in square metres – perhaps several 10s.

No information is contained in the literature which indicates any extensive areas of limestone pavement at Lough Reel Similarly, Dr Tom Curtis (pers. comm.) is not aware of any areas. The NPWS Conservation Plan notes that there are a number of very small areas of pavement around the shores of L Ree, but does not give any details.

In the Plan, it is considered that fragments of limestone pavement occur on the shoreline at one or more locations around Lough Ree. In some cases, this may be more a high concentration of limestone boulders than real pavement. It is concluded that **the presence of limestone pavement at Lough Ree is not significant and no assessment is made on the Natura 2000 form.**

**Moneen Mountain, Co. Clare** (January 1996)
54

8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **66%** of the site or **4047 ha.**

***Representivity***
The limestone pavement was given an **A** rating for Representivity owing to its large size, intact nature, diversity of limestone pavement formations including smooth, shattered and blocky types and association of species-rich flora and fauna. The interstitial vegetation forms a complex mosaic of different communities including calcareous grassland, heath and scrub which is typical of this habitat. The species-rich calcareous grassland plays host to certain Arctic Alpine species such as *Gentiana verna* and *Dryas octopetala* which occur in close proximity to Atlantic Mediterranean species such as *Neotinia maculata*. These species and the abundant cover of *Sesleria albicans* combine to form a unique assemblage of vegetation communities strictly confined to the Burren region in Co. Clare.

***Relative surface***
The national cover of limestone pavement is **30,000 ha**. There are **4047 ha.** of this habitat at this site, so the Relative Surface gets a **B** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **I** because its structure is well conserved with many large intact expanses of open limestone pavement interspersed with species-rich limestone grassland, heath and scrub. There is some scrub and woodland encroachment on the pavement area at the south of the site.

The degree of conservation of **function** has been given a rating of **II** because it is in multiple private ownership and is not currently afforded any legal status. However, the prospects of conservation of this habitat are improved as the Burren Management Plan for the area is in progress under the Department of Arts, Culture and the Gaeltacht. Continued scrub encroachment will lead to a loss of scientific interest at the site unless suitably managed.

The combination of these two ratings results in an **A** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **B** for Global Assessment because it is in multiple private ownership and is not afforded any legal status. The habitat is threatened by land reclamation activities, fertilisation and inappropriate grazing regimes. The future prospects appear good as there is a management plan for the area currently in progress (Burren Management Plan under the Department of Arts, Culture and the Gaeltacht).

***Geological interest***
Drew et al. (2001) list Sheshymore, which lies within Moneen Mtn SAC, as a site of international importance for its limestone exposures (ref. no. IGH1-7).

***References***
Drew, D., Jones, G.Ll. & Kelly, J.G., edited by Parkes, M.A. 2001. *The Karst Heritage of the Republic of Ireland.* Geological Survey of Ireland.

Webb, D.A. & Scannell, M.J.P. 1983. *Flora of Connemara and the Burren*. Cambridge University Press.

**Moyree River System, Co. Clare** (January 1996)
SAC no. 57
NGR: R.390.900 (in part on both Sheets 52 & 58)
8240 is Limestone Pavement which is an Annex I Priority Habitat and it covers **57%** of the site or **272 ha.**

***Representivity***
The limestone pavement was given an **A** rating for Representivity because it is one of the few karstic habitat types found in association with a partially subterranean river system in Ireland. The interstitial calcareous grasslands are species-rich and *Juniperus communis* occurs occasionally throughout the pavement, adding to its diversity. Scrub encroachment onto the pavement is evident in the SE. In other areas *Corylus avellana / Fraxinus excelsior* have attained such heights as to be considered woodland.

***Relative surface***
The national cover of limestone pavement is **30,000 ha**. There are **272 ha**. of this habitat at this site, so the Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure** has been given a rating of **II** because of the relatively intact nature of the habitat and associated vegetation communities. However, **disturbance through local agricultural intensification has resulted in the degradation of the habitat** through loss of species and habitat cover. There is some scrub and woodland encroachment onto the pavement as a result of poor grazing management.

The degree of conservation of **function** has been given a rating of **II** because the undulating topography acts as a natural deterrent to land reclamation in some areas. However, **elsewhere the habitat is still under threat from agricultural intensification including land reclamation and fertilisation. Continued scrub encroachment will lead to a loss of scientific interest unless suitably managed**.

The combination of these two ratings results in an **B** rating for Conservation Status for Limestone Pavement.

***Global Assessment***
Limestone pavement was assigned a rating of **C** for Global Assessment because it is in multiple private ownership and is not afforded any legal status. Agricultural intensification remains a threat as does lack of an appropriate grazing regime.

***Review of Natura 2000 assessment***
*Dromore Wood does not have any special features which would place it above other pavement sites in Clare / SE Galway. At least one of these sites should be dropped for this habitat.*

***Site Visit***
*Purpose*: site familiarisation as part of contract to RAW Group to assess extent and condition of limestone pavements.
*Observations*:
1]. Moyree River System SAC was not entered, but examined cursorily through binoculars looking SE from a gateway at approximately R.372899, to the SW of the castle. Extensive exposures of limestone pavement which looked to be undamaged could be seen.
2]. Outwith the SAC, a number of other limestone pavements were observed as follows:
**Teernea Commons:** there are limestone exposures both to the W and E of the minor road through the Commons, e.g. at R.331.903 (Sheet 52) and at 335.898 (Sheet 58).
3]. At **Ballyteige E / Teermulmoney** R.34857.89814 (Sheet 58) / R.34865.90136 (Sheet 52), lying to the west of the minor road, there is a field of **recently destroyed limestone pavement**. The map shows the area as being wooded and a few slim ash trees have survived. The field contains mounds of clints, probably taken up over the winter 2006/7. Cattle are present on site and there are feeders to contain big-bale silage. The field comes as a visual shock.

4]. At Ballyteige, to the SW and NE of the minor road running from 353.900 to 363.893 (Sheet 58), limestone pavement is exposed on both sides; there appear to be **extensive areas** to the NE heading up into **Moyree Commons**. Surprisingly, this appears to lie outwith any protected area, so far as I can tell – but this needs checking out.
5]. On the minor road between Rinroe and Ballard, limestone pavement outcrops 906.918 as a ridge within the fen. What appears to be a famine road runs blind from this point to the NE into the fen.
*Stephen Ward, 16th February, 2007.*

**St John's Point, Co. Donegal** (August 1995)
191

***Representivity***
In the national context, this is a small area of limestone pavement, but the habitat is rare in the NW. The examples on this site are intact and species-rich, with several uncommon species occurring. Ranking **B**: good.

***Relative surface***
**11 ha.** of this habitat occur on the site. The Relative Surface gets a **C** rating.

***Conservation Status***
The degree of conservation of **structure**. The limestone pavement has an excellent structure and is hardly disturbed (some grazing does occur). Ranking **I**: excellent.

The degree of conservation of **function.** Reclamation of the limestone pavement is not envisaged. The site is very exposed and largely unsuited to intensive agriculture. Ranking: **I** very good prospects.

The combination of these two ratings results in an **A** rating for Conservation Status for Limestone Pavement: excellent.

***Global Assessment***
St John's Point contains good quality examples of this habitat. Limestone pavement is very rare in the NW of the country, being otherwise met in any quantity only around Ballintra. The area of pavement here is not very large, however, compared with that found in the Burren and Aran Islands. Neither is it protected as a nature reserve. Ranking **B**: good.

***File note***
During the **SAC review meeting** of 22nd November 1996, C.O.Críodáin expressed the view that the **limestone pavement** and orchid-rich grassland habitats on this site are **not of very high quality.** In relation to other sites in the area, e.g. Ballintra (site 115), St. John's Point is not as important. However, a balance should remain in the 1st batch of candidate SACs, i.e. it should remain as listed for priority habitat.
*Aileen O'Sullivan, 29th November 1996.*

SACs containing, but not selected for, limestone pavement

**Ballycullinan Lough, Co. Clare**
SAC no.: 16
NGR: R.390.900 (Sheet 57)
194.16 ha.
N.B. This site is an SAC for wetland habitats such as *Cladium* fen, but not for limestone pavement. The N2K form records (para 4.1) that 17% of the site is estimated to be **limestone pavement, i.e. c. 32 ha.** This occupies the northern part of the site. Under 'vulnerability' (para 4.3) it states **"Some clearance of limestone pavement has already taken place and is a continuous threat."**

*Extract from site synopsis (March 2003)*
Ballycullinan Lake is a calcareous lake situated approximately 2 km south of Corrofin. The site includes a series of smaller lakes to the north-east of Ballycullinan, i.e. Cragmoher Lough, Drumcavan Lough and Shanvally Lough. Large reedbeds, sedge swamp, stands of Saw Sedge (Cladium mariscus) and fen surround these lakes. **Limestone pavement** and scrub woodland occupy the northern part of the site.

This site is a candidate SAC for *Cladium* fen, a habitat listed on Annex I of the EU Habitats Directive.

On sloping **limestone pavement**, Hazel (*Corylus avellana*) scrub is the dominant vegetation, with Ash (*Fraxinus excelsior*), Holly (*Ilex aquifolium*) along with occasional Yew (*Taxus baccata*). The uncommon plant Dog's Mercury (*Mercurialis perennis*) occurs in scrub woodland in the northern part of the site. A species rich calcareous grassland occurs in mosaic with the limestone pavement.

The site is of conservation value for its range of calcareous wetland habitats, particularly for the presence of *Cladium* fen. The occurrence of **limestone pavement** adds greatly to the importance of the site.

*Extract from survey notes (nos. refer to an annotated map in site docket):*
N8. *Habitat*. A large area of limestone pavement flanks the NW shore. Here, open hazel scrub is the dominant vegetation with ash *Fraxinus excelsior*, blackthorn, whitethorn, holly *Ilex aquifolium* and the occasional yew *Taxus baccata*. A smaller area of *Fraxinus* and hazel *Corylus avellana* with blackthorn and whitethorn is found along the southern shore. These adjoining scrub habitats provide excellent habitat for birds, mammals and insect life in the area and add greatly to the wildlife value of the lake. In some places the northern boundary *Fraxinus* forms the dominant species along with *Corylus* and *Ilex*.

N9. *Habitat*. An extensive area of limestone pavement occurs to the north of the site. Here, the open *Corylus* scrub forms the dominant species along with *Fraxinus* and *Ilex*. Species-rich limestone grassland is found regularly throughout the area, adding greatly to the diversity of the site.

N11. *Damage*. Parts of the limestone area to the NW of the lake have been damaged due to grazing pressure. Local enrichment of the grassland has taken place due to the amount and possible duration of cattle grazing. The exact extent of this damage is difficult to assess due to access problems experienced through the scrub. Similarly, damage due to heavy cattle poaching was recorded around the SW side of the lake.

N12. *Damage*. Recent attempts at agricultural improvement have damaged an area of limestone pavement / scrub inside the western boundary. Here some attempts at scrub removal have been made. The overall effect is not that drastic and could easily be reversed with time. More serious reclamation occurs along the NW shore where the land is highly improved.

N17. *Boundary*. In order to include a good stretch of limestone pavement and its associated species-rich calcareous grassland, an unmarked boundary (B12 type) is used.

## Ballyogan Lough, Co. Clare

0019
379.90 ha.
N.B. This site is an SAC for wetland habitats such as *Cladium* fen, but not for limestone pavement. The N2K form records (para 4.1) that "**an extensive area of limestone pavement** and scrub woodland, with patches of calcareous grassland, occupies the SW part of the site." This covers about 30% of the site, estimated to be **c. 114 ha**.

*Extract from site synopsis March 2003*
Ballyogan Lough is a complex of **limestone pavement**, scrub woodland, lake and fen situated about 10 km east of Corrofin, Co. Clare.

This site is a candidate SAC selected for *Cladium* fen, a habitat listed on Annex I of the EU Habitats Directive.

The site lies within a wedge shaped basin with low hills on both sides. It is oriented on a north-east/south-west axis. The south-west end is largely dominated by scrub and **limestone pavement** while the north-east is largely fen. A bog road divides this fen from Ballyogan Lough, which lies in the centre of the site.

The scrub and **limestone pavement**, which is situated in the southern part of the site, is dominated by Hazel (*Corylus avellana*) and Ash (*Fraxinus excelsior*). Other plants of note include Yew (*Taxus baccata*) and Spindle (*Euonymus europaeus*) both of which are relatively rare on site. Cotoneaster (*Cotoneaster microphyllus*) is frequent on the pavement where it has become fully naturalised.

The main **threats** to the site are from agricultural improvement, including drainage of wetlands and scrub removal from the limestone pavement areas (*to which I would add invasion by Cotoneaster – SD Ward*). The site is nevertheless of conservation value for its diverse range of habitats, and notably the presence of *Cladium* fen.

## Ben Bulben, Gleniff & Glanade, Co. Sligo / Leitrim

(November 1995)
800000623
The Natura 2000 proforma for this site says (para. 4.1) 'Wet and dry grassland, scrub, broad-leaved deciduous woodland, flushes, swallow holes and **small areas of** fen and **limestone pavement** are also found on this site.'

**Bricklieve Mountains & Keishcorran, Co. Sligo** (January 1997)
1656

*Extract from site synopsis*
The Bricklieve Mountains and Keishcorran are located west of Lough Arrow and approximately 6 km north-west of the town of Boyle. The site is a large isolated block of carboniferous limestone that reaches a height of approximately 300m. Typical landscape features associated with a karst topography are present, caves, dry valleys, and **limestone pavement**. A striking feature of the Bricklieve Mountains is that they are cut into four slices by narrow rift valleys which run north-north-west and south-south-east. The walls of these valleys are vertical cliffs which vary between 10-30m in height. During the last ice age retreating ice deposited morainic debris across the rift valleys, to form lakes which subsequently developed into bog.

Botanically the site is extremely rich and varied; this is primarily due to the very different floras of the limestone and peat areas (i.e. the calcicole and cacifuge element of the flora). In places leaching has facilitated the development of an interesting cacifuge flora.

The dominant habitats on the site include upland grassland on peaty soil, blanket bog, heath, upland grassland on mineral soil and scrub woodland. Calcareous dry grassland occurs on the lower slopes, bogland on the upper slopes above 200m and scrub woodland by the cliff walls of the rift valleys. The most widespread community throughout the site is calcareous grassland dominated by Bent Grass (*Agrostis* sp.), Sheep's Fescue (*Festuca ovina*) and Crested Dog's Tail (*Cynosurus cristatus*). Associated species are Blue Moor-grass (*Sesleria albicans*), Heath-grass (*Danthonia decumbens*), False Oat-grass (*Arrhenatherum elatius*), Quaking Grass (*Briza media*), Lady's Bedstraw (*Galium verum*), Mouse-ear Hawkweed (*Hieracium pilosella*), Pignut (*Conopodium majus*), Woodrush (*Luzula sylvatica*), Self Heal (*Prunella vulgaris*), Yellow Rattle (*Rhinanthus minor*) and Fairy Flax (*Linum catharticum*). The legally protected (Flora Protection Order, 1987) Small-white Orchid (*Pseudorchis albida*) has recently (1994) been recorded from the site.

The scrub woodland occurs mostly on the steep slopes beside the cliffs. Hazel (*Corylus avellana*) is the most common species with Ash (*Fraxinus excelsior*), Rowan (*Sorbus aucuparia*), Birch (*Betula pubescens*), Goat Willow (*Salix caprea*), Hawthorn (*Crataegus monogyna*), Holly (*Ilex aquifolium*) and Wych Elm (*Ulmus glabra*) also occurring. The ground flora is rich with Ramsons (*Allium ursinum*), Hart's-tongue Fern (*Phyllitis scolopendrium*), Primrose (*Primula vulgaris*), Bramble (*Rubus fruticosus* agg.) and other common woodland herb species. The abundance of woodland species in open situations is particularly striking.

Other habitats found on the site include cliff bases and ledges, bare rocks, scree slopes and aquatic habitats associated with L. Availe, L. na Leibe, Greenan Fen and a number of small springs. The cliffs on the site support a distinctive flora with Common Valerian (*Valeriana officinalis*), Nipplewort (*Lapsana communis*), Common Figwort (*Scrophularia nodosa*), Mossy Saxifrage (*Saxifraga hypnoides*), Harebell (*Campanula rotundifolia*), Hairy Rock-cress (*Arabis hirsuta*), Brittle Bladder-fern (*Cystopteris fragilis*) and the Red Data Book plant Hoary Whitlowgrass (*Draba incana*) occurring.

The main **threats** to the diverse flora of this site are the application of artificial fertilizers, overgrazing by domestic stock, burning, quarrying, turf-cutting and afforestation. The area has probably been grazed since prehistoric times and so is in equilibrium with the present prevailing landuse. However, this equilibrium needs to be maintained as a reduction in grazing pressure would result in the spread of scrub vegetation and overgrazing would lead to poaching and loss in vegetation cover and diversity. Turf-cutting resulted in the drainage of L. Availe in 1946.

The Bricklieve Mountains and Keishcorran are exceptionally diverse in habitats and species and form a discrete unit of scenic and amenity value. The most interesting ecological feature of the site is the presence of the orchid-rich calcareous grasslands, an EU Habitats Directive Annex I priority habitat. The site is also of geomorphological, geological and archaeological importance.

**Cahermore Turlough, Co. Galway** (October 2002)
2294

*Extract from site synopsis*
Cahermore Turlough is situated in the limestone lowlands of south Co. Galway about 5 km north-west of Gort and 5.5 km south-east of Kinvara. It is part of a series of lakes and turloughs in the region, most of which are Special Areas of Conservation (SAC) or Natural Heritage Areas (NHA). The nearest is Caherglassaun Turlough, the water levels of which are slightly higher than Cahermore. The site is mostly covered by drift which is mounded into hillocks in the south-eastern parts.

The site is a candidate SAC selected for turlough, a priority habitat listed on Annex I of the E.U. Habitats Directive.

The turlough is a dry one and there is no standing water in summer except for a few small ponds dug for cattle. A few collapse features occur in the drift on the southern side with a regular swallow-hole at the edge of the flooded area. Another hole occurs just behind the bungalow at the road junction in the south-east corner. The turlough appears to flood largely from the southern side.

Two areas of **limestone pavement** which are largely scrub-covered occur. The one in the east is grazed by sheep and has grassland plant species such as Thyme (*Thymus praecox*) and Downy Oat-grass (*Avenula pubescens*). The shrubs on this pavement include Blackthorn (*Prunus spinosa*), Burnet Rose (*Rosa pimpinellifolia*), Juniper (*Juniperus communis*) and the exotic species Small-leaved Cotoneaster (*Cotoneaster microphyllus*). A larger area of turlough scrub in the northern part is impenetrable and consists of Hawthorn (*Crataegus monogyna*), Buckthorn (*Rhamnus catharticus*), Blackthorn (*Prunus spinosa*) and Spindle (*Euonymus europaeus*).

**Galway Bay complex, Cos. Clare & Galway** (July 1996)
800000252
*Note*
Limestone pavement occurs along parts of the of the coastal fringe of this site. As the site has not been nominated for this habitat, **no assessment is made**.

The total area of the site is given as 11,178 ha. and the area of inland rock as 1%, so **the area of limestone pavement could be as much as 112 ha**.

*General Site Character*
84% marine. "The terraced Carboniferous (Visean) limestone platform of the Burren sweeps down to the shore and into the sublittoral.

This site contains sub-site no. 52 **Finavarra-Ballyvaughan Coast**
NGR: M.26.11.
Area: 2,135 ha.

*Extract from National ASI survey: surveyors S Keane & M Rule, June 1993.*
*Main habitat*
Open marine waters, tidal rivers and estuarine channels.
*Habitat Details*
Limestone pavement occupies <5% of the site.

*Extract from survey notes (nos. refer to an annotated map in site docket):*
*N17 Habitat.* The site includes some fantastic areas of limestone pavement. The most extensive and species diverse area occurs SE of Muckinish Bay. Here a low-lying expanse of pavement occurs supporting a typical limestone pavement flora along with the more unusual *Juniperus* and *Dryas*, both of which occur in abundance. A heathy type vegetation occurs in part where *Calluna, Erica cinerea* and *Molinia* co-dominate along with *Schoenus*. Such heathy

vegetation is normally associated with the uplands. Up to 7 different species of orchids were recorded, including *Ophrys insectifora, Anacamptis pyramidalis, Gymnadenia conopsea.* Many seed heads of *Gentiana verna* were seen.

**Rahasan Turlough, Co. Galway** (February 1997)
322
*Extract from site synopsis*
Rahasane Turlough lies in gently undulating land, approximately 2km west of Craughwell, County Galway. It consists of two basins which are connected at times of flood but separated as the waters decline. The larger of these, the northern basin, takes the Dunkellin River westwards. Rahasane was formerly the natural sink of the Dunkellin River, but now an artificial channel takes some of the water further downstream. Water escapes the artificial channel to sweep around the northern basin, and again in the west, where it flows into an active swallowhole system. The main swallowholes here are constantly changing, but reach 5m in diameter and 2-3m deep. Some minor collapses are found elsewhere in the turlough, as well as a small number of more permanent pools. Mostly, the edges of the turlough rise gradually into the surrounding land, but in places, rocks mark a more sudden transition. The southern basin is an impressive feature, with high rocky sides above an undulating base, strewn with boulders. There is a low hill on the south side of the main basin, and another on the north-east, near Shanbally Castle, where **smooth limestone pavement** is evident. The major part of the turlough is open, flat and grassy, with occasional depressions and dry channels. The substrate consists largely of silty clay with shell fragments, reaching over 3m in thickness. Locally in the main basin, there are signs of marl, but peat is absent everywhere. Like the southern basin, the eastern end of the main (northern) basin is distinguished by the presence of large rocks scattered over the floor.

There are small areas of scrub on the southern and north-western sides of the turlough, but the area of flooded woodland is small. The scrub is made up of Buckthorn (*Rhamnus cathartica*), Ash (*Fraxinus excelsior*) and Hazel (*Corylus avellana*). The trees support a range of epiphytic mosses such as *Leskea polycarpa, Amblystegium riparium, Isopterygium elegans, Isothecium myosuroides* and *Thuidium tamariscinum*.

The Turlough is closely grazed by cattle, sheep and horses. Grazing is a critical factor in maintaining a balance between open swards and woodland development at the edges of the turlough.

**Termon Lough, Co Galway** (January 1997)
1321
*Extract from site synopsis*
Termon Lough is situated approximately 6 km south-west of Gort. It is a flat turlough, with low, drift-covered slopes on all sides except in the north-east, where a small area of **limestone pavement** is found. A higher spur adjoins the basin in the north-east. The main area of the site is now a reedswamp underlain by marl deposits. Termon Lough is a particularly wet turlough that seldom dries out.

Termon Lough is an unusual turlough by virtue of its extreme wetness. It contains one of the largest stands of reedswamp to be found in a turlough. Although rare plant species have not been recorded, the relatively rare oligotrophic vegetation on marl does occur. The vegetation is in excellent condition and almost completely ungrazed. **The transition to limestone pavement in the north-eastern corner of the site is also of interest**.

**Spa Hill & Clomantagh Hill, Co. Sligo / Leitrim** (November 1995)
849
A very small area of limestone pavement occurs near the N end of Clomantagh Hill. This habitat was not listed by NPWS and has not been assessed.

## Other sites containing limestone pavement of interest

**Annaghmore Lough, Co. Roscommon** (November 1995)
1626
*Extract from Site Synopsis*
Annaghmore Lough is located about 5 kms NW of Strokestown … **a small area of limestone pavement** with abundant stonecrop (*Sedum album*) … adds to the diversity of the site.

**Brierfield Turlough, Co. Roscommon** (February 1995)
594
*Extract from Site Synopsis*
Brierfield Turlough is located 4 km east of Castleplunket. It is comprised of a large area of shallow water, lowland wet and dry grassland, a scrub-covered island, a crannog and **a small area of limestone pavement**.

**Ballindooly Hill**
2708
Proposed by the NGOs for its limestone pavment, it lies partially within Lough Corrib SAC (Ballindooly Lough and wetlands lie directly E). There is, however, an additional area of limestone pavement and heath at the N end of the hill that lies outwith the SAC. The boundary could be extended as far as the minor road running across the north of the site – or even beyond it to encompass additional calcareous heath areas.

**Carricknahorna & Lough Gorman, Co. Donegal** (1994)
2068
NGR: G.928.654
Limestone pavement: 5-20%
*Extract from National ASI survey*
*Site Quality*
The marl lakes and associated limestone habitats show a reasonable degree of naturalness, although all are affected by cattle grazing. There is slight eutrophication of the loughs, poaching in the woodlands and grazing on the **limestone pavement**.
*N24 Habitat.*
Limestone pavement with interstitial calcareous grassland and Corylus avellana scrub. The limestone slopes down to the NE side of Lough Gorman.
*N25 Habitat.*
*Corylus* scrub on limestone with *Rosa pimpinellifolia* and calcareous grassland understorey.

**Commons of Carney, Co. Tipperary (July 1997)**
NHA: 2211
NGR: R.872.916 (Sheet 53)
A small area of **limestone pavement** / outcrop occurs at the northern edge of the site with a typical calicole flora.

**Coteenty Hill, Co Galway**
Site: 2709
1.5 kms due E of Lough Corrib
Most of N part of hill has exposed limestone pavement; S & W of the limestone pavement is dense scrub / woodland.

**Doughiska & Curragrean, Co. Galway** (20th August 2004)
Status: proposed NHA approx 4 km E of Galway City Centre.
NGR: M.35.26.
*Extract from National ASI survey: surveyor S Keane*
*Main habitat*
Limestone pavement and heath.
*Habitat Details*
Limestone pavement occupies 21-50%.
*Site Quality*
Doughiska is a small site comprising limestone heath with some **open pavement** and scrub. The site has been **significantly reduced due to development and agricultural improvement**. The site supports significant populations of *Pseudorchis albida*, which is protected under the Flora Development Order 1999.

Curragrean is predominantly comprised of **open limestone pavement**, mainly of the shattered type. The area has excellent potential and merits further investigation earlier in the growing season. Grazing is by horses.

Species diversity is high at both sites. The addition of Curragrean adds to the value of Doughiska, particularly in the light of the loss of this habitat type in the recent past. Both areas are of high scientific and educational value, given the high intensity land use of the surrounding area and its proximity to Galway city.

*Extract from survey notes (nos. refer to an annotated map in site docket):*
*N1 General.* Of primary interest due to presence of *Pseudorchis albida*. Habitat mainly limestone heath interspersed with limestone pavement and hazel scrub. First described by C Roden, *Irish Naturalist Journal Vol **25** 1995*. Recently site has been greatly reduced – much of the open limestone pavement has been destroyed.
*N2 General*. Agreed with Dr Roden that, despite damage, site stilll worthy of designation. In view of the loss of open limestone pavement at this site, the area of limestone pavement further S in the townland of Curragrean should be included along with Doughiska for NHA status. Parts of site where greater proportion of *Pseudorchis albida* recorded still extant despite recent bulldozing.
*N3 Habitat*. The open pavement supports *Juniperus, Salix repens, Dryas,* along with *Sesleria, Teucrium scorodonia, Carlina, Thymus, Blackstonia* and *Epipactis atrorubens*. Scrub species include *Corylus, Sorbus sp.* and *Ulex europaeus*. Area lightly grazed by horses.
*N8 General*. Overall Doughiska is very lightly grazed and as a result **scrub encroachment** is evident on both pavement, heath and damp meadow.
*N9 Damage*. **A large area of limestone pavement and heath has been reclaimed for agricultural purposes**.
*N11 Damage*. **A large area of limestone pavement and heath has been developed for housing purposes – now excluded from the site.**
*N17 Boundary.* N6 dual carriageway.

*Extract from site synopsis*
" … one of last examples of limestone grassland and heath to be found on outskirts of Galway City."

**Fisherstreet pavement, Co. Clare (April 1993)**
1011
NGR: R.065.965 (Sheet 51)
*Extract from National ASI survey: surveyors S Keane & M Rule*
*Site Quality*

This is a fine example of limestone pavement with an excellent scenic position by the coast. There is a good diversity of species with a mixture of marine, terrestrial and calcareous grassland species. For such a relatively small site, it displays many of the limestone pavement features, both floristically and geomorphologically, generally associated with the Burren area. Although the species present are not as locally rich and abundant as expected, the communities recorded were interesting and varied. An increase in grazing pressure would add greatly to the overall diversity of the site and keep scrubby growth under control.

*Land use*
The whole area is lightly grazed by goats and hares; heavy grazing by sheep in parts has resulted in species-poor nutrient enriched grassland – particularly inside the far NE boundary. Areas of limestone pavement to the SE (landward side) are not as species-rich as expected; due to undergrazing there has been an increase in *Prunus spinosa, Hedera helix, Rubus fruticosus* and *Pteridium aquilinum*.

*Site notes*
N2. *Habitat*. The dominant habitat is limestone pavement, which varies in form both geomorphologically and floristically. The main area of classic pavement lies inside the western seaward boundary where smooth limestone pavement stretches north and south. Here the deep crevices support a maritime flora with *Armeria maritima, Plantago coronopus, Asplenium maritimum* and *Aster tripolium* along with *Festuca rubra*. Further inland, the limestone pavement had a shattered appearance with very striking solution hollows formations. Here the community was more terrestrial with a mixture of open pavement with patches of species-rich calcareous grassland in between. Species seen include *Ranunculus ficaria, Primula veris, Viola* spp*, Taraxacum spp, Hedera helix, Hypochaeris radicata* and *Bellis perennis* were seen. *Teucrium scorodonia, Saxifraga hypnoides* along with *Rosa pimpinellifolia* were recorded from the grykes. Further south, the pavement became more overgrown and shrubby in parts with noticable *Rubus* spp., *Hedera helix, Prunus spinosa* and *Pteridium aquilinum*. An area of smooth, blocky limestone pavement occurs just inside the southern boundary; here maritime species including *Beta vulgaris* and *Crithmum maritimum* were recorded.

N7. *Threat*. At present there is no obvious threat to the main limestone pavement. However, in some parts the effects of undergrazing are evident resulting in an increase in more vigorous species like *Prunus spinosa* and *Festuca rubra* which has led to a decrease in diversity in the grikes. Increased numbers of goats could control scrub and bracken invasion.

**Grange East, Co. Galway** (31st August 2004)
Status: proposed NHA approx 9 km NE of Galway City.
NGR: M.44.32.
*Extract from National ASI survey: surveyor S Keane*
*Main habitat*
Limestone pavement and heath.
*Habitat Details*
Limestone pavement occupies 21-50%.
*Site Quality*
Grange East is a relatively small site consisting of a low limestone ridge and a flat rectangular field. The site is important for good populations of *Pseudorchis albida* and *Vicia orobus*, both species protected under the Flora Protection Order 1999. The dominant habitat is limestone pavement and associated calcareous grassland, heath and scrub. 'Several areas of exposed limestone occur near the crest and the ridge supports a rich flora including *Arctostaphylos uva-ursi, Geranium sanguineum, Gentiana verna* and *Taxus baccata'* (Roden, 1995). The site is extensively managed and, in an otherwise agriculturally developed landscape, it is of high conservation and scientific value.

*Extract from survey notes (nos. refer to an annotated map in site docket):*
*N1 General.* Grange East consists of 2 separate areas, the main site being dominated by a low limestone ridge, the second is a flat rectangular field surrounded by improved pasture which

supports a large population of *Vicia orobus* – at least 100 plants in 1994. The site has been described as Grange E (M.44.32.) by C. Roden in *Ir Nat J* **25**, 4, 1995, as Ballybackagh (M.45.33.) by C. Roden in *Ir Nat J* **24**, 11, 1994 and as Cooleran by Praeger in 1906.
It consists of **a signigicant area of limestone pavement** and calcareous heath. It is subject to low intensity grazing by cattle and horses. There is a small gravel quarry in the SW corner.
*N6 Habitat*. Species recorded include *Geranium robertianum, Mycelis muralis, Arctostaphylos uva-ursi* and many notably tall *Taxus baccata* shrubs.
*N7 Habitat.* Shattered limestone pavement with tall *Taxus* + *Prunus spinosa* and *Ulex europaeus*.
*N8 Habitat.* Large meadow with *Vicia orobus*.
*N11 Damage*. Removal of limestone pavement – stones piled up and still present on site.
*N12 Habitat.* Open limestone pavement area with *Rosa pimpinellifolia, Fraxinus* etc.

*Reference*: Roden, C. 1995. *Wood bitter vetch* Vicia orobus *DC. on Lake Islands and Limestone Heath in Cos. Galway (H16, H17) and Mayo (H26).* Ir. Nat. J. **25**, 4, 128-134.

**Hill of Mael & Rock of Curry, Co. Westmeath**
681
*Extract from Site Synopsis*
Roughly midway between Lough Derravaragh and L Sheelin, the Hill of Mael and Rock of Curry are twin protrusions of pale grey reef limestone. Bare limestone outcrops on both hills. Although the only extensive cliffs are on the Rock of Curry, the generally horizontal strata have resulted in the development of **some limestone pavement on both hills**, this is largely covered by turf. This area is unique in County Westmeath; the few limestone exposures in the Midlands are of great importance.

The eastern slopes of Hill of Mael have been extensively planted with conifers. Afforestation, **bulldozing of scrub** and fertilisation of grassland are the main threats to this NHA.

**Killough Hill, Co. Tipperary south** (February 1995)
959
*Extract from Site Synopsis*
Rock is exposed by quarrying on the south slope where it has eroded into limestone pavement. The pavement is vegetated by a characteristic mix of species. The open area of pavement and limestone grassland are a rare feature in the country. To date only four exposures of pavement are known outside the western Clare-Galway area.
*Site notes*
N12. Disturbed limestone pavement may occupy the area between the quarry face and the edge of the scrub on the eastern side of the quarry; this seems to be a remnant of the area described in the county report as 'eroded into limestone pavement', although it looks from the photo as if this may merely be an area on which vegetation is regenerating after the bulldozing away of the thin soil layer.

**Knockmaa Hill, Co. Galway** (February 1995)
1288
*Extract from Site Synopsis*
Knockmaa Hill is a prominent limestone knoll 10 kms west of Tuam. The hill is 180 m high – towards the summit there is an area of limestone pavement and heath, supporting a Burren-type flora with some small areas of heath. *John Conaghan*.

*Geological interest*
Drew et al. (2001) list Knockmaa-Headford as a site of international importance for its karst integrity (ref. no. IGH1-3).

*Reference*
Drew, D., Jones, G.Ll. & Kelly, J.G., edited by Parkes, M.A. 2001. *The Karst Heritage of the Republic of Ireland.* Geological Survey of Ireland.

**Lauraclavagh, Co Galway**
Site 355
NGR: M.37.43.
Lying SW of Tuam in the townlands of Kilcurriv Eighter, Lauraclavagh and S of Bunghanaun, it is considered one of the most important exposures of limestone pavement Roden (1995), described by him as 'an extensive area of bare limestone and thin drift west of the Galway-Tuam road and south of Knockmaa … several members of the Burren flora occur, *Dryas, Gentian verna, Geranium sanguineum, Euphrasia salisburgensis, Galium sterneri and Ophrys insectifera*.'

*Reference*: Roden, C. 1995. *Wood bitter vetch* Vicia orobus *DC. on Lake Islands and Limestone Heath in Cos. Galway (H16, H17) and Mayo (H26).* Ir. Nat. J. **25**, 4, 128-134.

**Lough Scur, Co. Leitrim** (October 1989)
There is **an area of limestone pavement** at Lough Scur, to the north of Castle John. Ferns growing in the pavement include *Asplenium trichomanes, Athyrium filix-femina* and *Phyllitis scolopendrium*.

There is some scrub development, principally of blackthorn *Prunus spinosa*. The introduced stonecrop *Sedum sexangulare* is naturalized here.

*Reference:* Cabot, D., Mayes, E., Sheppard, R. & Grant, P. 1989. *Restoration of the Ballinamore and Ballyconnell Canal.* Environmental Impact Statement, Environmental Consultancy Services, Dublin.

## Appendix 6 Glossary

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CORINE - An information and mapping system, developed within the context of the Commission of the European Communities biotope project, which is used as a tool for the description of sites of importance for nature conservation in Europe. It catalogues recognisable communities of flora and fauna. The primary objective of this catalogue is to identify all major communities whose presence contributes to the conservation significance of a site. Included in this list of communities are interesting but rare natural or near-natural communities as well as the more widespread semi-natural ones.

DEHLG - Department of Environment, Heritage and Local Government

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the “health” quantity or quality of a habitat or species.

MOSAIC - Used to describe habitats that occur together and cannot easily be mapped separately.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

QUALIFYING INTERESTS – The habitat(s) and/or species for which an SAC or SPA is designated.

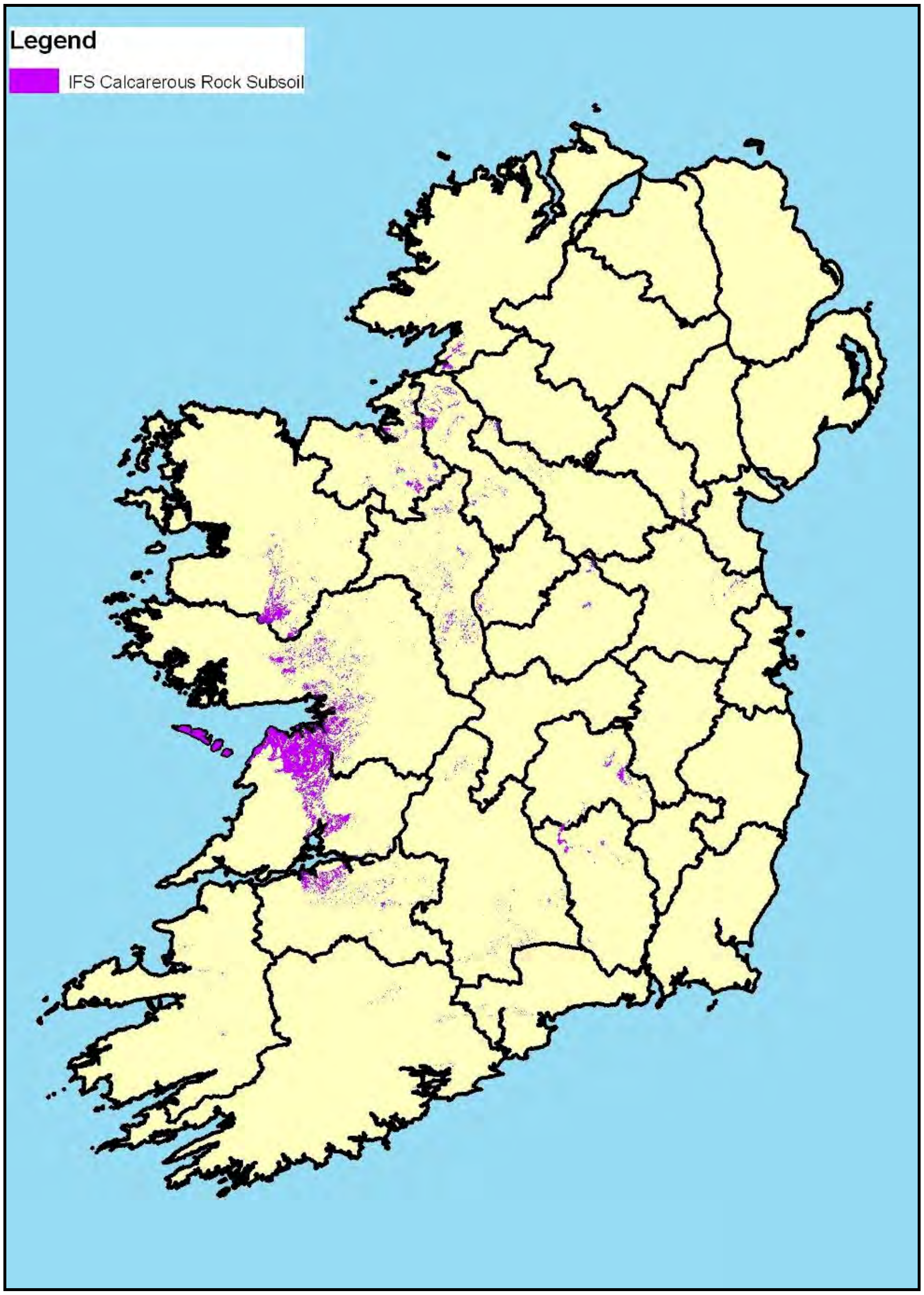
RECLAIMED LAND - this is applied to lands which have been modified from their natural state by intervention such as: a) drainage, b) bulldozing, c) clearance of scrub, d) infilling of wetland, e) ploughing and reseeding.

REPS - Rural Environment Protection Scheme. This is an Agri-Environmental programme which seeks to draw up agreements with farmers, according to the type of farming, landscape and features on the land. The overall objectives of REPS are to achieve: the use of farming practices which reduce the polluting effects of agriculture by minimising nutrient loss- an environmentally favourable extensification of crop farming, and sheep farming and cattle farming; - ways of using agricultural land which are compatible with protection and improvement of the environment, the countryside, the landscape, natural resources the soil and genetic diversity; - long-term set-aside of agricultural land for reasons connected with the environment; - land management for public access;- education and training for farmers in types of farming compatible with the requirements of environmental protection and upkeep of the countryside.

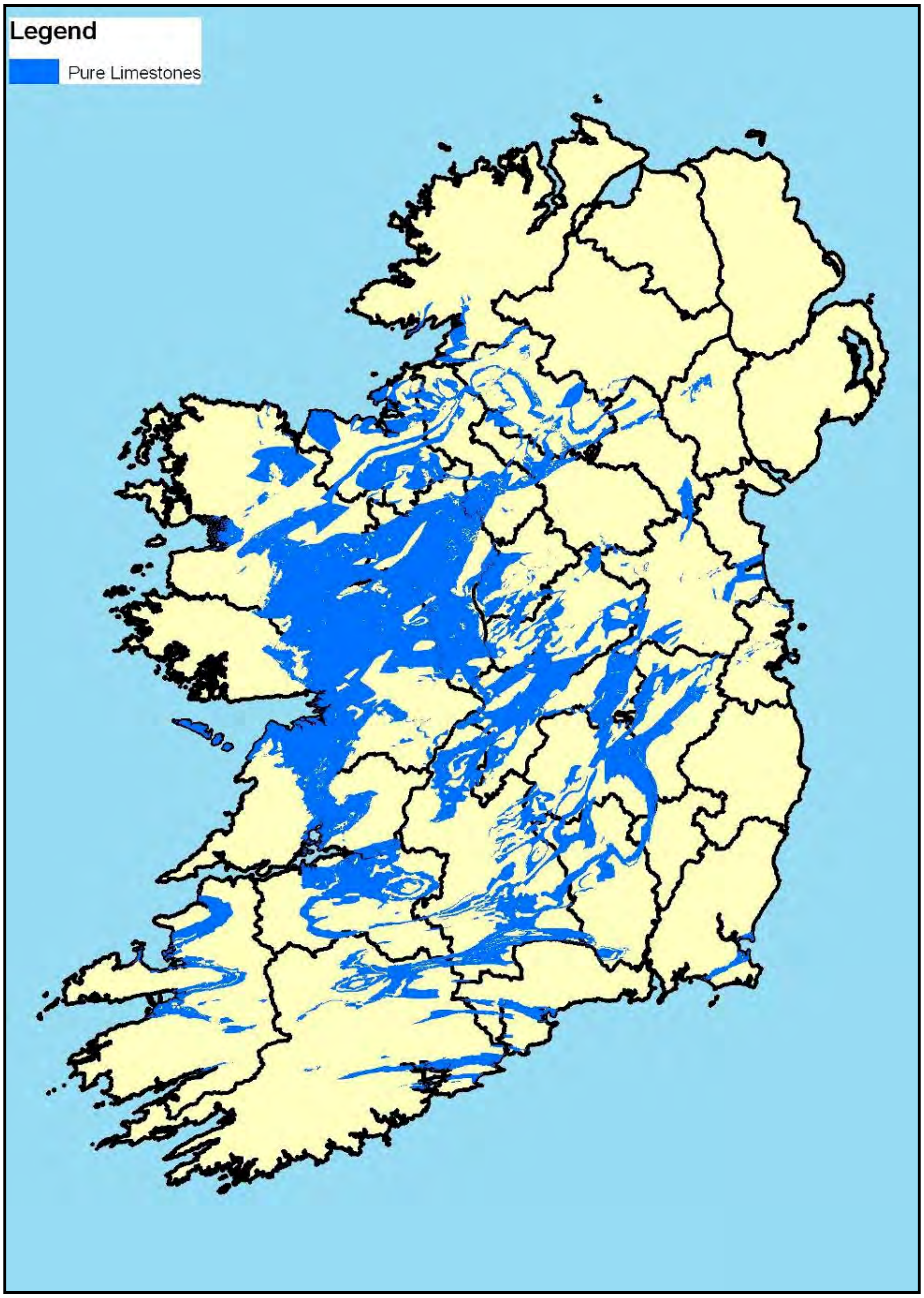
SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

SPECIES - The lowest unit of classification normally used for plants and animals.




**Appendix 7 Occurrence of calcareous rock sub-soils (Source; IFS)**




**Appendix 8 Occurrence of pure limestone bedrock (GSI)**

## Appendix 9 Damaging operations on SAC sites

A=Severe, B=Moderate and C=slight. + = positive effect, - = negative effect and 0 = no effect. Percentage change is for the whole site and not any particular habitat within it.

| | **Site code** | 000020 | 000054 | 000189 | 000194 | 000197 | 000213 | 000242 | 000365 | 000606 | 000623 | 001141 | 001501 | 001513 | 001926 | 001955 | 002244 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Damaging operation code** | **Site name/operation** | Black Head - Poulsallagh | Moneen Mountain | Sleeve League | Tranarossan & Melmore Lough | West of Ardara / Maas Road | Inishmore Island | Castletaylor alpine & juniper heath considered jointly | Killarney National Park | Lough Fingall | Ben Bulben, Gleniff & Glenade | Gweedore Bay & Islands | Erris Head | Keel Machair / Menaun Cliffs | East Burren | Croaghaun / Slievemore | Ardrahan |
| **102** | **Mowing / Cutting** | | | | | | | | C: 1% - | | C: 1% - | | | | B: 20% - | | |
| **110** | **Use of Pesticides** | | | | | | | | | | | | | C: 3% - | | | |
| **120** | **Fertilisation** | B: 5% - | B: 1% 0 | | C: 2% - | C: 1% - | C: 2% - | | C: 1% - | C: 1% - | | | | C: 5% - | B: 10% - | | |
| **140** | **Grazing** | B: 60% 0 | A: 80% +/- | B: 60% - | A: 70% - | C: 50% - | C: 75% +/- | B: 60% - | A: 70% - | C: 70% - | C: 80% - | A: 25% - | B: 8% 0 | A: 70% - | B: 60% - | A: 60% - | C: ?/ - |
| **141** | **Grazing cessation** | | | | | | | | C: 1% + | | | | | | | | |
| **150** | **Restruct'g agric land holding** | | A: 1% - | | | | | | | | | | C: 1% 0 | | | C: 1% - | |
| **151** | **Hedge / Copse removal** | | | | | C: <1% - | | B: 5% - | | C: 30% - | C: <1% - | | | | B: 20% - | | |
| **160** | **Forestry** | | | | | C: <1% - | | | B: 1% - | | C: <1% - | | | | | | |
| **171** | **Stock feeding** | | A: 1% - | | C: 10% - | | | | | | | C: 2% - | | | | | |
| **180** | **Burning** | | | | | | | | B: 2% - | C: 10% - | | | | | | | |
| **230** | **Hunting** | B: 60% - | | | C: 40% - | | | | B: 5% - | | C: <1% - | | | | C: 40% - | C: <1% - | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **250** | **Taking / removal of flora** | | | | | | | | | | | | | | | | |
| **301** | **Sand & Gravel Extraction** | | | | C: 10% - | C: <1% - | B: 1% - | | | | C: <1% - | C: 1% - | | C: 5% - | | C: <1% - | |
| **310** | **Peat Extraction** | | | B: 1% - | | C: 4% - | | | B: 1% - | | C: 1% - | | | | | B: 2% - | |
| **330** | **Rock disturbance / removal** | | C: 1% + | | | | | | | | | | | | | | |
| **403** | **Dispersed habitation** | | | | | | | | B: 3% 0 | C: 1% 0 | | | | | C: 5% - | | |
| **420** | **Unspecified discharges** | | | C: <1% - | C: 5% - | C: <1% - | | | | | C: <1% - | B: 5% - | | | | | |
| **421** | **Household waste** | | C: 1% - | | | | B: 2% - | | | | | | | C: 5% - | | | |
| **430** | **Agricultural structures** | | A: 1% - | | | | | | | | | | | | | | |
| **490** | **Industr'l activities** | | | | | | | | | | | | | | | C: 1% - | |
| **501** | **Paths** | C: 30% - | | C: <1% - | C: 5% - | C: <1% - | | | | | C: <1% 0 | C: 5% - | C: 1% 0 | | | | C: 1% 0 |
| **502** | **Routes** | | | C: <1% - | | C: <1% - | | | | | | | | C: 3% - | C: 1% 0 | C: 1% - | |
| **505** | **Airport** | | | | | | C: 1% - | | | | | | | | | | |
| **509** | **Other commun'n networks** | | | | | | | | | | C: 1% - | | | | | | |
| **601** | **Golf Course** | | | | | | | | | | | | | C: 5% - | | | |
| **606** | **Attraction Park** | | | | | | | | B: 2% 0 | | | | | | | B: 1% - | |
| **607** | **Sports Pitch** | | | | | C: <1% 0 | C: 1% - | | | | | | | C: 2% - | | C: 1% - | |
| **608** | **Camping & caravans** | B: 1% - | | | C: 10% - | | C: 1% - | | | | | C: 10% - | | | | | |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **620** | **Outdoor pursuits** | | C: 1% - | | | C: <1% - | | | | | | | | | | C: 1% 0 | |
| **622** | **Walking, horse riding** | | B: 20% - | | C: 40% - | | C: 1% - | | C: 10% 0 | | | C: 10% - | C: 6% 0 | B: 20% - | | | |
| **623** | **Motors** | | C: 1% - | | | | | | | | | | | | | | |
| **690** | **Leisure & Tourism** | | | | | | A: 75% - | | | | | | | | | | |
| **720** | **Trampling** | | C: 1% - | | | | | | | | | | | B: 20% - | | | |
| **810** | **Drainage** | | | C: <1% - | | C: <1% - | | | | | C: 1% - | | | | | | |
| **850** | **Modific'n of hydrogr'c function** | | | C: <1% 0 | | | | | | | | | | | | | |
| **852** | **Modific'n inland water course** | | | | | | | | | | | | | | | B: 1% - | |
| **900** | **Erosion** | | | C: 8% - | C: 10% - | C: 1% - | | | B: 10% - | | C: 25% - | C: 20% - | | B: 10% - | | | |
| **951** | **Accum'n of organic material** | | | B: 30% + | | C: 30% + | | | | | B: 40% + | | | | | | |
| **954** | **Species Invasion** | | | | | | | | A: 1% - | | | | | | | C: 2% - | |
| **966** | **Antagonism from introduced fauna** | | | | | | | | B: 5% - | | | | | | | | |
| **970** | **Interspecific floral relations** | | | | | | | | | | C: 2% - | | | | | | |

## Appendix 10 Damaging operations specifically on limestone pavements (SIR)

| End of period | Activity code | Activity | SAC code | Site | Influence | Area affected | Purpose | Causal agent |
|---|---|---|---|---|---|---|---|---|
| 2003 | 803 | Infilling wetland | 000479 | Cloughmoyne | -1 | 0.05 | Development | |
| 2001 | 150 | Restructuring agric land holding | 001926 | East Burren | -1 | 0.02 | Agriculture | |
| 2001 | 152 | Removal of scrub | 001926 | East Burren | -1 | 0.00 | Agriculture | |
| 2001 | 152 | Removal of scrub | 001926 | East Burren | -1 | 0.30 | Agriculture | |
| 2001 | 152 | Removal of scrub | 001926 | East Burren | -1 | 0.80 | Agriculture | |
| 2003 | 141 | Abandonment of grazing | 000252 | Coole-Garryland | -1 | 12.00 | Natural event | Other |
| 2003 | 104 | Removal of limestone pavement | 000019 | Ballyogan Lough | -1 | 1.84 | Agriculture | Owner/Occupier |
| 2001 | 301 | Quarry | 000020 | Blackhead - Poulsallagh | -1 | 5.00 | Development | Owner/Occupier |
| 2001 | 621 | Nautical sports | 000020 | Blackhead - Poulsallagh | 0 | 0.25 | Recreation | Owner/Occupier |
| 2003 | 103 | Agricultural improvement | 000032 | Dromore Woods & Loughs | 0 | 1.50 | Agriculture | Owner/Occupier |
| 2001 | 103 | Agricultural improvement | 000054 | Moneen Mountain | -1 | 0.50 | Agriculture | Owner/Occupier |
| 2003 | 103 | Agricultural improvement | 000057 | Moyree River | -1 | 49.00 | Agriculture | Owner/Occupier |
| 2001 | 301 | Quarry | 000213 | Inis Mor | -1 | 2.00 | Development | Owner/Occupier |
| 2003 | 104 | Removal of limestone pavement | 000238 | Caherglassaun Turlough | -1 | 0.15 | Agriculture | Owner/Occupier |
| 2001 | 104 | Removal of limestone pavement | 000252 | Coole-Garryland | -1 | 0.06 | Development | Owner/Occupier |
| 2001 | 152 | Removal of scrub | 000252 | Coole-Garryland | -1 | 6.00 | Development | Owner/Occupier |
| 2001 | 403 | Dispersed habitation | 000252 | Coole-Garryland | -1 | 0.01 | Development | Owner/Occupier |
| 2001 | 424 | Discharges | 000252 | Coole-Garryland | -1 | 0.01 | Agriculture | Owner/Occupier |
| 2001 | 800 | Landfill | 000432 | Barrigone | -1 | 0.00 | Development | Owner/Occupier |
| 2001 | 171 | Stock feeding | 000479 | Cloughmoyne | -1 | 1.00 | Agriculture | Owner/Occupier |
| 2001 | 301 | Quarry | 000479 | Cloughmoyne | -1 | 0.50 | Development | Owner/Occupier |
| 2001 | 803 | Infilling wetland | 000479 | Cloughmoyne | -1 | 0.10 | Development | Owner/Occupier |
| 2001 | 430 | Agricultural structure | 001275 | Inis Oirr | -1 | 1.50 | Agriculture | Owner/Occupier |
| 2003 | 403 | Dispersed habitation | 001774 | Loughs Carra / Mask | -1 | 1.00 | Development | Owner/Occupier |
| 2003 | 403 | Dispersed habitation | 001774 | Loughs Carra / Mask | -1 | 1.00 | Development | Owner/Occupier |
| 2001 | 104 | Removal of limestone pavement | 001926 | East Burren | -1 | 0.01 | Development | Owner/Occupier |
| 2001 | 152 | Removal of scrub | 001926 | East Burren | -1 | 1.00 | Agriculture | Owner/Occupier |
| 2001 | 180 | Burning | 001926 | East Burren | -1 | 0.01 | Other | Owner/Occupier |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2001 | 104 | Removal of limestone pavement | 001926 | East Burren | -1 | 0.02 | Agriculture | Owner/Occupier |
| 2001 | 152 | Removal of scrub | 001926 | East Burren | -1 | 0.30 | Agriculture | Owner/Occupier |
| 2001 | 152 | Removal of scrub | 001926 | East Burren | -1 | 0.80 | Agriculture | Owner/Occupier |
| 2001 | 152 | Removal of scrub | 001926 | East Burren | -1 | 2.50 | Agriculture | Owner/Occupier |
| 2001 | 421 | Disposal household waste | 001926 | East Burren | -1 | 0.01 | Other | Owner/Occupier |
| 2001 | 423 | Disposal inert material | 001926 | East Burren | -1 | 0.01 | Development | Owner/Occupier |
| 2003 | 104 | Removal of limestone pavement | 001926 | East Burren | -1 | 0.01 | Agriculture | Owner/Occupier |
| 2003 | 171 | Stock feeding | 001926 | East Burren | -1 | 0.01 | Agriculture | Owner/Occupier |
| 2003 | 171 | Stock feeding | 001926 | East Burren | 0 | 0.25 | Agriculture | Owner/Occupier |
| 2003 | 403 | Dispersed habitation | 001926 | East Burren | -1 | 0.01 | Development | Owner/Occupier |
| 2003 | 423 | Disposal inert material | 001926 | East Burren | -1 | 0.08 | Development | Owner/Occupier |
| 2001 | 160 | Forestry | 000032 | Dromore Woods & Loughs | 1 | 14.00 | Forestry | Statutory body |
| 2003 | 511 | Electricity line | 000191 | St John's Point | -1 | 0.30 | Other | Statutory body |
| 2001 | 501 | Paths | 001926 | East Burren | -1 | 0.01 | Agriculture | Statutory body |
| 2001 | 502 | Routes | 001926 | East Burren | -1 | 0.01 | Development | Statutory body |
| 2003 | 511 | Electricity line | 001926 | East Burren | -1 | 0.01 | Other | Statutory body |
| 2003 | 860 | Dumping dredgings | 000019 | Ballyogan Lough | -1 | 0.50 | Other | Third party |
| 2001 | 140 | Grazing | 000432 | Barrigone | 1 | 0.00 | Agriculture | Third party |
| 2001 | 104 | Removal of limestone pavement | 000252 | Coole-Garryland | -1 | 0.10 | Development | Unknown |
| 2001 | 502 | Routes | 000606 | Lough Fingall | -1 | 0.00 | Other | Unknown |
| 2001 | 104 | Removal of limestone pavement | 001271 | Gortnandarragh | -1 | 0.50 | Unknown event | Unknown |
| 2001 | 104 | Removal of limestone pavement | 001271 | Gortnandarragh | -1 | 1.00 | Unknown event | Unknown |
| 2001 | 104 | Removal of limestone pavement | 001926 | East Burren | -1 | 0.04 | Other | Unknown |
| 2001 | 530 | Improved access | 001926 | East Burren | -1 | 0.04 | Agriculture | Unknown |
| 2003 | 171 | Stock feeding | 001926 | East Burren | -1 | 0.01 | Agriculture | Unknown |
| | | | | | | | | |

# 8240 Limestone pavements

| National Level | |
|---|---|
| **Habitat Code** | 8240 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| Published sources | ▪ Barrington R.M. and Vowell, R.P. 1885 Report on the flora of Ben Bulben & the adjoining mountain range in Sligo & Leitrim. *Proceedings of the Royal Irish Academy*, 2nd series, 4, 493-517.<br>▪ Bohnsack U. and Carrucan P. 1999 *An assessment of farming prescriptions under the rural environmental protection scheme in the uplands of the Burren karstic region, Co. Clare.* The Heritage Council. Kilkenny.<br>▪ Byrne D.S. 2001 *A study of the numbers, diet and effects of cattle and feral goats on the ecology of the Burren National Park, Co. Clare Ireland.* PhD. TCD.<br>▪ Cabot D., Mayes E., Sheppard R. and Grant P. 1989 *Restoration of the Ballinamore and Ballyconnell Canal.* Environmental Impact Statement, Environmental Consultancy Services, Dublin.<br>▪ Corry TH. 1884. On the heights attained by plants on Ben Bulben. *Proceedings of the Royal Irish Academy*, 2nd series, 4, 73-77.<br>▪ Curtis T.G.F. 1983 *Proposed Nature Reserve at Lough Fingall, Co. Galway*. Nature Reserve Schedule, Wildlife Service, Dublin. Unpublished.<br>▪ Drew, D., Jones, G.Ll. and Kelly, J.G. 2001. *The karst heritage of the Republic of Ireland.* (Ed. Parkes, M.A.) Geological Survey of Ireland.<br>▪ Drew D. (1996) Agriculturally induced environmental changes in the Burren Karst, Western Ireland. *Environmental Geology* 28; 137-144.<br>▪ Drew, D. and Magee E. 1994 Environmental implications of land reclamation in the Burren, Co. Clare: a preliminary analysis. *Irish Geography* 27; 81-96.<br>▪ Dwyer R. 2000 *Protecting Nature in Ireland. The NGO SAC shadow list.* The Heritage Council, Kilkenny.<br>▪ ERM Ireland Ltd. 2003 *Landscape Character Assessment Co. Clare.* The Heritage Council.<br>▪ Gilbert O.L. 1970 *Dryopteris villarii.* Biological Flora of the British Isles. *Journal of Ecology* 58, 301-14.<br>▪ Ivimey-Cook R.B. and Proctor M.C.F. 1966 The Plant Communities of the Burren, Co. Clare. *Proceedings of the Royal Irish Academy* 64B: 211-301.<br>▪ Keane S. and Walsh T. 1995 NHA Internal Report to National Parks and Wildlife Service, Dublin.<br>▪ Kelly D.L. and Kirby N. 1982 Irish Native woodlands over limestone. In; (Jim White Ed.) *Studies on Irish Vegetation*. Royal Dublin Society. pp. 181-197.<br>▪ Kirby E.N. & MacGowran B.A. 1979 *A vegetation survey of the proposed National Park in the Burren, Co. Clare.* Unpublished report to the National Parks and Monuments Branch of the OPW, Dublin.<br>▪ McGough H.N. 1984 *A report on the grasslands and closely related vegetation types of the Burren region of western Ireland: a preliminary report.* National Parks and Wildlife Service, Dublin.<br>▪ Majs F. 2003 *Nitrogen cycling for outdoor wintering of dairy cows and characterisation of leachate from stockpiled manure.* Thesis. University of Minnesota.<br>▪ O'Criodain C. 1992 *Conservation of Grassland Sites of Scientific Interest in Ireland*. Internal Report to National Parks and Wildlife Service, Dublin.<br>▪ O'Donovan G. 1987 *Ecosystem dynamics of limestone grasslands in the Burren National Park, Co. Clare.* PhD Thesis, TCD. |

- Thorn R.H. and Coxon C. 1992 Hydrogeological aspects of bacterial contamination of some western Ireland karstic limestone aquifers. *Environmental Geology* 20; 65-72.
- Traffic International. 1999 *On Stony Ground: an investigation into the trade in water-worn limestone between the United Kingdom and the Republic of Ireland.* A report for The Heritage Council & The Countryside Agency.
- Vincent P. 1995 Limestone Pavements in the British Isles: A Review. *The Geographical Journal*, Vol. 161,
- Ward S.D. and Evans D.F.1976 Conservation assessment of British limestone pavements based upon floristic criteria. *Biological Conservation*, 9, 217-233.
- Webb D.A. and Scannell M.J.P. 1983 *Flora of Connemara and the Burren*. Cambridge University Press.
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- Willshaw K. 2005 *Shattered Stone: an investigation into the sale of water-worn limestone in the UK*. A report by the Limestone Pavement Action Group, based on market research by ADAS, for the Countryside Agency.
- Wilmot A. 1979 An ecological survey of the ferns of the Burren, Co. Clare, Eire. *Fern Gazette* 12, 9-28.
- Webb, S. and Glading P. 1998 The Ecology and Conservation of Limestone Pavement in Britain-British Wildlife. 10:.103-113.
- Restoration projects:
- Coillte Teoranta http://www.woodlandrestoration.ie/
- EU Burren LIFE 'Farming for Conservation' http://www.burrenlife.com/the_project.php


| | |
|---|---|
| **Range** | Limestone pavement has a stronghold along the western seaboard centred on Cos. Clare and Galway. However it extends in scattered fragments as far north as Donegal, as far east as Co. Westmeath and as far south as Killarney. |
| Surface area | 7400 sq km. This area also overlaps with other Annex I habitats such as *Juniperus communis* formations and Alpine and boreal heaths (4060) on calcareous substrates. |
| Date | 3/2007 |
| Quality of data | 3 = good |
| Trend | Stable (=) |
| Trend-Period | 1993 – 2006 |
| Reasons for reported trend | Not applicable |
| **Area covered by habitat** | |
| Surface area | The actual extent of Limestone Pavement using remote sensing data is 363 sq km |
| Date | 3/2007 |
| Method used | 2 = based on aerial photographs (2000), satellite imagery (2000/2001), existing GIS (1996-2000)<br>3= ground based survey |
| Quality of data | 3 = good |
| Trend | Negative; 106ha within designated sites, net loss of 0.33% over a 14 year period (0.02% per annum) |
| Trend-Period | 1990's - 2006 |
| Reasons for reported trend | 3 = direct human influence (pavement removal, development, agricultural improvement, grazing cessation) |
| Justification of % thresholds for trends | Increase in the intensity of impacting activities (e.g. removal of pavement, grazing cessation) more severely since the 1990's indicate this negative trend. |

| | |
|---|---|
| Main pressures | 390 Rock disturbance / removal<br>152 Scrub removal<br>141 Grazing cessation<br>171 Stock feeding<br>403 Dispersed habitation<br>500 Communication networks<br>690 Leisure & Tourism<br>740 Vandalism<br>301 Quarrying |
| Threats | 141 Grazing cessation<br>390 Rock disturbance / removal<br>171 Stock feeding<br>850 Modification of hydrographic function |
| ***Complementary information*** | |
| **Favourable reference range** | 7400 sq km |
| **Favourable reference area** | 364 sq km |
| **Typical species** | **Limestone pavement**<br>Vascular plants*: Sesleria albicans, Geranium sanguineum, Rubia peregrina, , G. robertianum, Rosa pimpinellifolia, Teucrium scorodonia, Briza media, Gentiana verna, Dryas octopetala, Coryllus avellana, Prunus spinosa, Rhamnus cathartica, Juniperus communis, Calluna vulgaris, Taxus baccata, Hedera helix, Viola reichenbachiana, Thymus praecox, Crataegus monogyna, Aphanes arvensis, Arabis hirsuta, Saxifraga hypnoides, Antennaria dioica, Asperula cynanchica, Adiantum capillus-veneris, Cystopteris fragilis, Dryopteris filix-mas, D. affinis, Asplenium trichomanes, A ruta-muraria, Phyllitis scolopendrium, Ceterach officinarum, Epipactis atrorubens.*<br>*Mosses and lichens;.Breutelia chrysocoma, Neckera crispa.* |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | |
| **Conclusions**<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Unfavourable Inadequate (U1) |
| **Specific structures and functions (incl. typical species)** | Unfavourable Inadequate (U1) |
| **Future prospects** | Unfavourable Inadequate (U1) - continued pressure from impacting activities (e.g. pavement removal, scrub encroachment, development) still high. |
| **Overall assessment of CS** | Unfavourable Inadequate (U1) |

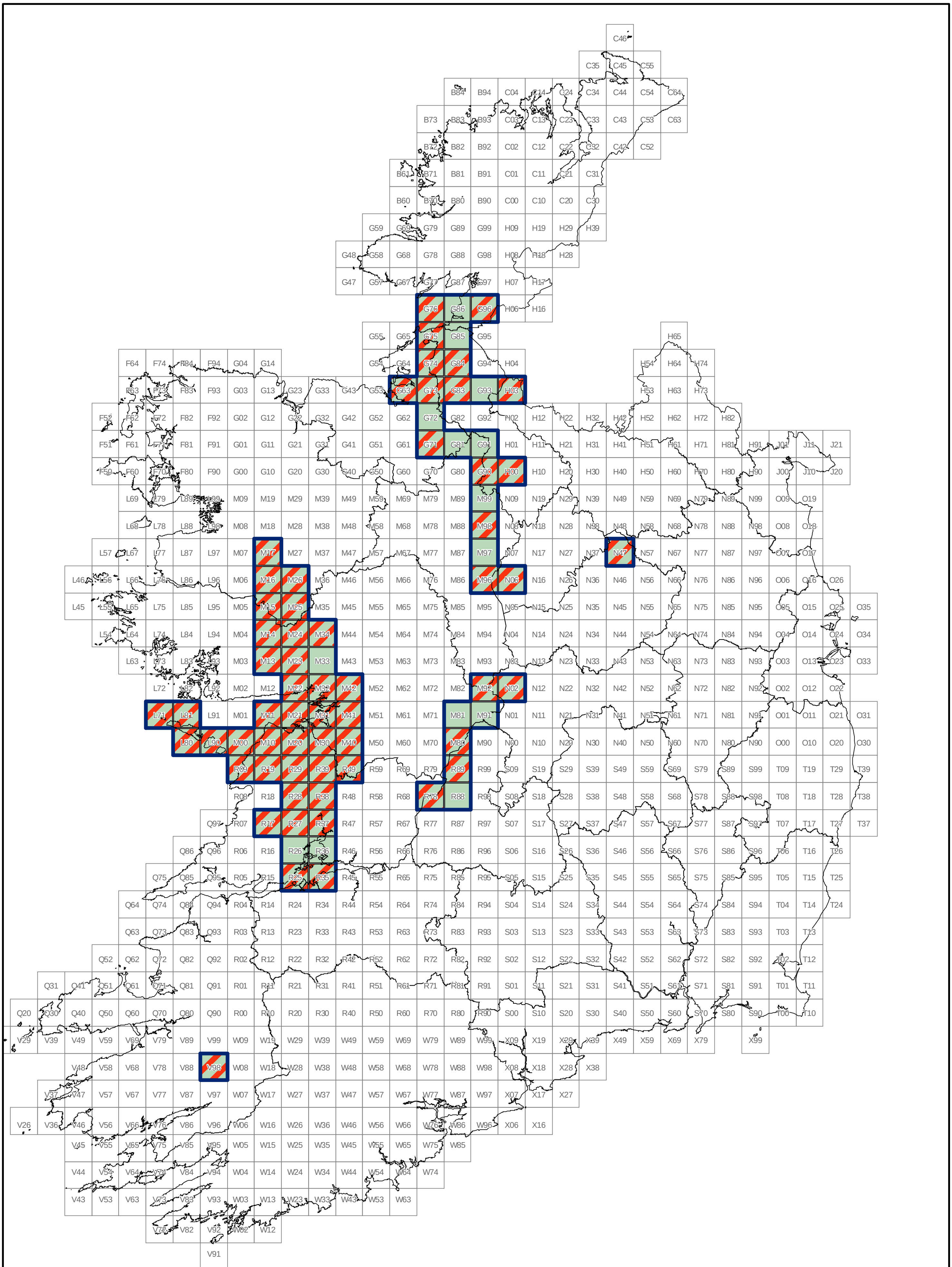
# 8240 Limestone pavements

| National Level | |
|---|---|
| **Habitat Code** | 8240 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| Published sources | ▪ Barrington R.M. and Vowell, R.P. 1885 Report on the flora of Ben Bulben & the adjoining mountain range in Sligo & Leitrim. *Proceedings of the Royal Irish Academy*, 2nd series, 4, 493-517.<br>▪ Bohnsack U. and Carrucan P. 1999 *An assessment of farming prescriptions under the rural environmental protection scheme in the uplands of the Burren karstic region, Co. Clare.* The Heritage Council. Kilkenny.<br>▪ Byrne D.S. 2001 *A study of the numbers, diet and effects of cattle and feral goats on the ecology of the Burren National Park, Co. Clare Ireland.* PhD. TCD.<br>▪ Cabot D., Mayes E., Sheppard R. and Grant P. 1989 *Restoration of the Ballinamore and Ballyconnell Canal.* Environmental Impact Statement, Environmental Consultancy Services, Dublin.<br>▪ Corry TH. 1884. On the heights attained by plants on Ben Bulben. *Proceedings of the Royal Irish Academy*, 2nd series, 4, 73-77.<br>▪ Curtis T.G.F. 1983 *Proposed Nature Reserve at Lough Fingall, Co. Galway*. Nature Reserve Schedule, Wildlife Service, Dublin. Unpublished.<br>▪ Drew, D., Jones, G.Ll. and Kelly, J.G. 2001. *The karst heritage of the Republic of Ireland.* (Ed. Parkes, M.A.) Geological Survey of Ireland.<br>▪ Drew D. (1996) Agriculturally induced environmental changes in the Burren Karst, Western Ireland. *Environmental Geology* 28; 137-144.<br>▪ Drew, D. and Magee E. 1994 Environmental implications of land reclamation in the Burren, Co. Clare: a preliminary analysis. *Irish Geography* 27; 81-96.<br>▪ Dwyer R. 2000 *Protecting Nature in Ireland. The NGO SAC shadow list.* The Heritage Council, Kilkenny.<br>▪ ERM Ireland Ltd. 2003 *Landscape Character Assessment Co. Clare.* The Heritage Council.<br>▪ Gilbert O.L. 1970 *Dryopteris villarii.* Biological Flora of the British Isles. *Journal of Ecology* 58, 301-14.<br>▪ Ivimey-Cook R.B. and Proctor M.C.F. 1966 The Plant Communities of the Burren, Co. Clare. *Proceedings of the Royal Irish Academy* 64B: 211-301.<br>▪ Keane S. and Walsh T. 1995 NHA Internal Report to National Parks and Wildlife Service, Dublin.<br>▪ Kelly D.L. and Kirby N. 1982 Irish Native woodlands over limestone. In; (Jim White Ed.) *Studies on Irish Vegetation*. Royal Dublin Society. pp. 181-197.<br>▪ Kirby E.N. & MacGowran B.A. 1979 *A vegetation survey of the proposed National Park in the Burren, Co. Clare.* Unpublished report to the National Parks and Monuments Branch of the OPW, Dublin.<br>▪ McGough H.N. 1984 *A report on the grasslands and closely related vegetation types of the Burren region of western Ireland: a preliminary report.* National Parks and Wildlife Service, Dublin.<br>▪ Majs F. 2003 *Nitrogen cycling for outdoor wintering of dairy cows and characterisation of leachate from stockpiled manure.* Thesis. University of Minnesota.<br>▪ O'Criodain C. 1992 *Conservation of Grassland Sites of Scientific Interest in Ireland*. Internal Report to National Parks and Wildlife Service, Dublin.<br>▪ O'Donovan G. 1987 *Ecosystem dynamics of limestone grasslands in the Burren National Park, Co. Clare.* PhD Thesis, TCD. |

| | |
|---|---|
| | ▪ Thorn R.H. and Coxon C. 1992 Hydrogeological aspects of bacterial contamination of some western Ireland karstic limestone aquifers. *Environmental Geology* 20; 65-72.<br>▪ Traffic International. 1999 *On Stony Ground: an investigation into the trade in water-worn limestone between the United Kingdom and the Republic of Ireland.* A report for The Heritage Council & The Countryside Agency.<br>▪ Vincent P. 1995 Limestone Pavements in the British Isles: A Review. *The Geographical Journal*, Vol. 161,<br>▪ Ward S.D. and Evans D.F.1976 Conservation assessment of British limestone pavements based upon floristic criteria. *Biological Conservation*, 9, 217-233.<br>▪ Webb D.A. and Scannell M.J.P. 1983 *Flora of Connemara and the Burren*. Cambridge University Press.<br>▪ Williams P.W. (1966). Limestone pavements with special reference to Western Ireland. *Transactions of the Institute of British Geographers*, No. 40. 155-172<br>▪ Willshaw K. 2005 *Shattered Stone: an investigation into the sale of water-worn limestone in the UK*. A report by the Limestone Pavement Action Group, based on market research by ADAS, for the Countryside Agency.<br>▪ Wilmot A. 1979 An ecological survey of the ferns of the Burren, Co. Clare, Eire. *Fern Gazette* 12, 9-28.<br>▪ Webb, S. and Glading P. 1998 The Ecology and Conservation of Limestone Pavement in Britain- British Wildlife. 10:.103-113.<br>▪ Restoration projects:<br>▪ Coillte Teoranta http://www.woodlandrestoration.ie/<br>▪ EU Burren LIFE 'Farming for Conservation' http://www.burrenlife.com/the_project.php |
| | |
| **Range** | Limestone pavement has a stronghold along the western seaboard centred on Cos. Clare and Galway. However it extends in scattered fragments as far north as Donegal, as far east as Co. Westmeath and as far south as Killarney. |
| Surface area | 7400 sq km. This area also overlaps with other Annex I habitats such as *Juniperus communis* formations and Alpine and boreal heaths (4060) on calcareous substrates. |
| Date | 3/2007 |
| Quality of data | 3 = good |
| Trend | Stable (=) |
| Trend-Period | 1993 – 2006 |
| Reasons for reported trend | Not applicable |
| **Area covered by habitat** | |
| Surface area | The actual extent of Limestone Pavement using remote sensing data is 363 sq km |
| Date | 3/2007 |
| Method used | 2 = based on aerial photographs (2000), satellite imagery (2000/2001), existing GIS (1996-2000)<br>3= ground based survey |
| Quality of data | 3 = good |
| Trend | Negative; 106ha within designated sites, net loss of 0.33% over a 14 year period (0.02% per annum) |
| Trend-Period | 1990's - 2006 |
| Reasons for reported trend | 3 = direct human influence (pavement removal, development, agricultural improvement, grazing cessation) |
| Justification of % thresholds for trends | Increase in the intensity of impacting activities (e.g. removal of pavement, grazing cessation) more severely since the 1990's indicate this negative trend. |

| | |
|---|---|
| Main pressures | 390 Rock disturbance / removal<br>152 Scrub removal<br>141 Grazing cessation<br>171 Stock feeding<br>403 Dispersed habitation<br>500 Communication networks<br>690 Leisure & Tourism<br>740 Vandalism<br>301 Quarrying |
| Threats | 141 Grazing cessation<br>390 Rock disturbance / removal<br>171 Stock feeding<br>850 Modification of hydrographic function |
| ***Complementary information*** | |
| **Favourable reference range** | 7400 sq km |
| **Favourable reference area** | 364 sq km |
| **Typical species** | **Limestone pavement**<br>Vascular plants*: Sesleria albicans, Geranium sanguineum, Rubia peregrina, , G. robertianum, Rosa pimpinellifolia, Teucrium scorodonia, Briza media, Gentiana verna, Dryas octopetala, Coryllus avellana, Prunus spinosa, Rhamnus cathartica, Juniperus communis, Calluna vulgaris, Taxus baccata, Hedera helix, Viola reichenbachiana, Thymus praecox, Crataegus monogyna, Aphanes arvensis, Arabis hirsuta, Saxifraga hypnoides, Antennaria dioica, Asperula cynanchica, Adiantum capillus-veneris, Cystopteris fragilis, Dryopteris filix-mas, D. affinis, Asplenium trichomanes, A ruta-muraria, Phyllitis scolopendrium, Ceterach officinarum, Epipactis atrorubens.*<br>*Mosses and lichens;.Breutelia chrysocoma, Neckera crispa.* |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | |
| **Conclusions**<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Unfavourable Inadequate (U1) |
| **Specific structures and functions (incl. typical species)** | Unfavourable Inadequate (U1) |
| **Future prospects** | Unfavourable Inadequate (U1) - continued pressure from impacting activities (e.g. pavement removal, scrub encroachment, development) still high. |
| **Overall assessment of CS** | Unfavourable Inadequate (U1) |



DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Limestone pavements**

**8240**

Current Distribution (60 cells)

Current Range (74 cells)

Favourable Reference Range (74 cells)

W48 10km grid cells

Date: August 2007

# CONSERVATION STATUS ASSESSMENT REPORT

## 1. Introduction

The *Interpretation Manual of EU Habitats* defines this habitat as :

"*Caves not open to the public including their water areas and flows, hosting specialised or high endemic species, or that are of paramount importance for the conservation of Annex II species (e.g. bats, amphibians).*"

Very little has been published on Irish cave fauna and while there is some information on the occurrence of cavernicolous species from warm springs in Ireland (see http://www.ecoserve.ie/projects/springs/introduction.html), this data is of more relevance to another EU Annex I priority habitat: 'petrifying springs with tufa formation (Cratoneurion)' (7220). There is little evidence that Irish caves support much in the way of specialised troglobite fauna, or highly endemic cave species. Furthermore, only one of the species of bat found in Ireland is listed on Annex II – the lesser horseshoe bat. Consequently, this EU habitat is, in practise, confined in Ireland to caves, not open to the public, which host important numbers of lesser horseshoe bat.

The lesser horseshoe bat is the only member of the Rhinolophidae occurring in Ireland (O' Sullivan, 1994) and was first recorded in Ireland in 1858 (McAney, 1994). It is confined to the west coast of Ireland in the counties of Cork, Kerry, Limerick, Clare, Galway and Mayo (McAney, 1994). A single animal was recorded in Co. Roscommon in 2004 (Roche, *pers. comm.,* 2006). Kerry is the main stronghold for this species, followed by Clare, then Galway, Cork, Mayo and Limerick in turn (Kelleher, 2004). Ireland represents the most northerly and westerly limits of the species' distribution (Roche, 2001).

Unlike other bat species, lesser horseshoe bats are unable to crawl and must be able to fly directly into a roost through an opening. At summer roosting sites, females gather in large numbers forming maternity colonies where they give birth to just one young every second year. They are faithful to a roost site and will return to the same site each year. Maternity roosts do not occur in caves in Ireland, however individual lesser horseshoe bats may turn up in caves at any time of year. From September to November, bats leave the maternity roost and go to hibernation sites for the winter. These hibernation sites are structures that maintain a constant low temperature throughout the winter, typically caves, but also souterrains, cellars and icehouses (O' Sullivan, 1994).

Lesser horseshoe bats rely on linear landscape features such as treelines, stonewalls and hedgerows to navigate and commute from roosts to feeding sites, because, unlike other bat species, they do not fly out in the open (Motte & Libois, 2002). The bats forage predominantly in deciduous woodland and riparian vegetation normally within c. 3km of the roost (Motte & Libois, 2002).

## 2. Range

**Dr David Drew has compiled a database of all the known caves in Ireland. He has made this data available to NPWS. NPWS have a database of all known lesser horseshoe bat roosts in Ireland. The range of this habitat has been estimated by overlaying these two datasets - 46 x 10km squares, 4,600 km$^2$.**

### *2.2 Trend*

The range of the lesser horseshoe bat has remained stable in recent decades (McAney, pers. comm., 2006) and there is no evidence that the range of this habitat has changed since the Directive came into force.

## 3. Area covered by the habitat

The measurement of this parameter is problematic. While extensive mapping surveys of some cave systems have been done and the length and area may be known (e.g. Jones et al. 1997; British Speological Society, 2007), a complete national survey has not been undertaken. Furthermore, only parts of any cave will be of value to bats and this in turn may vary from year to year.

**In the absence of more detailed information, which would require extensive field survey, the number of 10km squares where caves and lesser horseshoe bats overlap – 35 10 km squares = 3,500km$^2$ – is taken as the extent of the habitat.**

*3.1 Trend*

The range of the lesser horseshoe bat has remained stable in recent decades (McAney, pers. comm., 2006) and there is no evidence that the area of this habitat has changed since the Directive came into force.

*3.2 Main pressures / threats*

Pressures can relate to activities within the cave itself (e.g. dumping), or to those adjacent to the cave which may impact directly on its structure (e.g road development), or indirectly on the suitability of the cave for lesser horseshoe bats (e.g. adjacent housing). Future threats are considered the same as current pressures.

400 - Human habitation
421 - Disposal of household waste (i.e. dumping of rubbish)
502 - Road development
624 – Speleology (leading to disturbance of the bats)
740 – Vandalism
941 - Inundation

## 4. Specific structures and functions

The structures and functions of this habitat are taken to refer to the factors that make a cave suitable for bats, specifically lesser horseshoe bats. Of particular importance is that there are areas of the cave, accessible to bats, where there is relatively little variation in temperature and humidity (Mitchell & McLeish, 2004). Dumping of household and farmyard waste, disturbance (accidental or deliberate) by humans of roosting bats, and natural events such as flooding, have all been implicated in the loss of value of individual caves for bats. In some cases bat populations may abandon an underground site for less obvious reasons, perhaps due to subtle changes in air-flow patterns (K McAney pers. comm.).

While there has been some work recently (e.g. by Eurobats) to develop best practise guidelines specifically for the protection and management of underground bat roosts, more research to identify the particular factors that make caves suitable (or unsuitable) for lesser horseshoe bats is required. In the meantime, given that lesser horseshoes continue to occupy caves throughout their range in Ireland, with many sites holding over 100 bats, and monitoring data shows that lesser horseshoe bat numbers are increasing here, this parameter can be assessed as favourable.

## 5. Future prospects

The overall conservation assessment for the lesser horseshoe bat in Ireland is Favourable. Nine of the most important cave sites are protected as SACs. Many of the most important bat caves are already protected from disturbance through grilling. A programme is underway to identify further vulnerable cave sites and these will also be grilled. Overall the future prospects for this habitat are considered to be good.

## 6. Complementary information

*6.1 Favourable reference range*

**Range is stable. Current range (4,600 km$^2$) is taken as the FRR.**

*6.2 Favourable reference area*

**More work is required before a meaningful reference area can be estimated. This parameter remains Unknown.**

*6.3 Typical species*

Lesser horseshoe bat. NPWS field staff conduct annual monitoring at maternity and hibernation sites of *Rhinolophus hipposideros*. Approximately 100 known winter sites throughout its range in the west of Ireland are surveyed annually. In 2006, 32 people counted a total of 4,260 bats (approximately 45% of the national population). 153 known summer sites are monitored annually and approximately 5,500 bats were counted in 2006 (approximately 60% of the national population). Although most of the sites included in the annual monitoring programme are known to be important for this species, a proportion of the sites are also included where only a small number of droppings or individual bats have previously been recorded. Most of these minor roosts are at the edge of the bat's range in Ireland and by monitoring these on a regular basis (e.g. every 3 years) it is hoped to chart any changes in the species distribution.

There are indications that this species is increasing in number and possibly range.

## 7. Conclusions

| | |
|---|---|
| **Range** | Favourable (FV) |
| **Area** | Unknown (XX) |
| **Structures & functions** | Favourable (FV) |
| **Future Prospects** | Favourable (FV) |
| **Overall CS Assessment** | Favourable (FV) |

**References**

Jones, G.L., Burns, G., Fogg T. and J. Kelly, J. (1977) *The Caves of Fermanagh and Cavan.* Florencecourt, Co. Fermanagh

Kelleher, C. 2004. Thirty years, six counties, one species – an update on the lesser horseshoe bat *Rhinolophus hipposideros* (Bechstein) in Ireland. *Ir. Nat. J.* 27: 387-392

McAney, C.M. 1994. The lesser horseshoe bat in Ireland – Past, Present and Future. *Folia Zoologica.* 43 (4): 387-392

Mitchell, AJ. & McLeish, AP. (2004) *Bat worker's manual*. JNCC

Motte, G & Libois, R. 2002. Conservation of the lesser horseshoe bat (*Rhinolophus hipposideros* Bechstein, 1800) (Mammalia: Chiroptera) in Belgium. A case study of feeding habitat requirements. *Belg. J. Zool*. 132 (10: 49-54.

Mullan, G. (ed) (2007) *The Caves of County Clare and South Galway.* University of Bristol Speleological Society.

O'Sullivan, P. 1994. Bats in Ireland. Special Zoological Supplement, *The Irish Naturalist's Journal.*

Roche, N. 2001. The status of lesser horseshoe bats *Rhinolophus hipposideros* Bechstein in Co. Limerick. *Ir. Nat. J*. 26: 446-452
Self, CA (1981) *The Caves of County Clare*. University of Bristol Speleological Society .

Tratman E.K. & Hazleton M. 1974 Notes on the Irish Cave sites from which Fauna has been collected. *CRG - Transactions* Vol 15 (4) pp 217 - 220

http://www.caving.ie/caving/ireland/cavinginireland.php

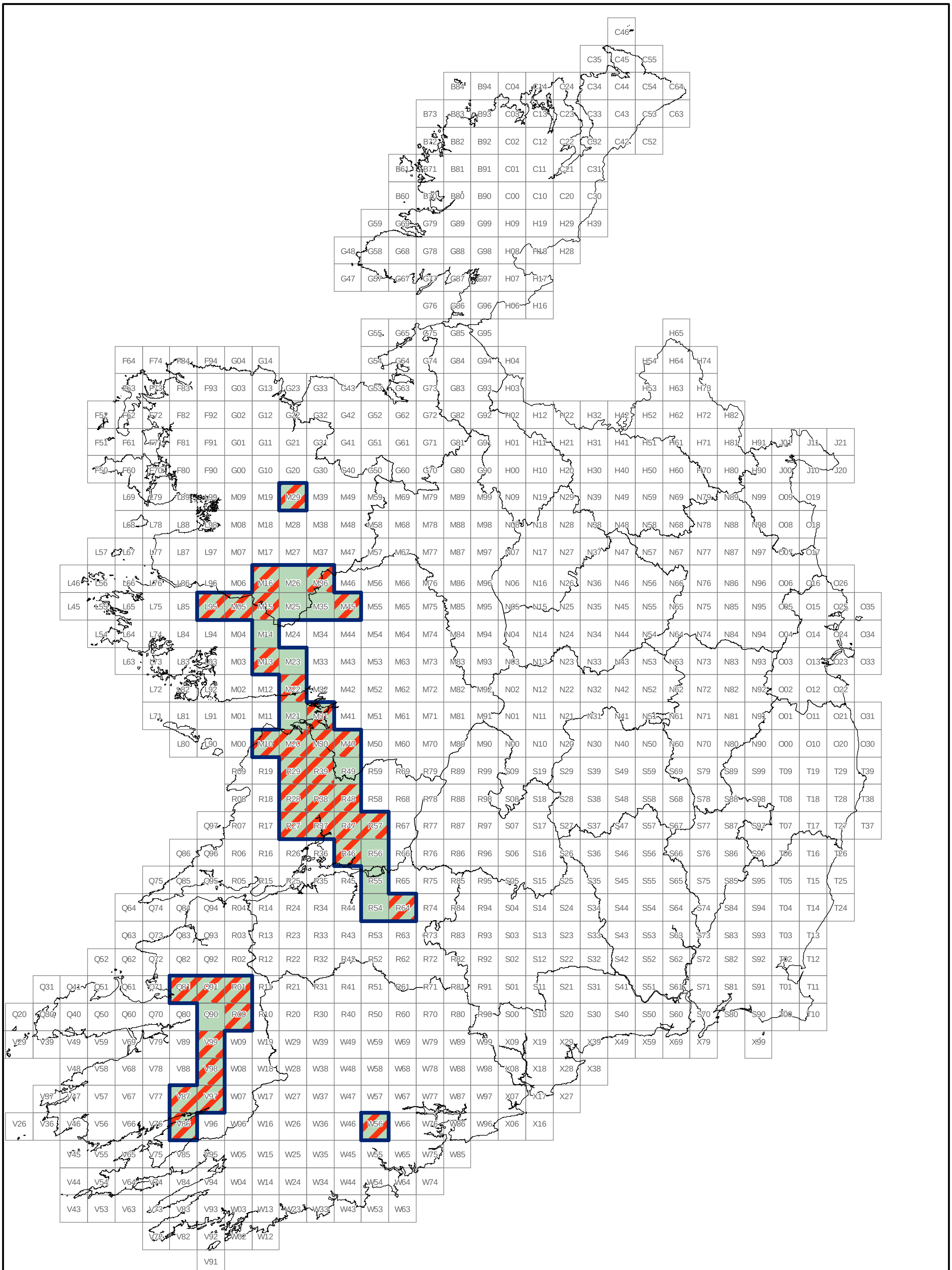
http://www.gsi.ie/

## **8310** Caves not open to the public

| National Level | |
|---|---|
| **Habitat Code** | 8310 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | ▪ Jones, G.L., Burns, G., Fogg T. and J. Kelly, J. (1977) *The Caves of Fermanagh and Cavan.* Florencecourt, Co. Fermanagh<br>▪ Kelleher, C. 2004. Thirty years, six counties, one species – an update on the lesser horseshoe bat *Rhinolophus hipposideros* (Bechstein) in Ireland. *Ir. Nat. J.* 27: 387-392<br>▪ McAney, C.M. 1994. The lesser horseshoe bat in Ireland – Past, Present and Future. *Folia Zoologica.* 43 (4): 387-392<br>▪ Mitchell, AJ. & McLeish, AP. (2004) *Bat worker's manual*. JNCC<br>▪ Mullan, G. (ed) (2007) *The Caves of County Clare and South Galway.* University of Bristol Speleological Society.<br>▪ O'Sullivan, P. 1994. Bats in Ireland. Special Zoological Supplement, *The Irish Naturalist's Journal.*<br>▪ Roche, N. 2001. The status of lesser horseshoe bats *Rhinolophus hipposideros* Bechstein in Co. Limerick. *Ir. Nat. J.* 26: 446-452<br>▪ Self, CA (1981) *The Caves of County Clare*. University of Bristol Speleological Society .<br>▪ Tratman E.K. & Hazleton M. 1974 Notes on the Irish Cave sites from which Fauna has been collected. *CRG - Transactions* Vol 15 (4) pp 217 - 220 |
| **Range** | |
| Surface area | 4,600km² (46 grid cells x 100km²) |
| Date | July 2007 |
| Quality of data | 2 = moderate |
| Trend | Stable |
| Trend-Period | 1994 - 2007 |
| Reasons for reported trend | N/A |
| **Area covered by habitat** | |
| Distribution map | |
| Surface area | 3,500km² |
| Date | July 2007 |
| Method used | 1 = based on expert opinion |
| Quality of data | 1 = poor |
| Trend | Stable |
| Trend-Period | 1994 - 2007 |
| Reasons for reported trend | N/A |
| Justification of % thresholds for trends | |

| | |
|---|---|
| Main pressures | 400 - Human habitation<br>421 - Disposal of household waste (i.e. dumping of rubbish)<br>502 - Road development<br>624 – Spieleology<br>740 – Vandalism<br>941 - Inundation |
| Threats | 400 - Human habitation<br>421 - Disposal of household waste (i.e. dumping of rubbish)<br>502 - Road development<br>624 – Spieleology<br>740 – Vandalism<br>941 - Inundation |
| ***Complementary information*** | |
| **Favourable reference range** | 4,600km$^2$ (The Favourable Reference Range is considered to be the same as the Current Habitat Range) |
| **Favourable reference area** | Unknown |
| **Typical species** | Lesser horseshoe bat *Rhinolophus hipposideros* |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | NPWS conducts annual monitoring at maternity and hibernation sites of *Rhinolophus hipposideros*. Approximately 100 known winter sites throughout its range in the west of Ireland are surveyed annually. 32 people were involved in the survey and in 2006 4,260 bats were counted (approximately 45% of the national population). 153 known summer sites are monitored annually and approximately 5,500 bats were counted in 2006 (approximately 60% of the national population). Although most of the sites included in the annual monitoring programme are known to be important for this species, a proportion of the sites are also included where only a small number of droppings or individual bats have previously been recorded. Most of these minor roosts are at the edge of the bat's range in Ireland and by monitoring these on a regular basis (e.g. every 3 years) it is hoped to chart any changes in the species distribution.<br><br>There are indications that this species is increasing in number and possibly range. |
| ***Conclusions*** ***(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Unknown |
| **Specific structures and functions (incl. typical species)** | Favourable (FV) |
| **Future prospects** | Favourable (FV) |
| **Overall assessment of CS** | Favourable (FV) |



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DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Caves not open to the public**

**8310**

Current Distribution (35 grid squares)
Current Range (46 grid squares)
Favourable Reference Range (46 grid squares)
W48 10km grid squares

Date: January 2008

# Conservation Assessment of Submerged or partially submerged sea caves (8330)

## Habitat characteristics in Ireland

Submerged or partially submerged sea caves vary from being small, i.e. too small for an person to enter to being large caverns 50 – 100m in width that generally taper as they extend back into the shore and may become too narrow for a person to enter. Where a bank of boulders is present at the back of a cave and the area is not continually submerged it may be used as a haul out area by seals. Caves usually occur on cliff faces with entrances extending above the surface of the sea but a number of caves are known to be completely under water and form tunnels or caverns some of which may have both underwater openings and small surface openings. Caves are known to extend up to 1.5 km.

The floor of caves vary from being a sediment floor to bedrock and or boulders. Frequently the sides of caves are devoid of fauna close to the floor due to sediment or boulder scour. Where boulder / sediment scour it intense the cave may have very limited fauna.

## Habitat mapping

The distribution of the Annex I habitat Submerged or Partially Submerged Sea Caves in Ireland has not been systematically mapped with the exception of the cave system at Doolin, Co. Clare.

The Department of Communications, Marine and Natural Resources flew large parts of the coast taking oblique photographs for the purpose of coastal protection. This imagery has provided some information on the location of caves.

A limited amount of information is available from the SCUBA diving community and 23 caves, a number of which are completely under water, have been identified from Hook Head in Co. Wexford to Malin Head, Co. Donegal.

The Ordinance Survey of Ireland 1:50,000 Discovery Series maps were examined to determine where cliffs were likely to be present on the coast and this in combination with place names and the information outlined above was sued to map the likely distribution of caves.

## Habitat Range

Neilson and Costello (1999) estimated that the Irish coast-line had 304 km of cliff, with cliffs occurring from Co Donegal to Co Dublin. No cliffs were recorded for Counties Meath of Louth. As most caves occur in areas where cliffs are present this give an indication of the coastal range but further work is needed to determine the exact distribution of caves. To date no caves have been recorded in areas away from the coast. All known caves occur within 1 km of the coastline. The range of the habitat may alter as better information becomes available.

The current range is considered to be from North Co Dublin to Lough Foyle, Co Donegal and using a combination of the limited information available, and coastal place names caves are estimated to fall within 127 x 100 $kn^2$

**Conservation Status of Habitat Range**
The conservation status of caves is considered to be stable as there is no evidence that significant habitat loss has occurred since the Directive came into force. The current range is considered to be equal to the total historical habitat range and is therefore regarded as the Favourable Reference Range.

**Habitat Area**
The extent of caves is unknown as no caves have been mapped to determine their dimensions and the full distribution of caves is unknown. It is unlikely that they full extent / area covered by the habitat will be known for many years to come due to the difficulties of surveying this habitat.

**Conservation Status of Habitat Area**
While the extent of the habitat is unknown the habitat extent is considered stable as there are no identified human activities that are unlikely to have reduced the habitat area. The current area is considered sufficient to ensure the long-term survival of the habitat and is therefore regarded as equal to the Favourable Reference Area.
Area is therefore assessed as Favourable, in the absence of any significant habitat reduction events (e.g. infilling)

**Habitat Structure and Function**
There is no information on habitat structure and function as good biological data is only available from a very limited number of caves due to the difficulties of access and health and safety issues related to surveying the habitat.

From the limited available information caves support a wide variety of species and the communities present are characterised by sponges, colentrates, ascidians and bryozoans. The variety and extent of the biological communities will depend on the degree of scour and wave action or swell that the habitat is subjected to.

Where narrow caves systems are very regularly frequented by large numbers of divers there is the possibility of damage to the communities present by abrasion and air being trapped on the roof.

Conservation Status of Habitat Structures and Function
Water pollution would pose the greatest threat to the habitat but is not considered to be having a significant impact at present.

In the absences of any known significant human impacts on caves the structure and function is considered to be Favourable.

**Typical species**

Two caves were surveyed by the BioMar Project (Picton and Costello, 19997) surveyed and the species found on the walls and roofs support a community that is typical of steeply sloping rock or overhangs. The walls and roofs are generaly densely covered in encrusting sponges including *Leuconia nivea*, *Clathrina coriacea*, *Dysidea fragilis* and *Dercitus bucklandi*, which is characteristic of caves and crevices. Other species recorded included the hydroid, *Tubularia indivisa*, anthozoans, *Corynactis viridis,*and *Phellia gausapata*, bryozoans *Crisia* spp and *Scrupocellaria reptans*, the sea squirt *Dendrodoa grossularia* and encrusting coralline algae.

All species recorded to date are typical of species occurring on steeply sloping to vertical bedrock in a high energy zones. The species recorded to date are not specific to caves and are widely distributed.

**Threats and Impacts**

701, Water pollution – poor water quality which could lead to a loss of species. The level of threat is considered to be low and any occurrences are likely to impact on a very small proportion of the habitat.

**Future Prospects**

Future prospects are considered to be Favourable for the habitat Submerged or Partially Submerged Sea Caves. This conclusion is derived from expert judgement based on the limited threats and the current information that no sea caves have been identified at distances greater than I km from the shore. In addition full implementation of the Water Framework Directive should ensure that the water quality of coastal and transitional waters does not deteriorate.

Overall Future Prospects
Favourable : Threats are considered negligible.

**Overall Assessment**

- There is no evidence of any significant overall loss of the Submerged or Partially Submerged Sea Cave habitat range or area since the Directive came into force.
- There is no evidence of any significant threats on the habitat.
- At present the habitat is only known to occur with I km of the shore and so full implementation of the Water Framework Directive should ensure that the water quality of coastal and transitional waters does not deteriorate.
- Overall the assessment of the habitat is Favourable.

References

Bell, James, J. (2002) The Sponge Community in a Semi-Submerged Temperate Sea Cave: Density, Diversity and Richness, Marine Ecology 23 (4), 297–311.

Mullan, G. (2003) *Caves of County Clare and South Galway.* University of Bristol Spelaeological Society. Iles Central Press, Bristol. 259pp.

Neilson B. and Costello, M. J.  (1999) The relative length of seashore substrata around the coast of Ireland as determined by digital methods in a geographical information system.  Estuarine and Coastal Shelf Science 49 (4), 501 – 508.

Ordnance Survey of Ireland, 1:50,000 Discovery Series maps.

Picton, B.E. & Costello M. J. (1997) *The BioMar biotope viewer: a guide to marine habitats, fauna and flora in Britain and Ireland*, Environmental Sciences Unit, Trinity College, Dublin.

www.Glacus.org.uk/Green_Holes.htm

www.salteeislands.info.

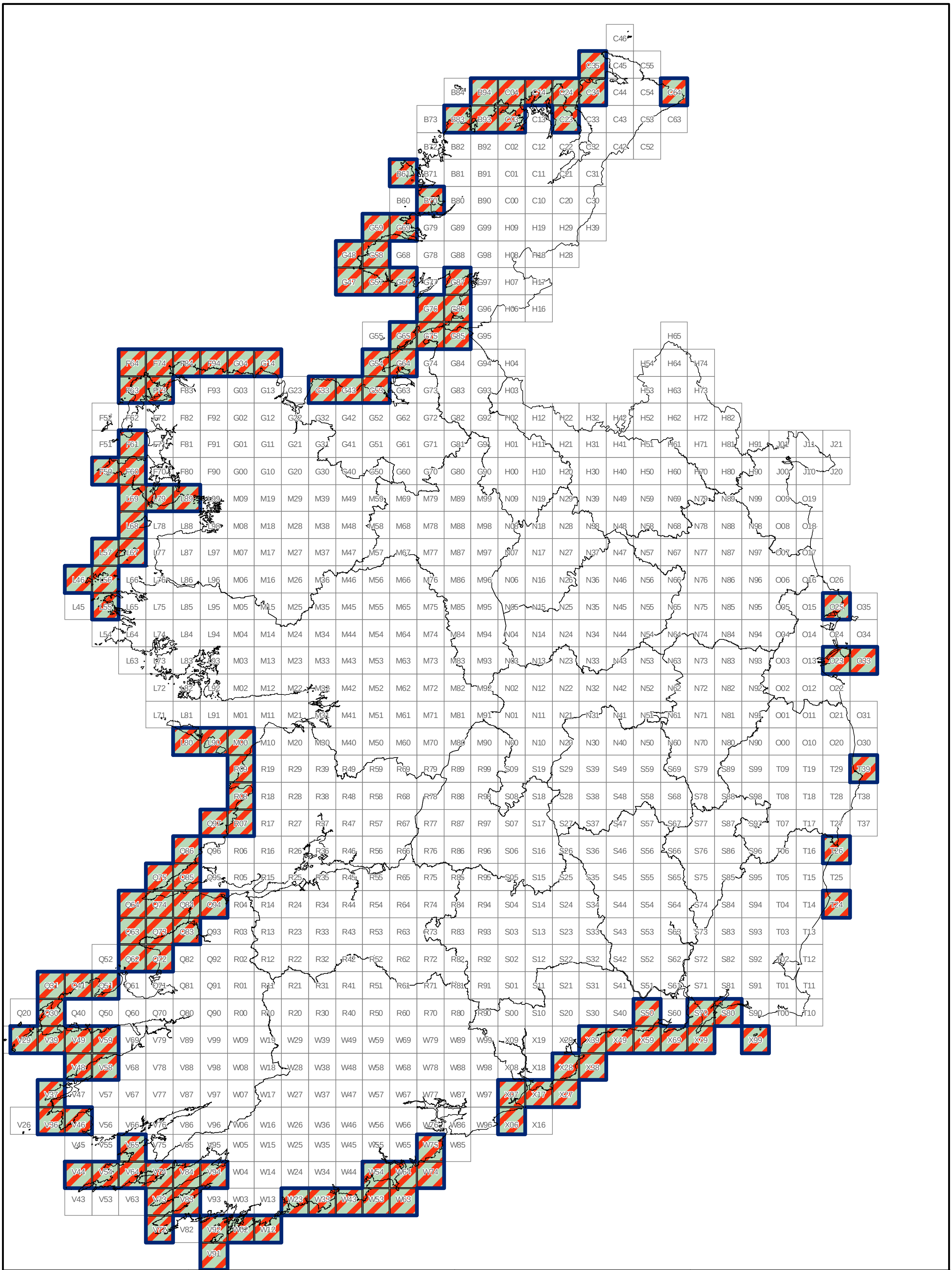
www.tempoweb/diveireland/sites.htm

# 8330 Submerged or partially submerged sea caves

| National Level | |
|---|---|
| **Habitat Code** | 8330 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Marine Atlantic (MATL) |
| **Range** | Marine Atlantic (MATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Marine Atlantic (MATL) |
| **Published sources** | ▪ Bell, James, J. (2002) The Sponge Community in a Semi-Submerged Temperate Sea Cave: Density, Diversity and Richness, Marine Ecology 23 (4), 297–311.<br>▪ Mullan, G. (2003) Caves of County Clare and South Galway. University of Bristol Spelaeological Society. Iles Central Press, Bristol. 259pp.<br>▪ Neilson B. and Costello, M. J. (1999) The relative length of seashore substrata around the coast of Ireland as determined by digital methods in a geographical information system. Estuarine and Coastal Shelf Science 49 (4), 501 – 508.<br>▪ Picton, B.E. & Costello M. J. (1997) The BioMar biotope viewer: a guide to marine habitats, fauna and flora in Britain and Ireland, Environmental Sciences Unit, Trinity College, Dublin.<br>▪ www.Glacus.org.uk/Green_Holes.htm<br>▪ www.salteeislands.info.<br>▪ www.tempoweb/diveireland/sites.htm |
| **Range** | |
| Surface area | 127 X 100 km² |
| Date | April 2007 |
| Quality of data | 1 = poor |
| Trend | Stable |
| Trend-Period | 1990 - 2007 |
| Reasons for reported trend | N/A |
| **Area covered by habitat** | |
| Surface area | Unknown |
| Date | July 2007 |
| Method used | 1= based on expert opinion & 3 = ground based survey |
| Quality of data | 1 = poor |
| Trend | Stable |
| Trend-Period | 1990 - 2007 |
| Reasons for reported trend | N/A |
| Justification of % thresholds for trends | N/A |
| Main pressures | 701 water pollution |
| Threats | 701 water pollution |
| ***Complementary information*** | |
| **Favourable reference range** | 127 X 100 km² |
| **Favourable reference area** | Unknown |

| | |
|---|---|
| **Typical species** | Porifera including *Leuconia nivea, Clathrina coriacea* and *Dysidea fragilis. Dercitus bucklandi*, which is characteristic of caves and crevices, The Hydroid, *Tubularia indivisa* and anthozoans *Corynactis viridis*and *Phellia gausapata* and bryozoans including *Crisia* spp and *Scrupocellaria reptans*, the sea squirt *Dendrodoa grossularia* and coralline algae are also present |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Typical species conservation status: Unknown |
| **Other relevant information** | The full distribution and extent of caves are unknown but based on expert judgement there is no evidence to suggest that the range or extend has changed since the Directive came into force or in the historical past. Caves are considered to fall within 127 100 km2 squares but the area of the habitat will be small fraction of each 100 km2 .The range of the habitat may alter as better information becomes available on cave distribution for both submerged and partially submerged caves. It is unlikely that the full extent / area covered by the habitat will be known for many years to come due to the difficulties of surveying this habitat. Of the species recorded to date none are cave specialists. Algal species are only present at the entrance of caves when there is enough light. |
| ***Conclusions (assessment of conservation status at end of reporting period)*** | |
| **Range** | **Favourable (FV)** - As the current range is equal to the favourable reference range, the overall status of the range is considered to be favourable. |
| **Area** | **Unknown** |
| **Specific structures and functions (incl. typical species)** | **Favourable (FV)** |
| **Future prospects** | **Favourable (FV)** |
| **Overall assessment of CS** | **Favourable (FV)** |



1:1,800,000

0 12.5 25 50 Kilometers

**Submerged or partially submerged sea caves**

**8330**

Current Distribution (127 cells)
Current Range (127 cells)
Favourable Reference Range (127 cells)
W48 10km grid cells

Date: August 2007

AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

**91A0 Old sessile oak woods with *Ilex* and *Blechnum***

## CONSERVATION STATUS ASSESSMENT REPORT

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## 1. Habitat characteristics in Ireland

Sessile oak woods are one of the best studied of Irish woodland types. They occur chiefly on podzolised soils in upland, southern and western regions but also on localised, non-waterlogged acid soils elsewhere. *Ilex aquifolium* typically dominates the understorey with *Luzula sylvatica* swards a characteristic feature of the field layer. Kelly & Moore (1975) classified these woodlands as part of the Blechno-Quercetum association and described three variants. The *scapanietosum* subassociation occurs in areas with high rainfall, and is rich in epiphytes, chiefly bryophytes, lichens and filmy ferns. It is found mainly in the western, oceanic, areas of the country. The *typicum* subassociation occurs in drier regions and on less rocky terrain and is characterised by being comparatively species-poor, due in part to the absence of more oceanic species (Kelly 2006). The *coryletosum* subassociation occurs on soils with a higher base content and differs from the previous two in the greater diversity of tree and herb species. It typically has an understorey dominated by *Corlyus avellana* and is regarded as transitional to the *Fraxinus excelsior* woodlands of the Irish lowlands. These subassociations form the basis of the classification of Cross (2005).

A comprehensive survey of native woodlands in Ireland is currently ongoing (National Survey of Native Woodlands in Ireland, hereafter NSNW). In an interim report by Perrin *et al.* (2006a), which covered the eastern half of the country, a *Quercus petraea - Luzula sylvatica* woodland group was defined which contained almost all vegetation samples that had been recorded in mature sessile oak woods. Within this group, two variations were described. The *Vaccinium myrtillus* vegetation type occurs chiefly on podzolised soils in the eastern uplands with a field layer dominated by a relatively small number of calcifuge species. The *Hedera helix* vegetation type occurs on podzols and brown earths at lower altitudes, and it differs in a more diverse understorey and field layer and the greater frequency of hybrid oaks and *Fagus sylvatica* in the canopy. These two vegetation types evidently match well with the *typicum* and *coryletosum* subassociations described above. The survey of the western half of the country is incomplete, but unpublished data suggests a third vegetation type may emerge matching the *scapanietosum* subassociation.

The definition for 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles (hereafter Old Sessile Oak Woods) presented in the Interpretation Manual (Anon. 2003) most closely matches the oceanic woodlands of the *scapanietosum* subassociation, as these typically contain “low-branched, trees, with many ferns, mosses, lichens and evergreen bushes”. However, a broader interpretation has previously been applied (Fossitt 2000, Cross 2005), in which woodlands from all three subassociations have been included under this EU habitat type, and this is the approach taken in this report. Furthermore, whilst *Arbutus unedo* is included in the definition of Irish sessile oak woods in Anon. (2003), this species has a very restricted range in Ireland and its presence is relatively poor as a defining characteristic of this habitat.

## 2. Habitat mapping

The following data sources were used to map the occurrence of Old Sessile Oak Woods in Ireland on 10km square basis:

- The National Survey of Native Woodlands in Ireland: Second Phase Report (Perrin *et al.* 2006a)
- Unpublished data produced by the NSNW in 2006
- Information on designated sites, (c)SACs and (p)NHAs held on file by the National Parks and Wildlife Service (NPWS)
- Other data sources (Webb & Glanville 1962; Kelly & Moore 1975; Kirby & O’Connell 1982; Poole *et al.* 2003; Lynch 2004)

All 10km squares overlapped by an area of Old Sessile Oak Wood were included. Site synopses were used to locate areas of Old Sessile Oak Wood within designation sites. Range was defined by mapping a minimum polygon around the identified occurrences. Breaks in the range were justified when there was a gap of greater than 2 grid squares between occurrences (not counting squares joined diagonally). Favourable reference range was defined as the current range as it was deemed that this was sufficient to ensure the long term viability of the habitat and that it encompassed the range of ecological variation that occurs in this habitat type in Ireland.

## 3 Habitat range

Old Sessile Oak Woods in Ireland are predominantly found on acidic podzolised soils or brown earths of low fertility, often on sloping ground in upland areas of Ireland. Consequently, Old Sessile Oak Woods are uncommon in the lowland plains of central Ireland where the underlying rock is carboniferous limestone. The area and range of Old Sessile Oak Wood habitat has declined since Neolithic man started to clear the forests in Ireland approximately 5000 BP. A comparison with a map of potential vegetation shows that there have been significant losses in the northeast of the country and contraction of the range in coastal areas. The current range however is still extensive and includes the ecological variation that occurs between the west and east of the country.

### 3.1 Conservation status of habitat range

The favourable reference range has been defined as the current range therefore the status of the habitat range is **favourable**.

**Current range:** 22,800km$^2$ (minimum polygon around grid cells containing habitat)
**Favourable reference range:** 22,800km$^2$ (defined as current range)

## 4 Habitat extent

As stated above human activity over the last 5000 years has drastically reduced the habitat range of Old Sessile Oak Woods in Ireland and the same is true for habitat extent. Old Sessile Oak Woods would have once occupied the majority of their range whereas the known habitat extent of 42.85km$^2$ represents only 0.19% of their current range.

### 4.1 Conservation status of habitat extent

The habitat extent of Old Sessile Oak Woods is decreasing, with 7.2ha of the habitat located within (c)SACs reported as destroyed by NPWS site inspections between 1998 and 2003. Important sites that lost areas of Old Sessile Oak Wood habitat include Glen of the Downs, Co. Wicklow, which lost 2ha to a road widening scheme.

The favourable reference area is very difficult to define. In the absence of dependable information on what would represent a sustainable area, this was set at 228km$^2$, which represents 1% of the favourable reference range. On average, this translates as 100ha in every 10km square. Peterken (2002) suggests that large woods are maintained above 25ha, with smaller woods being at least 3ha. The 1%

level would therefore permit two or three sizeable woods plus several smaller sites in every 10km square, thereby reducing fragmentation.

Due to the fact that the current habitat extent of Old Sessile Oak Woods is 81% below the favourable reference area the conservation assessment for habitat extent is **unfavourable bad**

| |
|---|
| **Current area:** 42.85km$^2$<br>**Favourable reference area:** 228km$^2$ (1% of favourable reference range) |

## 5. Structures and functions

### 5.1 Habitat structures and functions

Within Ireland, Old Sessile Oak Woods have been heavily altered by thousands of years of human activity. What remains is a modified and highly fragmented sample of the primeval forests that once covered large areas of the island. It should therefore be noted that as Ireland no longer contains any pristine examples of Old Sessile Oak Woods, any assessment of structure and function is hampered by a lack of reference points. Knowledge of ecological processes and expert opinion has thus been used to judge what constitutes favourable status for these characteristics.

In assessing the structure and function of Old Sessile Oak Woods the following factors were considered:

- Habitat fragmentation
- Natural regeneration
- Stand structure
- Dead wood
- Fauna

When assessing habitat structures and functions the Explanatory Notes and Guidelines (Anon. 2006) were interpreted where relevant so that if greater than 25% of sites surveyed by the NSNW were judged to be unfavourable as regards any one specific structure or function then the habitat type overall was judged to be in an unfavourable condition.

### Habitat fragmentation

The Old Sessile Oak Woods resource in Ireland is highly fragmented. Of the 188 sites identified the average size is 23ha, with only 24% of sites covering an area of 25ha or more and 15% of sites with an area of less than 3ha. Fragmentation increases the impact of edge effects on the habitat and greatly decreases the area of core woodland habitat. One of the main effects of this on the structure and function of the habitat is that there are now very few specialist species of flora or fauna located within Old Sessile Oak Woods and the number of generalist species recorded within even the core habitats of sites is large. Smaller sites can support only small populations that are more vulnerable to stochastic events. Habitat fragmentation can be regarded as **unfavourable bad**.

### Natural regeneration

Natural regeneration of tree species is evidently an integral function of Old Sessile Oak Woods. Regeneration status at a site can be assessed by counting the number of immature individuals (seedlings, saplings and poles). The data from the NSNW (Perrin *et al.* 2006a, unpublished data) show that *Quercus petraea* poles were recorded as absent from 25% of Old Sessile Oak Woods (Table 1). The data also show that seedlings are absent from 14% of sites and saplings are absent from 32%.

**Table 1: Frequency of *Q. petraea* regeneration at NSNW sites. Seedlings are ≤ 25 cm tall, <7 cm dbh; saplings are < 200 cm tall, <7 cm dbh; pole ≥200 cm tall and dbh <7 cm. Mature *Q. petraea* was frequent to dominant in the canopy of all of the sites included within this data set.**

| | **Modified DAFOR Scale** | | |
|---|---|---|---|
| Regeneration class | Absent | Rare/Occasional | More than Occasional |
| Seedlings | 14% | 66% | 20% |
| Saplings | 32% | 65% | 3% |
| Poles | 25% | 62% | 14% |

The absence of *Q. petraea* poles from 25% of Old Sessile Oak Woods can be considered to be **unfavourable inadequate**.

**Stand structure**

Optimally, woodland structure should remain diverse with a relatively closed canopy layer, a subcanopy layer composed mostly of young mature canopy species and an understorey layer. The current situation within Old Sessile Oak Woods is indicated by the NSNW data set (*Perrin et al.* 2006, unpublished data). *Q. petraea* or the hybrid *Quercus petraea x Q. robur* (*Q.* x *rosacea*) is frequent as a mature tree within 98% of Old Sessile Oak Woods. Frequency of mature trees for the other typical tree species is 52% for *Betula pubescens,* 64% for *Ilex aquifolium* and 19% for *Sorbus aucuparia*. As *Q. petraea* is the most frequent mature tree within Old Sessile Oak Woods the structural data for mature *Q. petraea* stems within relevant relevés surveyed during NSNW was analysed and the data are presented in Figure 1.

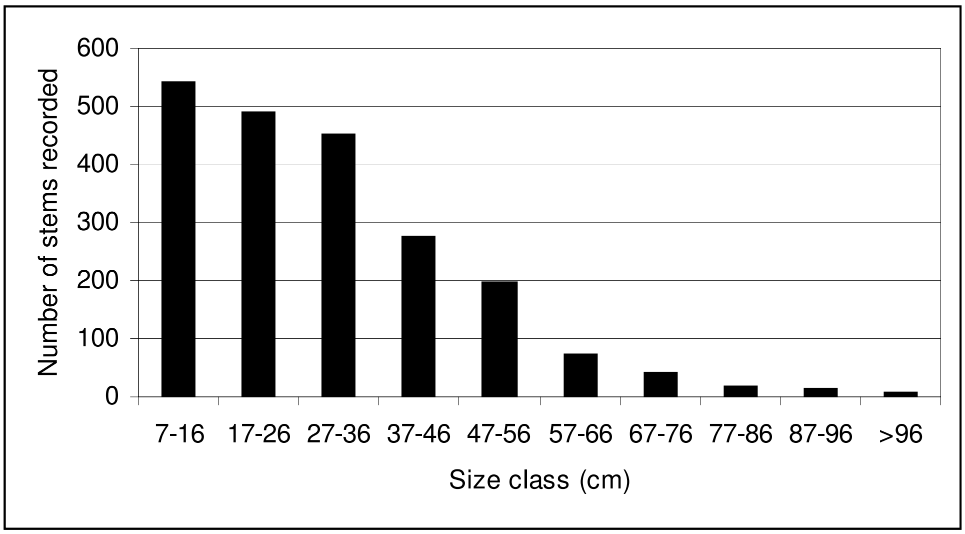


**Figure 1**: **Number of *Quercus petraea* stems recorded in 10cm size classes. All mature *Q. petraea* trees recorded by NSNW within Old Sessile Oak Wood relevés with a stem ≥7cm in diameter were included.**

*Q. petraea* is most frequent in the smaller size classes and least frequent in the larger size classes, a scenario you would expect within a sustainable population. However, the drop off in the curve after size class 27-36 cm is noticeable and this together with the fact that only 7.2% of mature trees have a diameter >56 cm indicate that the overall structure of Old Sessile Oak Woods in Ireland tends towards younger and smaller trees than would be expected in a primary example of the habitat. This is due to the relatively young nature of *Q. petraea* stands within Ireland due to clearfelling and replanting over the last few centuries and the selective felling of larger trees. Stand structure is **unfavourable inadequate** with less than 10% of mature trees having a diameter greater than 56cm

**Dead wood**

Dead wood increases the range of substrates available to lichens and bryophytes and provides important niches and resources for other taxa, most notably invertebrates. The accumulation of a range of dead wood type takes time and is indicative of older woodlands. The removal of large stature dead wood from intensively managed sites can reduce their conservation status.

The NSNW recorded the frequency of dead wood in Old Sessile Oak Woods and found that smaller woody debris, such as branches and twigs, were the most abundant types of dead wood, being recorded as at least occasional on the DAFOR scale at 98% of sites. Larger dead wood structures such as standing dead and uprooted trees were recorded as at least occasional at 89% of sites. Such a pattern is unsurprising given the nature of the different categories: smaller woody debris may be generated by most trees in most years, whereas large dead wood structures such as uprooted trees are a less frequent occurrence. The fact that larger dead wood structures are rare or absent from 11% of sites may be indicative of the young nature of some of the surveyed sites, but could also be a consequence of human removal of older trees from sites. Due to this lack of larger dead wood, the dead wood component of the habitat is regarded as **unfavourable inadequate**.

**Mammals**

Red deer (*Cervus elaphus*) is the only extant large herbivore native to Ireland (Mitchell 2005), wild boar (*Sus scrofa*) having been long extinct. The red deer population in Ireland is much modified with the introduction of non-Irish red deer populations and some localised hybridisation between red deer and introduced sika deer (*Cervus nippon*). Due to the extinction of the wolf (*Canis lupus*) in Ireland, red deer no longer have an effective natural predator and in certain areas of Ireland this has resulted in an increase in grazing pressure on woodlands. The distribution of red deer in Ireland is also patchy with the species being absent from some areas of the current range of Old Sessile Oak Woods.

The function of smaller mammals (e.g. *Sciurus vulgaris, Lepus timidus hibernicus, Meles meles, Neosciurus carolinensis*, *Martes martes*) that are found in Old Sessile Oak Woods is either minimal or unclear based on present available data. For some of these species these woods are not their primary habitat.

In addition to mammals other fauna such as birds and invertebrates should also be used in the assessment of Old Sessile Oak Woods, however currently there is very little data available on these groups within Irish Old Sessile Oak Woods.

In the case of the fauna of Old Sessile Oak Woods the current situation is **unfavourable bad** with the only extant native large herbivore, the red deer, being patchily distributed and suffering locally from outbreeding and hybridisation.

### 5.1.1. Conservation Status of Habitat Structures and Functions

Old Sessile Oak Woods are an extremely fragmented habitat with 76% of sites less than 25ha in size, a situation that is **unfavourable bad**. Natural regeneration within Old Sessile Oak Woods, represented by the main canopy species *Quercus petraea*, is **unfavourable inadequate** with 25% of sites having no *Q. petraea* poles, the next generation of canopy trees. Stand structure is **unfavourable inadequate** with less than 10% of mature trees having a diameter greater than 56cm, i.e. a general absence of veteran trees. Larger dead wood structures were absent from 11% of sites a situation that is **unfavourable inadequate**. Finally, the mammal component of Old Sessile Oak Woods is judged to be **unfavourable bad** with red deer being patchily distributed and suffering locally from outbreeding and hybridisation. Overall the conservation status of habitat structures and functions is **unfavourable bad**.

## 5.2. Typical Species

Due to the long-term and widespread nature of the modification to this habitat it is difficult to assess with confidence what may or may not have once been a “typical species”. As a result of its long history of fragmentation and greatly reduced area most species now found in this habitat are also commonly found in other woodland types (e.g. *Betula pubescens* dominated stands) or non-woodland habitats (e.g. heath). A few species which might potentially be regarded as specialists for this habitat (e.g. *Trichomanes speciosum* and *Gymnocarpium dryopteris*) are now either extinct or very rare. There is insufficient information to assess whether these species were ever widespread enough to be suitable as status indicator species for the habitat as whole. It should therefore be noted that few if any species in this list are "species which are inseparable from the habitat – other than those on which the habitat is defined" as recommended by in the assessment guidelines (Anon. 2006).

Ireland has a depauperate vascular flora in comparison with the rest of Europe due to its geographic position (Webb 1983) and Old Sessile Oak Woods in Ireland are species-poor in terms of vascular plants even in comparison with other native woodland types. Much of the species diversity lies in the bryophyte component, although this diversity differs considerably between the habitat variants, being particularly rich in the western, oceanic woodlands. In compiling the list of typical species, each of the variants was therefore assessed separately (Table 2). The data

**Table 2: Typical species for Old Sessile Oak Woods habitat in Ireland. Data are from: Perrin *et al.* (2006a) [1], Kelly & Moore (1975) [2]. Species in bold are indicator species for *Quercus petraea –Luzula sylvatica* woodland as defined by Perrin *et al.* (2006a).**

| Typical species | Frequent *Vaccinium myrtillus* vegetation type species (>60%) [1] | Frequent *Hedera helix* vegetation type species (>60%) [1] | Frequent *scapanietosum* subassociation species (>80%) [2] |
|---|---|---|---|
| *Betula pubescens* | * | | |
| ***Blechnum spicant*** | * | | * |
| *Calypogeia muellerana* | | | * |
| *Dicranum scoparium* | * | | * |
| *Diplophyllum albicans* | | | * |
| *Dryopteris dilatata* | * | * | |
| *Hedera helix* | | * | * |
| *Hylocomium brevirostre* | | | * |
| *Hypnum andoi* | * | | |
| *Hypnum cupressiforme* | * | | |
| *Hypnum jutlandicum* | | | * |
| ***Ilex aquifolium*** | * | * | * |
| ***Isothecium myosuroides*** | * | * | * |
| *Kindbergia praelongum* | | | * |
| ***Lonicera periclymenum*** | * | * | |
| ***Luzula sylvatica*** | * | | * |
| ***Mnium hornum*** | | | * |
| *Plagiothecium undulatum* | | | * |
| ***Polytrichastrum formosum*** | * | | * |
| ***Pseudotaxiphyllum elegans*** | | | * |
| *Pteridium aquilinum* | * | | |
| ***Quercus petraea*** | * | * | * |
| *Rhytidiadelphus loreus* | | | * |
| *Rubus fruticosus* | | * | |

| | | | |
|---|---|---|---|
| *Saccogyna viticulosa* | | | * |
| *Scapania gracilis* | | | * |
| *Sorbus aucuparia* | * | | |
| *Thuidium tamarascinum* | * | * | * |
| ***Vaccinium myrtillus*** | * | | * |

for the *scapanietosum* subassociation presented by Kelly & Moore (1975) was used, selecting those species occurring in 80% or more of the samples. The data for the *Vaccinium myrtillus* and *Hedera helix* vegetation types from Perrin *et al.* (2006a) were used in favour of their corresponding subassociations due to larger sample sizes. As the data from the NSNW is from a large number of different woods with less replication at each site, a lower threshold of 60% was used for selecting species. *Fagus sylvatica*, which was frequent in the *Hedera helix* vegetation type, was removed as it is not native in Ireland. This list of frequent species includes all of the ten indicator species identified by Perrin *et al.* (2006a) as differentiating *Quercus petraea – Luzula sylvatica* woodland from other native woodland types. Only three character species are presented in the Interpretation Manual (Anon. 2003) for Old Sessile Oak Woods: *Quercus petraea*, *Ilex aquifolium* and *Blechnum* ssp. [sic], and these are also included in the list.

#### 5.2.2. Conservation Status of Habitat Typical Species

Due to lack of natural regeneration at many important sites (discussed above) the conservation status of several of the trees in the typical species list (e.g. *Quercus petraea, Ilex aquifolium, Sorbus aucuparia*), may be regarded as unfavourable. Furthermore, there has been little emphasis in the past on the use of local provenance seed. There may therefore have been negative impacts on the conservation status of the native *Quercus petraea* genotype. Due to heavy grazing at many important sites (discussed below) the status of several palatable species (e.g. *Luzula sylvatica*, *Vaccinium myrtillus*, *Blechnum spicant*, *Lonicera periclymenum*) may be regarded as unfavourable. Most of the remaining species are bryophytes; their status may tentatively be regarded as stable and therefore favourable.

## 6. Impacts and Threats

Old Sessile Oak Woods in Ireland face both internal and external threats. Internal effects include inappropriate grazing levels and invasive species, whereas external threats include clearance for agriculture or felling for timber. The increasing number of road schemes and housing developments currently occurring in Ireland has also negatively impacted upon this habitat. There is little quantifiable data available on losses due to these activities, partly due to lack of baseline data prior to the NSNW. However, the data presented in Section 4.1 from the NPWS site inspection reporting forms has shown that there have been recent negative impacts even on Old Sessile Oak Woods within (c)SACs e.g. the loss of 2ha from Glen of the Downs due to a road widening scheme. Currently more information is available on internal threats to this habitat, which consist primarily of inappropriate grazing levels and invasive species.

### 6.1 Grazing

Grazing is a natural feature of Old Sessile Oak Woods, but high levels of grazing can be detrimental. Heavy grazing reduces or precludes natural regeneration and impacts on the diversity and species composition of the field layer through the suppression of palatable species (e.g. *Rubus fruticosus* and *Luzula sylvatica*) and the associated promotion of unpalatable or grazing-tolerant species (e.g. grasses). Conversely, a complete lack of grazing can also be undesirable as strong competitors, such as *Rubus fruticosus*, can dominate the field layer, again effecting diversity and species composition. Species favoured by disturbance of the soil and litter layers may also decline.

Overall, overgrazing was not a feature of the Old Sessile Oak Woods surveyed by the NSNW (Perrin *et al.* 2006a, unpublished data). High and severe grazing levels were infrequently encountered, occurring at 8% and 9% of sites respectively. Deer (45% of sites) and cattle (25% of sites) were the most frequently identified grazers. Deer observed included red deer and introduced sika deer and fallow deer (*Dama dama*). Cattle were, unsurprisingly recorded largely at lowland sites but deer were recorded from sites at a range of altitudes. Sheep, rabbits, horses, goats, and hares were recorded much less frequently. However, the sites at which heavy grazing does occur include several of those deemed to be of high conservation status (e.g. Killarney National Park, Wicklow Mountains National Park), and at some of these the problems are chronic (Kelly 2000, Kelly 2002, Perrin *et al.* 2006b, P. Perrin and D. Kelly, unpublished data).

Conversely, at 20% of sites no grazing was apparent. These woods may have been ungrazed because they were enclosed by walls, ditches or fences, or in arable or urban landscapes. Overall, it may be regarded that 37% of sites had suboptimal (no grazing or high/severe grazing) grazing levels.

**Grazing trend**

No comparable records are available.

## 6.2 Invasive species

The four most common invasive plant species found in Old Sessile Oak Woods are *Rhododendron ponticum, Prunus laurocerasus, Fagus sylvatica* and *Acer pseudoplatanus*.

### 6.2.1 *Rhododendron ponticum*

The negative effects of *R. ponticum* in Old Sessile Oak woods, such as shading out the herb layer and preventing tree regeneration are well documented (Neff 1975, Cross 1982, Hayes *et al*. 1991, Barron 2000). *R. ponticum* is a serious threat due to its high fecundity and the difficulties in removing it from an area once a serious infestation has occurred. Despite concerted efforts to manage *R. ponticum* in various woodlands over the past decades, few sites have been successfully cleared (Barron 2000). Data from the NSNW show that *R. ponticum* was present in 36% of Old Sessile Oak Woods and was deemed a high level threat at 13% of sites. Infested sites included several which are deemed to be of particularly high conservation status (e.g. site in the National Parks).

### 6.2.2 *Prunus laurocerasus*

Unlike *Rhododendron* the negative effects of *P. laurocerasus* in Old Sessile Oak Woods within Ireland have not been well documented, but the main effects on the structure and function of the woodland are similar as it can drastically reduce the amount of light reaching the herb layer preventing the growth of the native species including tree seedlings. It is viewed as a less aggressive invader then *R. ponticum*. Data from the NSNW show that *P. laurocerasus* was present in 21% of Old Sessile Oak Woods and the species was a high level threat at 8% of these sites. It should be noted that *P. laurocerasus* was only present in 9% of woods in the west of Ireland compared to 31% in the east.

### 6.2.3 *Fagus sylvatica*

*F. sylvatica* was present in 80% of the Old Sessile Oak Woods surveyed by the NSNW, making it the most common of the four main invasive species, and was frequent in 27% of the sites. There is very little quantitative data on the invasive potential of *F. sylvatica* in Ireland. Due to the heavy shade it casts, high shade tolerance and unpalatability it has the potential to out-compete native oaks. *F. sylvatica* also has the negative effect on the field layer of producing a deep, acidifying and smothering litter layer.

6.2.4 *Acer pseudoplatanus*

*A. pseudoplatanus* was present in 61% of the Old Sessile Oak Woods surveyed by the NSNW, but was frequent in only 6% of the sites. There is very little quantitative data on the invasive potential of *A. pseudoplatanus* in Ireland. It is regarded as being a more serious invasive threat in woodlands on base-rich soils, where it may compete with *Fraxinus excelsior* as a canopy dominant.

**Invasive species trend**

No comparable records are available.

### 6.3 Planting of non-native conifers

Data from the NSNW (Perrin *et al.* 2006a, unpublished data) show that old conifer planting had occurred at 46% of sites, but new conifer planting (generally within the last 10 years) had only occurred at 8% of sites. Although some non-native conifer species that are planted within Old Sessile Oak Woods can regenerate within the woodland they do not pose a significant invasive threat. However, the planting of conifers do have a negative impact on Old Sessile Oak Woods primarily because of the disturbance that occurs during planting and the competitive effects on native species.

**Planting of non-native conifers trend**

No comparable records are available.

### 6.4 Felling of native tree species

Generally there should be no felling of native tree species within Old Sessile Oak Woods. Canopy gaps and standing or fallen dead wood should be allowed to generate naturally. However, if felling takes place within a sustainable forest management plan it is not necessarily a threat and coppicing may also be an appropriate management option in hazel-rich variants of this habitat. Data available from Old Sessile Oak Woods sites surveyed during the Native Woodland Survey of Ireland show that the felling of native tree species had occurred at 11% of sites.

**Felling of native tree species trend**

No comparable records are available.

# 7 Future Prospects

## 7.1 Negative Future Prospects

As 37% of Old Sessile Oak Wood sites have sub-optimal grazing, the most invasive shrub species *Rhododendron* is present in 36% of sites and the most invasive tree species *Fagus sylvatica* is present in 80% of sites, the future prospects with regards to these factors may be regarded as **unfavourable bad**. The recent planting of conifers at 8% of sites and the felling of native tree species at 11% sites may be regarded as **unfavourable inadequate**.

## 7.2 Positive Future Prospects

Currently, 41% of Old Sessile Oak Wood sites are within a (c)SAC and an additional 30% of sites are within a (p)NHA, resulting in 71% of all sites being within a designated area. This optimism must be tempered by the fact that losses of this habitat are still occurring within (c)SACs and improved enforcement may be necessary.

The Native Woodland Scheme launched in 2000 provides government funding for the planting of new native woodlands and the restoration of existing sites (Anon. 2005). In August 2006, 126 restoration projects involving 590ha of woodland and 35 establishment projects involving 340ha had been approved. Approximately 32% of these projects would have involved Old Sessile Oak Woods (Forest Service, unpublished data). These projects include restoration of Old Sessile Oak Woods at several NPWS properties, mostly statutory Nature Reserves. These include: Vale of Clara, St. Saviour’s Wood and Deputy’s Pass, Co. Wicklow; Glengarriff Woods and Ballyvourney Woods, Co. Cork; Uragh Wood, Co. Kerry; Derrycrag Wood, Co. Galway; Union Wood, Co. Sligo. Works conducted include removal of non-native conifers and *Rhododendron* clearance.

Under the People's Millennium Forest Project, Coillte Teoranta (the state-sponsored forestry company) are restoring sessile oakwoods at several sites around the country including: Ballygannon Wood, Co. Wicklow; Rosturra Wood, Co. Galway; Rossacroonaloo, Co. Kerry; Brackloon Wood, Co. Mayo; Derrygorry Wood, Co. Monaghan; Cullentra Wood, Co. Sligo. Planting of new woodlands at green-field sites suitable for sessile oak woods (Derrygill, Co. Galway; Camolin Park, Co. Wexford; Shelton Abbey, Co. Wicklow) has also occurred under this scheme.

These restoration / planting initiatives are evidently positive steps but they do come with some caveats. The most frequent response to overgrazing has been to erect deer fencing (e.g. Ullauns Wood, Killarney National Park), despite evidence that total exclusion of grazers may have negative impacts; a better approach would be reduction of the deer population. In the Killarney National Park a *Rhododendron* clearance initiative conducted by volunteers has had significant success in removing this invasive species from several Old Sessile Oak Woods (Barron 2000). However, in Glenveagh National Park there has been significant failure to match this progress over a similar timescale due to lack of a consistent, systematic eradication effort. Finally, areas of new planting must be of appropriate species and managed appropriately in the long-term before being deemed as Old Sessile Oak Woods.

These aspects by their nature must be regarded as **favourable**.

### 7.3 Overall habitat future prospects

Despite several positive prospects, overall the habitat future prospects are **unfavourable bad.**

## 8 Overall Assessment of the Habitat Conservation Status

- The Favourable Reference Range (FRR) has been defined as the current range therefore the status of the habitat range is **favourable**.
- The current habitat extent of is more than 10% below the Favourable Reference Area (FRA) and thus **unfavourable bad**. The FRA is defined as 1% of the FRR area.
- An **unfavourable bad** assessment is also given to the habitat structures and functions, with the extremely fragmented nature of Old Sessile Oak Woods contributing to this assessment.

- The habitat's future prospects are deemed to be **unfavourable bad**. Sub-optimal grazing levels and the presence of invasive species in more than 25% of sites severely threatens the viability of the habitat. Major positive management actions including the removal of invasive species are required.

Thus, considering the **unfavourable bad** assessment for three of the habitat's attributes the overall conservation status for Old Sessile Oak Woods is **unfavourable bad**.

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**Appendix 1**: An index of the 188 Old Sessile Oak Woods within Ireland listed alphabetically by county.

| Site Name | County | Primary Selection Criteria |
|---|---|---|
| Baggot's Wood | Carlow | NSNW Site |
| Carrickduff Wood | Carlow | NSNW Site |
| Clonogan Wood | Carlow | NSNW Site |
| Coolaphuca | Carlow | NSNW Site |
| Orchard | Carlow | NSNW Site |
| Deerpark | Cavan | NSNW Site |
| Derinish More Wood | Cavan | NSNW Site |
| Ballykelly Woods | Clare | NSNW Site |
| Bealkelly Woods | Clare | NSNW Site |
| Caherkillania | Clare | Designated Site |
| Cahermurphy | Clare | NSNW Site |
| Cahiracon | Clare | Designated Site |
| Cloggagh Wood | Clare | NSNW Site |
| Derrygoul Wood | Clare | NSNW Site |
| Derrymore Wood | Clare | NSNW Site |
| Dooros | Clare | NSNW Site |
| Garrannon Woods | Clare | NSNW Site |
| Glenomra | Clare | Designated Site |
| Knocknageeha | Clare | NSNW Site |
| Maryfort | Clare | NSNW Site |
| Old Railway | Clare | NSNW Site |
| Oysterman's Marsh | Clare | Designated Site |
| Violethill | Clare | NSNW Site |
| Aghabeg | Cork | NSNW Site |
| Aghaneenagh | Cork | NSNW Site |
| Ardamadare | Cork | Designated Site |
| Ballyedmond | Cork | NSNW Site |
| Barrees | Cork | NSNW Site |
| Bride Valley | Cork | Designated Site |
| Carrigskullihy Wood | Cork | NSNW Site |
| Castletownshend | Cork | Designated Site |
| Cleanderry Wood | Cork | NSNW Site |
| Coolmoohan Wood | Cork | NSNW Site |
| Curragh East | Cork | NSNW Site |
| Derreennacusha | Cork | NSNW Site |
| Drinshane Beg | Cork | NSNW Site |
| Dromasta | Cork | NSNW Site |
| Dromore | Cork | NSNW Site |
| Gearagh | Cork | Designated Site |
| Glanatnaw Wood | Cork | NSNW Site |
| Glengarrif | Cork | Designated Site |
| Gortnascreeny Wood | Cork | NSNW Site |
| Lahardane More | Cork | NSNW Site |
| Leamlara | Cork | Designated Site |
| Lough Allua | Cork | Designated Site |
| Priory | Cork | Designated Site |
| **Site Name** | **County** | **Primary Selection Criteria** |
| Prohus | Cork | NSNW Site |

| | | |
|---|---|---|
| Shournagh Valley | Cork | Designated Site |
| St. Gobnet's / Ballyvourney Woods | Cork | Designated Site |
| Ardnamona Wood | Donegal | NSNW Site |
| Ards Forest Park | Donegal | NSNW Site |
| Ballyarr Wood | Donegal | NSNW Site |
| Ballynarry | Donegal | NSNW Site |
| Carndonagh | Donegal | NSNW Site |
| Cottian Wood | Donegal | NSNW Site |
| Crolly Bridge Woods | Donegal | NSNW Site |
| Derkmore Wood | Donegal | NSNW Site |
| Derrybeg | Donegal | NSNW Site |
| Derrynamansher | Donegal | NSNW Site |
| Foxhall | Donegal | NSNW Site |
| Glenineeny | Donegal | NSNW Site |
| Keadew Upper | Donegal | NSNW Site |
| Mullangore Wood (Glenveagh NP) | Donegal | NSNW Site |
| Rathmullan Wood | Donegal | NSNW Site |
| Roxborough Glebe | Donegal | NSNW Site |
| Salt Pans | Donegal | NSNW Site |
| Fitzsimons Wood | Dublin | NSNW Site |
| Connemara Islands | Galway | Miscellaneous |
| Dernasliggaun | Galway | Designated Site |
| Derryclare | Galway | Designated Site |
| Derrycrag Wood | Galway | NSNW Site |
| Doon | Galway | Designated Site |
| Drummin Wood | Galway | NSNW Site |
| Gortacarnaun | Galway | NSNW Site |
| Kylemore | Galway | Designated Site |
| Lahardaun West | Galway | NSNW Site |
| Pollnaknockaun Wood | Galway | NSNW Site |
| Shannawoneen | Galway | Miscellaneous |
| Camillan Wood | Kerry | NSNW Site |
| Derrycunihy Wood | Kerry | NSNW Site |
| Dooneen | Kerry | Designated Site |
| Glanmore Lake | Kerry | Designated Site |
| Lehid Wood | Kerry | NSNW Site |
| Lough Caragh | Kerry | Miscellaneous |
| Mucksna | Kerry | Designated Site |
| Tomies Wood | Kerry | NSNW Site |
| Uragh | Kerry | Designated Site |
| Brownstown Wood | Kilkenny | NSNW Site |
| Coolnamuck | Kilkenny | NSNW Site |
| Cullentragh | Kilkenny | NSNW Site |
| Dysart | Kilkenny | NSNW Site |
| Garryricken North | Kilkenny | NSNW Site |
| Grenan Wood | Kilkenny | NSNW Site |
| Kylecorragh | Kilkenny | NSNW Site |
| Troyswood | Kilkenny | NSNW Site |
| **Site Name** | **County** | **Primary Selection Criteria** |
| Brittas | Laois | NSNW Site |
| Cloonaquin Wood | Leitrim | NSNW Site |
| Garadice Wood | Leitrim | Designated Site |
| Ballcoskerry | Limerick | Miscellaneous |

| | | |
|---|---|---|
| Ballynacourty | Limerick | Designated Site |
| Clare Glen | Limerick | Designated Site |
| Glenanair | Limerick | Miscellaneous |
| Glenastar | Limerick | Designated Site |
| Glenstal | Limerick | Designated Site |
| Heathfield | Limerick | Designated Site |
| Templeglantin | Limerick | Miscellaneous |
| Erne Head | Longford | NSNW Site |
| Kiltyclogh | Longford | NSNW Site |
| Brackloon | Mayo | Designated Site |
| Oldhead | Mayo | Designated Site |
| Pontoon | Mayo | Designated Site |
| Derrygorry Wood | Monaghan | NSNW Site |
| Ballincor Demesne Bogwood | Offaly | NSNW Site |
| Derryad North East | Offaly | NSNW Site |
| Graigue South | Offaly | NSNW Site |
| Correagh | Sligo | NSNW Site |
| Cullentra Wood | Sligo | NSNW Site |
| Slishwood | Sligo | NSNW Site |
| Union Wood | Sligo | NSNW Site |
| Eaa Moir | Tipperary | Miscellaneous |
| Geary's Wood | Tipperary | Miscellaneous |
| Inchinsquillib | Tipperary | Designated Site |
| Keale River | Tipperary | Miscellaneous |
| Knockanavar | Tipperary | Designated Site |
| Mount Russell | Tipperary | Miscellaneous |
| Scaragh | Tipperary | Designated Site |
| Ballinatray | Waterford | Designated Site |
| Dromona | Waterford | Designated Site |
| Glendine | Waterford | Designated Site |
| Glenmore Glen | Waterford | Designated Site |
| Lismore Glen | Waterford | Designated Site |
| Newport / Carrigane | Waterford | Designated Site |
| Nier Valley | Waterford | Designated Site |
| Rincrew | Waterford | Designated Site |
| Toor | Waterford | Designated Site |
| Lough Slevin's Wood | Westmeath | NSNW Site |
| Ballingarry Wood | Wexford | NSNW Site |
| Ballyfad | Wexford | NSNW Site |
| Ballyhighland | Wexford | NSNW Site |
| Ballynabarny Wood | Wexford | NSNW Site |
| Ballynacoolagh | Wexford | NSNW Site |
| Big Wood | Wexford | NSNW Site |
| Bricketstown House | Wexford | NSNW Site |
| Camolin | Wexford | NSNW Site |

| Site Name | County | Primary Selection Criteria |
|---|---|---|
| Coolpuck Wood | Wexford | NSNW Site |
| Glandoran Upper / Carthy's Wood | Wexford | NSNW Site |
| Kililnahue | Wexford | Miscellaneous |
| Killoughrum Forest | Wexford | NSNW Site |
| Mountgarrett | Wexford | NSNW Site |
| Stokestown | Wexford | NSNW Site |
| Tombrick Lower | Wexford | NSNW Site |

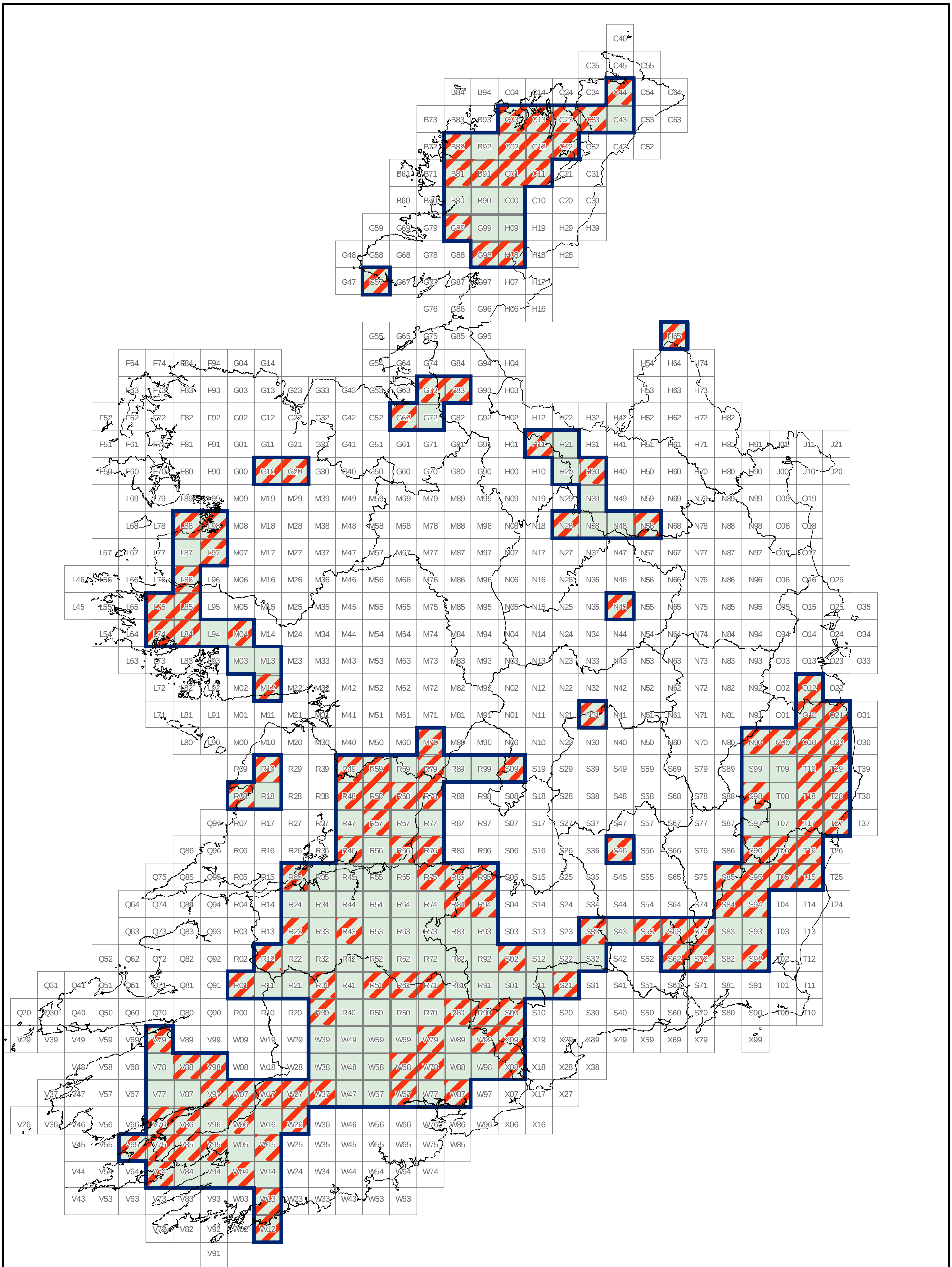
| | | |
|---|---|---|
| Tombrick Wood | Wexford | NSNW Site |
| Altidore Demesne | Wicklow | NSNW Site |
| Avondale | Wicklow | NSNW Site |
| Ballard Hill | Wicklow | NSNW Site |
| Ballard Lower | Wicklow | NSNW Site |
| Ballinagee Wood | Wicklow | NSNW Site |
| Ballyarthur | Wicklow | NSNW Site |
| Ballymacsimon | Wicklow | NSNW Site |
| Ballyross Wood | Wicklow | NSNW Site |
| Baltynanima | Wicklow | NSNW Site |
| Barnbawn | Wicklow | NSNW Site |
| Bray Head Woodland | Wicklow | NSNW Site |
| Brockagh | Wicklow | NSNW Site |
| Brockagh South | Wicklow | NSNW Site |
| Castlehoward | Wicklow | NSNW Site |
| Castlekevin | Wicklow | NSNW Site |
| Cronroe | Wicklow | NSNW Site |
| Deputy's Pass | Wicklow | NSNW Site |
| Derrybawn | Wicklow | NSNW Site |
| Glen of the Downs | Wicklow | NSNW Site |
| Glenwood | Wicklow | NSNW Site |
| Hollywood Glen | Wicklow | NSNW Site |
| Kelshabeg | Wicklow | NSNW Site |
| Kilcarra West | Wicklow | NSNW Site |
| Kilmacrea Wood | Wicklow | NSNW Site |
| Kiltimon | Wicklow | NSNW Site |
| Knocksink | Wicklow | NSNW Site |
| Luggala Lodge | Wicklow | NSNW Site |
| Oldboleys | Wicklow | NSNW Site |
| Roundwood | Wicklow | NSNW Site |
| Shelton Abbey North | Wicklow | NSNW Site |
| Templelyon Upper | Wicklow | NSNW Site |
| The Devil's Glen | Wicklow | NSNW Site |
| The Giants Cut & Lugduff | Wicklow | NSNW Site |
| The Quill Woods | Wicklow | NSNW Site |
| Tomnafinnoge | Wicklow | NSNW Site |
| Vale of Clara | Wicklow | NSNW Site |

## 91A0 Old sessile oak woods with *Ilex* and *Blechnum*

| National Level | |
|---|---|
| **Habitat Code** | 91A0 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | ▪ Cross, J.R. (2005) Irish native woodland classification. In *Native Woodland Manual*. Forest Service, Department of Agriculture and Food, Dublin: 41-50.<br>▪ Cross, J.R. (2006) The potential natural vegetation of Ireland. *Biology and Environment,* 106B, 2: 65-116.<br>▪ Kelly, D.L. & Moore, J.J. (1975) A preliminary sketch of the Irish acidophilous oakwoods. In *La Vegetation des Forets Caducifoliees Acidophiles* (ed Géhu). Cramer, Lille: 375-387.<br>▪ Mitchell, F.J.G. (2005) How open were European primeval forests? Hypothesis testing using palaeoecological data. *Journal of Ecology,* 93: 168–177<br>▪ Neff, M. (1975) Woodland Conservation in the Republic of Ireland. In *La Vegetation des Forets Caducifoliees Acidophiles* (ed Gehu). Cramer, Lille: 275-285.<br>▪ Perrin P.M., Barron S.J. and Martin J.R. (2006a) *National Survey of Native Woodland in Ireland: Second Phase Report*. National Parks and Wildlife Service, Dublin. |
| **Range** | Concentrated in the southern half of Ireland with some significant areas of the habitat along the Atlantic coast in the west and northwest. Isolated sites in the northeast. |
| Surface area | 22,800km² |
| Date | 03/2007 (Data sources from 1995 to 2006) |
| Quality of data | 3 = good (based on an extensive survey) |
| Trend | 0 = stable |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | No change |
| **Area covered by habitat** | |
| Surface area | 42.85 km² (current area of known polygons containing this habitat) |
| Date | 02/2007 |
| Method used | 3 = ground based survey |
| Quality of data | 3 = good (based on an extensive survey) |
| Trend | Decrease (-) |
| Trend magnitude | -0.5% of habitat within (c)SACs<br>Therefore minimum estimate of -0.2% of total habitat area |
| Trend-Period | 1998 - 2003 |
| Reasons for reported trend | 3 = direct human influence destruction |
| Justification of % thresholds for trends | - |
| Main pressures | 140 Grazing<br>160 General forestry management<br>400 Urbanised areas, human habitation<br>500 Communication networks<br>954 Invasion by species |
| Threats | 140 Grazing<br>160 General forestry management<br>400 Urbanised areas, human habitation<br>500 Communication networks<br>954 Invasion by species |

| | |
|---|---|
| ***Complementary information*** | |
| **Favourable reference range** | 22,800 km²  (= current range) |
| **Favourable reference area** | 228 km²<br>The favourable reference area is 1% of the favourable reference range |
| **Typical species** | Vascular plants: *Betula pubescens, Blechnum spicant, Dryopteris dilatata, Hedera helix, Ilex aquifolium, Lonicera periclymenum, Luzula sylvatica, Pteridium aquilinum, Quercus petraea, Rubus fruticosus, Sorbus aucuparia , Vaccinium myrtillus.*<br><br>Bryophytes: *Calypogeia muellerana, Dicranum scoparium, Diplophyllum albicans, Hylocomium brevirostre, Hypnum andoi, Hypnum cupressiforme, Hypnum jutlandicum, Isothecium myosuroides, Kindbergia praelongum, Mnium hornum, Plagiothecium undulatum, Polytrichastrum formosum, Pseudotaxiphyllum elegans, Rhytidiadelphus loreus, Saccogyna viticulosa, Scapania gracilis, Thuidium tamariscinum.*<br><br>Methods of assessing status – Data from National Survey of Native Woodland in Ireland (2003-) and expert judgement |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Typical species were assessed as unfavourable/bad using data from Perrin et. al, (2006) |
| **Other relevant information** | The Native Woodland Scheme is a national initiative administered by the Forest Service to encourage the planting of native tree species and restoration of native woodland habitats. Under this scheme restoration of several Old Sessile Oak Woods has begun, including several important sites owned by NPWS. Restoration and new planting of sessile oakwoods has also been conducted recently as part of the People's Millennium Forests Project. |
| ***Conclusions***<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable – Range stable and not below favourable reference range |
| **Area** | Bad (U2) – More than 10% below the favourable reference area |
| **Specific structures and functions (incl. typical species)** | Bad (U2) – Structures and functions were assessed by investigating habitat fragmentation, natural regeneration, stand structure, dead wood and fauna and the overall assessment was bad |
| **Future prospects** | Bad (U2) – Invasive species were present in the majority of sites |
| **Overall assessment of CS** | Bad (U2) |



1:1,800,000

0 12.5 25 50 Kilometers

**Old sessile oak woods with Ilex and Blechnum in the British Isles**

**91A0**

Current Distribution (134 cells)

Current Range (228 cells)

Favourable Reference Range (228 cells)

W48 10km grid squares

Date: July 2007

AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

**91D0** Bog Woodland

# CONSERVATION STATUS ASSESSMENT REPORT

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## 1. Habitat characteristics in Ireland

The Habitats Directive (92/43 EEC) Interpretation Manual describes Bog Woodland as coniferous and broad-leaved forests on a humid to wet peaty substrate, with the water level permanently high and even higher than the surrounding water table. The water is always very poor in nutrients (raised bogs and acid fens). These communities are generally dominated by *Betula pubescens*, *Frangula alnus*, *Pinus sylvestris, Pinus rotundata* and *Picea abies*, with species specific to bogland or, more generally, to oligotrophic environments, such as *Vaccinium* spp., *Sphagnum* spp., *Carex* spp. [Vaccinio-Piceetea: Piceo-Vaccinienion uliginosi (Betulion pubescentis, Ledo-Pinion) i.a.].

The Manual also specifies that in most of the Irish sites, these forests represent sub types of raised bogs, generally degraded and invaded by commercial forestry species; however, those stands dominated by *Betula pubescens* or *Pinus sylvestris* may be of interest.

The Raised Bog Monitoring Project (Fernandez *et al*. 2005) surveyed a total of 48 raised bogs previously surveyed by the National Parks and Wildlife Service (NPWS). Bog Woodland habitat was recorded at 9 sites. The habitat was described as dominated by either *Betula pubescens* and/or *Pinus sylvestris*. Only those woodlands on the high bog with a relatively high cover of *Sphagnum* species and wet to very wet substrate were considered to be habitat 91D0. These nine Bog Woodland sites retain typical bog species and were considered to be actively forming peat. The remaining stands dominated by similar species or other non-native species on dry substrate were deemed to be non-bog woodland and thus do not correspond with the priority habitat. Groups of trees invading the high bog from adjacent plantations or scattered trees on the rand were also excluded from the Bog Woodland category and they are part of Degraded Raised Bog still capable of natural regeneration habitat (7120). Wooded flushes with a sparse tree canopy, less than 4m in height and high *Sphagnum* cover were described as active flushes but not habitat 91D0.

Bog Woodland habitat in Ireland typically consists of small, isolated stands on raised bogs or on cutaway. The stands are dominated by a rather open birch cover (>50% cover), consisting mostly of *Betula pubescens* but occasionally with *B. pendula*, 6m-8m in height (occasionally up to 10m) [See description in Cross 1990]. A rich epiphyte flora occurs on the trees, including, e.g. *Parmelia* spp,. *Ramalina* spp and *Usnea* spp. While the ecology and distribution of the habitat has been little studied in Ireland, bog woodland appears to be characterised by a fine balance between tree growth and bog development. Tree growth is slow, and dead trees may be common even among fairly small individuals, as their weight depresses the peat locally leading to waterlogging and death.

True Bog Woodland is much rarer than woodland on bogs resulting from natural colonisation or afforestation following changes in the drainage pattern that leads eventually to the loss of the bog community. Therefore, woodland encroachment resulting from falling water tables is excluded from the Annex I definition.

While some Irish Bog Woodlands sites have developed naturally on flushed areas of raised bogs, some have developed due to human impacts such as turf cutting or high bog drainage. This has caused subsidence leading to focused flow conditions (e.g. flushes) with more available nutrients, which can favour the colonisation of wooded species such as *Betula pubescens* and *Pinus sylvestris*. As the impacts of the original drainage decreases, water levels rise in these wooded areas which can then support typical raised bog species (e.g. *Sphagnum* spp.) and continue peat formation.

The National Survey of Native Woodlands, currently being carried out by the NPWS reported a variant of Bog Woodland on transitional fen –raised bog areas with many of the characteristic species mentioned above. This variant was reported in counties Cavan and Monaghan and corresponds to transition mire habitat (code 7140). A third variant is also considered within this report, which correspond with *Betula pubescens* stands on peat soils on cutover areas containing species characteristic of the habitat (see section 2).

The Heritage Council Guide to Habitats in Ireland (Fossit, 2000) describes a woodland type named Bog Woodland (WN7). According to the guide's description Bog Woodland can develop on intact ombrotrophic bogs, bog margins and cutover bog where most of the peat has been removed. It also mentions that the habitat is commonly associated with former turf cutting activity or drainage. Although some of the characteristic species described by Fossit (2000) correspond with those mentioned within this section and those recorded by Fernandez *et al*. (2005), the abundance of *Sphagnum* spp. or the peat-forming capacity of the habitat is not mentioned in the guide. Thus, many of those areas deemed Bog Woodland (WN7) according to Fossit (2005) would be allocated to Degraded Raised Bog habitat (7120) within Annex I of the Habitats Directive.

Fossit (2000) also describes a similar habitat type WN7 of woodland in waterlogged acid peat in hollows or depressions in areas of upland woodland on siliceous rocks, e.g. in oak woodland with *Ilex* and *Blechnum*. *Betula pubescens* and/or *Salix* spp. dominate and the ground flora is characterised by an extensive cover of mosses (*Sphagnum* and *Polytrichum* spp.), in addition to grasses (*Molinia caerulea, Anthoxanthum odoratum*), *Carex echinata*, *Juncus effusus* and ferns (*Dryopteris dilatata, Blechnum spicant*) (Kelly and Iremonger 1997, Cross and Kelly 2003). It is not clear whether this woodland type corresponds to habitat 91D0 or not.

The are no known examples of bog woodland in upland areas; this may be due to climatological factors or a result of intensive management, especially burning and grazing, over many centuries.

## 2. Habitat mapping

The mapping of the distribution and range of Bog Woodland is based on the following NPWS surveys carried out since 2000 (see Appendix II):

- *Raised Bog Restoration Project*. Derwin & MacGowan (2000)
- *Raised Bog Monitoring Project - 2004/05*. Fernandez *et al*. (2005)
- *Assessment of Impacts of Turf Cutting on Designated Raised Bogs Project - 2003*. Fernandez *et al*. (2006)
- *National Survey of Irish Native Woodland.* NPWS (2003/06) (ongoing)

Other sources of data containing potential habitat records were:

- NPWS Enquiries database.
- The Habitat Assignment Project, which includes a comprehensive list of potential habitat sites from NPWS survey. However, many of them correspond with sites supporting dry wooded flushes rather than habitat 91D0.

Derwin & MacGowan (2000), Fernandez *et al*. (2005) and Fernandez *et al*. (2006) are the most recent NPWS projects that mapped high-bog vegetation of designated raised bogs. Vegetation was mapped at ecotope level (see glossary). However, only the last two projects mapped Bog Woodland as a separate habitat according to the Habitats Directive description. Derwin & MacGowan mapped the habitat as part of the active flush category, but not all the active flushes on the high- bog correspond with this priority habitat. The three surveys focused on designated sites (i.e. NHAs or SACs). A total of 14 habitat records were reported by these sources (see Annex I).

The National Survey of Native Woodland (NSNW), currently ongoing, recorded a total of 27 areas where Bog Woodland Habitat may occur. Their habitat definition is slightly different from the one given in the Habitats Directive Interpretation Manual. Three of these records were already comprehensibly described by the NPWS surveys mentioned above. The NSNW follows Fossitt (2000). However, as already mentioned in section 1, this woodland type does not strictly correspond with habitat 91D0. The actual occurrence of the priority habitat was confirmed by revising the species list provided as part of each site's releve. *Sphagnum* spp. presence and cover were a determining factor in this assessment. As a result, 9 of the 27 new sites were considered to correspond to habitat 91D0. Eight additional sites were deemed to potentially correspond to habitat 91D0 as they feature some of this habitat's characteristics: typical species presence, dominance of birch, abundance of *Sphagnum* spp. However, further surveys are required (see Annex I). 7 of the 27 records were deemed not to correspond with habitat 91D0. Six of the new habitat records are located in counties Cavan and Monaghan. These new habitat records are considered to be a particular variant of Bog Woodland habitat characterised by highly acid soils rich in *Sphagnum* species and dominated by birch, but the substrate is a transitional fen-raised bog instead of intact high bog. This is in line with the Habitats Directive Interpretation Manual that describes Bog Woodland habitat on acid fens as well as on raised bogs. Lough Oughter SAC 0007 contains a typical example of this habitat variant characterised by the dominance of *Betula pubescens* and other typical species such as *Molinia caerulea*, *Carex rostrata Sphagnum capilifollium, S. palustre, Polytrichum commune*. The geomorphology of Co. Cavan and Monaghan is characterised by the occurrence of drumlins and small shallow lakes and basins that have developed this particular type of Bog Woodland. The other 3 new records of Bog Woodland located in counties Louth, Meath and Wicklow have developed on cutover bogs and are dominated by *Betula pubescens* and characterised by the abundance of *Sphagnum* sp (*S. fimbriatum, S. palustre, S. squarrosum, S. capilifollium, S. compactum*).

An additional potential habitat site (Ussey) was identified as part of the Active Raised Bog habitat (7110) Conservation Status Assessment Project (Fernandez, 2007). It consists of a 72ha high bog raised bog supporting two separate stands (c.a. 3ha), which are likely to be dominated by *Betula pubescens* as there are no coniferous plantations surrounding the bog. Active peat- forming vegetation is likely to be present at least on the southeastern larger stand. (see Annex I).

The distribution of the habitat is illustrated on a 10km square grid and has been produced by selecting those squares intersecting the habitat digitised site boundaries. Potential habitat sites have been also taken into account in the production of this map.

The habitat range is defined by the smallest polygon size containing all grid squares where the habitat was recorded, drawn using a minimum number of 90 degree angles.

Horizontal or vertical gaps in the habitat distribution of 3 or more grid squares (10-km side) or oblique gaps of 2 or more squares are deemed enough as to justify a break in the range.

## 3. Habitat Range

Bog Woodland habitat is mostly related to relatively intact raised bogs supporting Active Raised Bog habitat (7110). Raised bogs are mainly concentrated in the lowlands of central and mid-west Irelandwhere annual rainfall is below 1250 mm (Hammond, 1984). They occur principally on land below 130m and are most extensive and abundant where the limestone plain is covered by a variable thickness of undulating glacial drift which originally provided suitable basins for the development of lakes and/or fens, which in turn acted as precursors to the bogs.

Bog Woodland associated with transitional mires is found throughout the north-east (Co. Cavan, Monaghan) where the topography of these areas have encouraged the formation of shallow peaty lakes and basins.

Isolated Bog Woodland records are found in counties Wicklow, Meath and Kerry.

### 3.1. Conservation Status of Habitat Range

Although the current range of Active Raised Bogs (7110) in Ireland, closely related to Bog Woodland habitat, is much smaller than the range in the past; there has not been any significant known change in the Bog Woodland range in the reporting period (1994-2005).

Bog Woodland habitat favourable reference range is considered to be similar to the current range. Therefore, the habitat range conservation status is assessed as **Favourable**.

- **Habitat Range Area:** 5,800km² (58 grid x 100 km²) is defined by the area of the polygon which contains all the 10km grid squares containing the habitat (see section 2).
- **Favourable Reference Range** 5,800km² (58 grid x 100 km²). Favourable reference range is considered to be similar to the habitat current range.

## 4. Habitat Extent

Data on the extent of the habitat is available from all the sources mentioned in section 2 (see Annex I). Habitat extent is not available for three of the 33 habitat records identified. The overall extent of Bog Woodland habitat (910), including potential sites, is 145ha. Thus, considering the absence of area data for 3 of the 33 records it can be estimated that the overall known extent of habitat national resource is 150ha approximately. It should be highlighted that the actual description of the habitat and therefore the site boundary definition vary between the data sources. According to data provided in Annex I, the average extent of a Bog Woodland site recorded as part of the NSNW is 6.2 ha, whereas the remaining sources give an average extent of 3.5ha. This is likely to indicate a more strict definition of the habitat type and habitats boundaries by other NPWS surveys than the NSNW.

Bog woodland in Ireland is naturally likely to have a very restricted extent as oceanic raised bogs are typically treeless. Bog woodland on active raised bogs appears to be/

have been associated with flushed areas or soaks, which tend to occur mostly on the larger complexes of raised bogs. They would also have occupied very small areas because of the very specific conditions required for their formation. Most of these larger complexes have now been destroyed and it is therefore extremely difficult to estimate the original extent of bog woodland. However, it is probable that even before their destruction bog woodland would not have covered more than a few hundred hectares. The favourable reference area is likely to be greater than 150 ha. The NSNW may increase the current extent of the habitat once finished and a more accurate value for the habitat favourable reference area could then be given.

### 4.1. Conservation Status of Habitat Extent

Fernandez *et al*. (2005) noted a decrease in the habitat extent of 3 of the nine habitat sites surveyed[1]. This decrease occurred as a result of fire directly affecting the habitat and damage was particularly high at Trien Bog Woodland (SAC 2110). This project only reported a decline as a result of recent and obvious burns. The slow and steady decline as a result of turf cutting, drainage or drying out caused by afforestation was not reported. Fernandez *et al*. (2005) reported declines in the extent of Active Raised Bog habitat of between 5-10% at 10 of the 48 sites surveyed and greater than 15% at 26 sites in the reporting period (1994-2005). Both Active Raised Bog and Bog Woodland habitats are closely related as both are water dependent habitats which may be part of the same hydrological unit. Thus, a decline in Active Raised Bog within a site is likely to indicate, in the long term, a decline in the extent of Bog Woodland. This potential decrease in Bog Woodland extent was not reported by Fernandez *et al*. (2005) and the baseline surveys did not specifically map Bog Woodland habitat but rather flushes, which could be active or inactive. Thus, accurate baseline figures for the habitat are not available for comparison purposes. The actual definition of the habitats may vary from the baseline survey to the 2004-05 survey, which may lead to discrepancies in the habitat mapping. The mapping techniques employed in both surveys were different, becoming more accurate in the latter survey. Considering that generally Bog Woodland sites have small extent, a small variation in the habitat area due to mapping discrepancies is likely to result in high variations of percentage habitat area. Therefore, only obvious changes in the habitat's extent were reported and used to assess the habitat's conservation status.

To summarise, although Fernandez *et al*. (2005) only reported a decrease in the habitat extent of a small number of sites it is likely that a decline has occurred in a larger number of sites. This is particularly so for those sites on raised bogs where turf cutting, drainage and forestry are having a more serious impact. Therefore the habitat extent conservation status is deemed to be **Unfavourable Inadequate.**

[1] A total of 16 sites are considered to correspond to the typical Bog Woodland habitat on raised bogs (See Annex I). Fernandez *et al*. (2005) assessed the conservation status of 9 of these 16 sites.

- **Area covered by the habitat:** 1.5 km$^2$
- **Favourable Reference Area:** more than 1.5 km$^2$

## 5. Structures and Functions

### 5.1. Habitat Structures and Functions

Fernandez *et al*. (2005) assessed the habitat's structure and functions based on changes in tree ages classes, variations in *Sphagnum* spp. cover, presence and cover of lichens and presence of disturbance indicators (e.g. burning, invasive species). Although this project did not provide a separate assessment for the extent and structure-functions, declines in habitat extent as a result of burning also indicate a likely decline in the structure and functions.

Bog Woodland habitat requires generally high water table levels (Schouten, 2002). Thus, the variation in water table levels should be one of the main attributes to assess the habitat's structures and functions. Drainage, peat cutting and coniferous plantations are the main activities causing lowering of the water table on raised bogs and subsequently Bog Woodland habitat. For those sites developed on transition mires, drainage, in-filling and burning are likely to be the main causes of decline.

#### 5.1.1. Conservation Status of Habitat Structures and Functions

Fernandez *et al*. (2005) was the first project specifically surveying and mapping Bog Woodland habitat (91D0) on raised bogs according to the Habitats Directive Interpretation Manual description. Previous surveys mapped wooded area on the high bog mostly as either wet or dry flushes and therefore the results of the two surveys are not easily comparable. Fernandez *et al*. (2005) did not specifically measure changes in water table levels. However, an overall lowering is indicated by declines in the extent of Active Raised Bog habitat (7110) on 8 of 9 raised bogs containing Bog Woodland. Turf cutting was described as having a negative influence on Active Raised Bog on 7 of 9 bogs. Additionally, high-bog drainage was reported as having a negative influence on 8 bogs. Therefore, although Fernandez *et al*. (2005) only assessed obvious changes on the extent and structure and functions of Bog Woodland as a result of recent burns, further declines in the structure and functions, particularly on the *Sphagnum* cover and thus the peat forming capacity, are likely to have occurred during the reporting period (1994-2005), as the Active Raised Bog habitat assessment and impacts indicate. Additionally, Nore Valley – the 4.38h Timoney bog (NHA 1835) was completely drained in 2001. The structure and functions of the habitat on this site are likely to have been seriously damaged, accounting for nearly 3% of the national resource.

The overall structure and functions for the national habitat resource are assessed as **Unfavourable Inadequate**.

### 5.2. Typical Species

According to the 2003 version of the Habitats Directive Interpretation Manual the characteristic plant communities and species of Bog Woodland (91D0) are as follows:

*Agrostis canina, Betula pubescens, B. carpatica, Carex canescens, C. echinata, C. nigra, C. rostrata, Frangula alnus, Juncus acutiflorus, Molinia caerulea, Trientalis europaea, Picea abies, Pinus rotundata, P. sylvestris, Sphagnum* spp., *Vaccinium oxycoccus, V. uliginosum, Viola palustris*; in spruce swamp woods also: *Carex disperma, C. tenuiflora, Diplazium sibiricum, Hylocomium umbratum* and *Rhytidiadelphus triquetrus*.

However, only the following species from the above list are considered as characteristic for Irish sites by Cross (1990 and pers. comm. 2007): Vascular plants*:* *Agrostis canina, Betula pubescens, Calluna vulgaris, Carex canescens, C. echinata, C. nigra, C. rostrata, Dryopteris dilatata, Empetrum nigrum, Eriophorum vaginatum, Holcus lanatus, Juncus effusus, Molinia caerulea, Pinus sylvestris, Pteridium aquilinum, Salix aurita, Vaccinium myrtillus, V. oxycoccus.*
Mosses, Liverworts and Lichens: *Aulacomnium palustre, Polytrichum commune, Sphagnum capilifollium, S. fimbriatum, S. palustre, S. recurvum, S. squarrosum* and *S. teres, Cladonia portentosa.*

Bog Woodland corresponds with "W4 *Betula pubescens-Molinia caerulea* woodland" of the United Kingdom classification according to the Interpretation Manual.

The presence of *Sphagnum* spp. and their cover were used as indicators of changes on Active Raised Bog habitat quality. Taking into account that Bog Woodland is also characterised by a peat-forming substrate mostly generated by *Sphagnum* spp., these species, along with *Betula pubescens*, are selected as habitat quality indicators.

**Fauna**

There is very little information available for fauna associated specifically with bog woodland. However, O'Connor and Speight (1987) recorded the dipteran *Dictenidia bimaculata* in rotting birch timber on All Saint's Bog and Clara Bog. This species is a member of the ancient forest fauna of Europe. The green hairstreak butterfly (*Callophrys rubi*) has been observed in large numbers on the same sites (Cross, pers. comm.).

### 5.2.1. Conservation Status of Habitat Typical Species

A considerable decrease in cover was noted on 3 of the 9 bogs surveyed. However, further declines are likely to have occurred in many of the other sites as indicated by the decline in the surrounding Active Raised Bog habitat and the impacts of turf cutting and drainage reported on the high bogs supporting Bog Woodland. Therefore,the conservation status of typical species is **Unfavourable Inadequate.**

## 6. Impacts and Threats

Fernandez *et al*. (2005) assessed the intensity and influence of impacting activities on 48 raised bogs including 9 supporting Bog Woodland (91D0). Peat cutting, drainage and burning were the most important activities impacting negatively on the conservation status of these bogs. These activities were found to seriously disrupt the hydrology, leading to desiccation of the bog and loss of the characteristic micro-topography and eventually the flora and fauna (Schouten 2002). The project found that generally drainage and burning are related to the occurrence of turf cutting. A similar scenario is likely to occur on the remaining 7 raised bogs supporting Bog

Woodland. The intensity and influence of impacts are not available for those Bog Woodland sites (17) reported as part of the National Survey of Native Woodland.

### 6.1. Turf cutting

Traditional cutting of bogs for turbary over the last 400 years has had a serious impact on raised bogs and 68% of their extent has been cut away by this process (Hammond 1979, Ryan & Cross 1984, Cross 1989). The mechanisation of peat cutting combined with a grant aid scheme under the Turf Development Act (1981) enabled many small-scale extraction programmes to get underway resulting in further loss of raised bog resource. This has been accompanied by intensive drainage of the high bog, which was practically non-existent on smaller bogs up to 1981 (Feehan & O'Donovan, 1996). Peat is still currently cut privately for fuel purposes. The most serious impact of mechanisation has been on midland raised bogs, accounting for a loss of 22% of the resource in less than 50 years (Cross 1990). Only 8% of the original peatland area was considered suitable for conservation (Ryan & Cross 1984). Further losses have occurred in the last two decades but despite this, the Republic of Ireland still has the most extensive area of conservation-worthy sites remaining in Western Europe.

Fernandez *et al*. (2006) noted that turf cutting continues on 84.2% of the designated raised bogs and rights to cut turf exist for most of the remaining bogs. Furthermore, 86% of designated bogs containing Active Raised Bog habitat (7110) are subjected to peat cutting. A total of 15 Bog Woodland sites have been identified as developing on raised bogs. Turf cutting occurs at 13 of these sites (87%). One of them (Nore Valley - Timoney NHA 1835) was completely drained in 2001.

Although peat cutting recorded by Fernandez *et al*. (2006) is mainly for domestic purposes, peat cutting for semi-commercial purposes also occurred at a number of designated sites. Mechanical peat extraction, generally by Hopper machinery, was the most common technique on the sites surveyed. This method of peat cutting also involves the insertion of drains of various width and depth generally perpendicular to the face-bank. Occasionally, high bog drains were also inserted parallel to the face-bank. Fernandez *et al*. (2005) noted that the trend has been a reduction in the length of margin actively cut and a decline in number of cutters in the 1994/95-2004/05 reporting period. However, this trend has been accompanied by intensification in the amount of peat extracted as result of the mechanisation of cutting with an associated increase in negative impacts. It was estimated that the overall loss of high bog to peat cutting in the ten-year reporting period was 1%.

Following the publication of the list of SAC raised bog sites in 1997, there was prolonged and strenuous objection from turf cutters. The objectors were especially concerned about loss of property rights, loss of future fuel supplies and loss of a way of life in the summer months. A ministerial decision was taken to allow the bog owners to cut turf for domestic use for 10 years, up to and including 2008, at which stage all cutting would have to cease. When the NHAs were designated in 2004, a similar 10-year derogation was put in place, allowing cutting until 2014.

**Turf Cutting Trend**

Unless a more restrictive approach (i.e. mandatory cessation of cutting coupled by compensation packages) is taken, turf cutting is likely to continue at current levels or even increase with increasing fuel prices.

## 6.2. Drainage

Drainage is intended to dry out the high bog surface and is generally used to facilitate the cutting of turf. It occurs on both the high bog and/or the cutover area (Fernandez *et al*., 2005).

Fernandez *et al*. (2005) recorded drainage on the high bog on 8 of the 9 raised bogs where Bog Woodland habitat is present. The activity was considered to have a high negative influence on 4 of these raised bogs and a moderately negative influence on the remaining 4. It is probable that a similar situation exists at the remaining 6 raised bogs.

Arterial drainage directed at improving agricultural land and bog drainage is also considered a serious threat to the hydrological status of the high bog and therefore Active Raised Bog habitat including Bog Woodland.

**Drainage Trend**

Although according to the findings of Fernandez *et al*. (2005) the insertion of new high bog drains on designated raised bogs is unusual, the presence of old drains continues to have a serious impact on the raised bog habitats within designated sites. Data are not available for un-designated sites.

## 6.3. Burning

According to Fernandez *et al*. (2005), within the 48 raised bogs surveyed, burning is the most obvious and serious impacting activity directly threatening Bog Woodland habitat. Three out of the nine raised bogs with the habitat were reported to have declined in area and quality Trien bog (SAC 2110) was the most severely affected.

Burning is mainly associated with peat extraction and thus is more frequent in those sites with high intensity of cutting where the bog surface is frequently burnt to facilitate marginal cutting. Except on the wettest bogs, repeated burning causes a rapid decline in *Sphagnum* cover and thus in the bogs capacity to generate new peat.

**Burning Trend**

No previous records are available. However, the 2005 project shows that burning frequently occurs on raised bogs and its occurrence is mainly related to peat cutting. Thus, any increase in peat cutting is likely to lead to an increase in fires.

## 6.4. Afforestation

Forestry, which mainly consists of coniferous plantations, is found either on the high bog or on the adjacent cutover area. Surface drainage is always associated with forestry plantations and has similar negative effects to that carried out to facilitate peat cutting. Additionally, some of the species used for afforestation (e.g. *Pinus contorta,* *P. sylvestris, Picea sitchensis*) may eventually spread on to the high bog and invade Bog Woodland.

Fernandez *et al*. (2005) recorded forestry on the high bog and cutaway at only 2 of the raised bogs supporting Bog Woodland. One additional site was described as being impacted by coniferous forestry on the cutover.

**Afforestation Trend**

Grant aid for private forestry, which is administered by the Forest Service of the Department of Agriculture Fisheries and Food, is now effectively withheld from designated peatlands. All grant-aided development in Ireland must also conform to the Forest Service forest biodiversity guidelines, which set out measures to protect existing habitats and wildlife and to maximise the biodiversity of forest.

Coillte Teoranta, one of the major owners of peatland in the country, has ceased planting conifers on intact peatlands in its ownership, principally on economic grounds. It has also made strong commitments to the implementation of the Helsinki Process on Sustainable Forest Management and as part of their Nature Conservation Programme. Coillte has initiated a *Raised Bog Restoration Project* that will result in the felling of coniferous plantations and drain blocking on some of their raised bogs.

The threat to raised bogs from afforestation therefore appears to be declining, particularly on designated raised bogs. The current trend for un-designated sites is unknown.

### 6.5. Invasive Species

Invasive species such as *Pinus contorta, Picea sitchensis, Rhododendron ponticum* and *Sarracenia purpurea* were recorded by Fernandez *et al*. (2005) on 35 of 48 raised bogs surveyed. Only very occasionally were some of these species found on Bog Woodland habitat and they are considered to pose only a minor threat to the habitat. *Pinus sy*lvestris was deemed invasive when it was found encroaching on the high bog as result of drying out processes. However, while this species probably became extinct in Ireland over 1000 years ago, it is still deemed to be native and its presence is not considered a cause for concern.

**Invasive Species Trend**

Although the overall trend is an increase in invasive species mainly related to ongoing drying out of the high bog and spreading of coniferous from adjacent plantations, their impact is considered minor compared to impacts arising from peat cutting, drainage and burning. However, their impact may increase in the future as other threats decrease and the area of forest in the surrounding increases.

## 7. Future Prospects

### 7.1. Negative Future Prospects

Deterioration of the raised bog hydrology at current rates caused by peat cutting, drainage, forestry and burning will continue threatening the viability of Bog Woodland sites on raised bogs.

Climate change predictions of increases in temperatures accompanied by a decrease in summer rainfall would increase the summer moisture deficit of peatlands and potentially prevent peat formation. Therefore, it will particularly threaten Bog woodland sites on raised bogs.

### 7.2. Positive Future Prospects

Only a few examples of restoration works have been undertaken on Irish raised bogs. NPWS commenced a *Raised Bog Restoration Project* in 1994, which ran up to the end of 1999 and included 10 sites. This project was assisted by the EU Cohesion Fund (Ryan and Streefkerk, 1998). Objectives of the project were the restoration of the bog hydrology, acquisition of land, a survey of high bog and lagg systems and establishment of a monitoring programme. These restoration works consisted of blocking drains, mainly on the high bog, and the construction of dams. NPWS again carried out restoration works (i.e. blocking of drains) on three new sites in 2003 and one in 2006. The results of these restoration works are considered positive overall, as there is some expansion, and new development, of Active Raised Bog habitat formation (Fernandez *et al.* 2005). Although restoration works took place in Clara Bog these were mainly carried out on Clara East where Bog Woodland is absent. Restoration works were also carried out at Clonfinane bog, which contains a small area of Bog Woodland habitat.

Coillte Teoranta initiated a *Raised Bog Restoration Project* in 2004. This was funded by an EU Life - Nature Programme. This project will be completed in 2008 and forms part of Coillte's Nature Conservation Programme. The project will work towards restoring 571.2 hectares of raised bog habitat on its property in the midland counties. This project area will be managed with nature conservation as the primary management objective into the future. The project also involves the felling of 450ha of plantation forest, felling of naturally regenerated exotic trees on open bog, perimeter protection of vulnerable raised bog sites against fire, blocking of drains after felling and ongoing monitoring of vegetation and water levels on 14 sites (Coillte, 2005 - www.raisedbogrestoration.ie). Cloonmoylan bog and Cloonshanville were part of this project and both support Bog Woodland habitat. In addition the blockage of drains on the cutaways at the project sites may increase the area of Bog Woodland on cutaway in the medium to long term.

55% of the Bog Woodland records, including potential habitat records, are within a designated site (e.g. NHA or SAC). Although designation provides statutory protection and many of the activities impacting the habitat require licence or consent, the results from the Raised Bog Monitoring Project (Fernandez *et al*. 2005) indicate that highly impacting activities continue on designated sites as well as un-designated sites.

Restoration of cutover areas is likely to lead to the development of the third variant of Bog Woodland habitat and points towards a much more promising future prospects for the habitat. However, the potential expansion of this variant would not counteract the decline of the variant on high bog.

NPWS have operated two turf cutting cessation schemes since 1999 to buy out turbary rights in NHAs and SACs. Fernandez *et al*. (2006) considered that the schemes were relatively successful in dealing with obvious commercial activity (i.e. moss peat developments), but were less successful in dealing with small scale, semi-commercial to commercial fuel peat operations and had almost negligible impact on domestic cutting. They did not appear to have significantly reduced the numbers of cutters and thus the negative effects of cutting on raised bog priority habitats

### 7.3. Overall Habitat Future Prospects

A significant difference in the habitat's future prospects is noted from Bog Woodland sites developed on typical raised bog areas, where impacting activities continue drying out the high bog and thus threatening the long-term survival of the habitat, to those habitat variants developed on transitional raised bog-fen habitats, such are those in counties Cavan and Monaghan or those stands developing on cutover areas. Whereas the first variant seems to have an overall negative future prospects, the other two seem to be much less threatened. However, the last type is mainly dependent on the restoration of many of these cutover areas to encourage the formation of new Bog Woodland stands. It should be mentioned that not all cutover areas colonised by trees and with wet peaty soils have the potential to develop into Bog Woodland habitat (91D0) (see section 2).

Although certain positive management actions have been taken in recent year (raised bog restoration projects, Turf Cutting cessation schemes, land purchase and surveillance programs (e.g. SIR program)), these actions seem to have affected only a small portion of the habitat resource. A long-term programme of targeted restoration is needed on raised bogs.

Scrub encroachment on the high bog cannot be assessed as an indication of favourable conservation status, as this process indicates a drying out and lowering of water tables rather than any expansion of Bog Woodland habitat.

To summarise, the long-term viability of the habitat is not assured and there are poor prospects for its future. Therefore, the Future Prospects are deemed to be **Unfavourable Inadequate**.

## 8. Overall Assessment of the Habitat Conservation Status

The habitat conservation status of three of the four attributes has been assessed as **Unfavourable Inadequate** at national level.

- The habitat range has not changed in the reporting period. Both current and favourable reference ranges are similar and thus the conservation status of this attribute is assessed as **Favourable**.
- The results of Fernandez *et al*. (2005) indicate a decrease in habitat extent at 3 of the 9 habitat sites. However, this assessment only estimated a decrease in habitat extent as a result of recent burns. Reduction in the extent caused by drying out induced by turf cutting and drainage, which occurs in the majority of this habitat's sites, were not estimated, but must be considered as negative. Thus the habitat extent has been assessed as **Unfavourable Inadequate**.
- An **Unfavourable Inadequate** assessment is also given to Bog Woodland structures and functions, mainly relating to the assessment given to those sites assessed by Fernandez *et al*. (2005) and the impacting activities recorded in previous surveys.
- The Future Prospects are overall deemed to be **Unfavourable Inadequate** due to the ongoing deterioration of the hydrological conditions of raised bogs resulting

from peat cutting, drainage, forestry and burning. Restoration of raised bog areas, particularly by blocking drains and flooding, will reverse this trend, not only protecting current habitats but encouraging the formation of new habitat stands on the cutover. The reversal of the trend is expected to take at least 20 years due to the ongoing impacts of current drainage and the period of time taken for Woodland to develop.

The overall conservation status for Bog Woodland habitat is **Unfavourable Inadequate**.

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# APPENDICES

# APPENDIX I

## BOG WOODLAND (91D0) HABITAT SITES LIST

| Site Name | Site Code | Designation | County | Releve | Fossit habitat type (2000) | BEC survey type (2003/6) | X | Y | Data Source | Authors / Year | Conservation Status Assessment | Habitat Area (ha) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lough Oughter | 0007 | SAC | Cavan | 46501 | WN7 | BetPsePol | 239346 | 313170 | National Survey of Irish Native Woodland (NSNW) | NPWS / 2003-2006 | N/A | 2.04 | Habitat 91D0 confirmed |
| Cordonaghy Bog | 0978 | NHA | Cavan | 61401 | WN7 | BetPsePol | 230948 | 294446 | NSNW | NPWS / 2003-2006 | N/A | 9.24 | Habitat 91D0 confirmed |
| Wicklow Mountains | 2122 | SAC | Wicklow | 78601 | WN7 | BetPsePol | 311361 | 196440 | NSNW | NPWS / 2003-2006 | N/A | 5.80 | Potential Habita 91D0 |
| Cloonmoylan | 0248 | SAC | Galway | N/A | N/A | N/A | 177562/ 177463 | 199671/ 200895 | Raised Bog Monitoring Project (RBMP) | Fernandez et al./ 2005 | B- Unfavourable Inad | 0.97 | Habitat 91D0 confirmed |
| Kilmore | 0283 | NHA | Galway | N/A | N/A | N/A | 174260 | 254882 | Turf Cutting Impact Assessment | Fernandez et al. / 2006 | N/A | 3.11 | Habitat 91D0 confirmed |
| Addergoole | 0297 | SAC | Galway | N/A | N/A | N/A | 130980 | 233387 | RBMP | Fernandez et al./ 2005 | A- Favourable | 1.22 | Habitat 91D0 confirmed |
| Sheheree | 0382 | SAC | Kerry | N/A | N/A | N/A | 98436 | 88642 | RBMP | Fernandez et al./ 2005 | A- Favourable | 0.13 | Habitat 91D0 confirmed |
| Clooncoe Wood and Lough | 0424 | NHA | Leitrim | N/A | N/A | N/A | 210834 | 292279 | NPWS Enquires database | NPWS / N/A | N/A | NA | Potential Habita 91D0 |
| All Saints | 0566 | SAC | Offaly | N/A | N/A | N/A | 201309 | 211207 | RBMP | Fernandez et al./ 2005 | A- Favourable | 17.48 | Habitat 91D0 confirmed |
| Clara | 0572 | SAC | Offaly | N/A | N/A | N/A | 224098 | 230055 | RBMP | Fernandez et al./ 2005 | A- Favourable | 1.38 | Habitat 91D0 confirmed |
| Cloonshanville | 0614 | SAC | Tipperary | N/A | N/A | N/A | 175247 | 291534 | RBMP | Fernandez et al./ 2005 | A- Favourable | 2.36 | Habitat 91D0 confirmed |
| Clonfinane | 0641 | SAC | Tipperary | N/A | N/A | N/A | 198807 | 203702 | RBMP | Fernandez et al./ 2005 | A- Favourable | 0.51 | Habitat 91D0 confirmed |
| Nore Valley - Timoney | 1853 | NHA | Tipperary | N/A | N/A | N/A | 216567 | 184589 | Raised Bog Restoration Project (RBRP) | Derwin & MacGowan / 2000 | N/A | 4.38 | Habitat 91D0 confirmed |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Corliskea** | 2110 | SAC | Roscommon, Galway | N/A | N/A | N/A | 169150 | 273593 | RBMP | Fernandez et al./ 2005 | A- Favourable | 2.46 | Habitat 91D0 confirmed |
| **Trien** | 2110 | SAC | Roscommon | N/A | N/A | N/A | 165466 | 275955 | RBMP | Fernandez et al./ 2005 | C- Unfavourable Bad | 2.15 | Habitat 91D0 confirmed |
| **Clooncraff-Cloonlarge** | 2310 | SAC | Roscommon | N/A | N/A | N/A | 195024 | 262997 | Turf Cutting Impact Assessment | Fernandez et al. / 2006 | N/A | 2.12 | Habitat 91D0 confirmed |
| **Ballynamona Bog** | 2339 | SAC | Roscommon | N/A | N/A | N/A | 194167 | 242919 | RBRP | Derwin & MacGowan / 2000 | N/A | 7.82 | Habitat 91D0 confirmed |
| **Clooneen** | 2348 | SAC | Longord | N/A | N/A | N/A | 206658 | 284328 | RBRP | Derwin & MacGowan / 2000 | N/A | 3.38 | Habitat 91D0 confirmed |
| **Ussey** | N/A | N/A | Galway | N/A | N/A | N/A | 172046 | 268333.00 | Conservation Status Assessment Project | Fernandez 2007 | N/A | 3.00 | Potential Habita 91D0 |
| N/A | N/A | N/A | Laois | 29702 | WN7 | BetPsePol | 236000 | 187800 | NSNW | NPWS / 2003-2006 | N/A | 6.29 | Potential Habita 91D0 |
| N/A | N/A | N/A | Offaly | 32601 | WN7 | BetPsePol | 197558 | 183098 | NSNW | NPWS / 2003-2006 | N/A | NA | Potential Habita 91D0 |
| N/A | N/A | N/A | Cavan | 45901 | WN7 | BetPsePol | 234866 | 301552 | NSNW | NPWS / 2003-2006 | N/A | 1.81 | Potential Habita 91D0 |
| N/A | N/A | N/A | Cavan | 62102 | WN7 | BetPsePol | 265488 | 301768 | NSNW | NPWS / 2003-2006 | N/A | 7.24 | Habitat 91D0 confirmed |
| N/A | N/A | N/A | Louth | 64001 | WN7 | BetPsePol | 290943 | 303687 | NSNW | NPWS / 2003-2006 | N/A | 22.97 | Habitat 91D0 confirmed |
| N/A | N/A | N/A | Cavan | 65001 | WN7 | BetPsePol | 251417 | 298020 | NSNW | NPWS / 2003-2005 | N/A | 4.98 | Potential Habita 91D0 |
| N/A | N/A | N/A | Cavan | 69801 | WN7 | BetPsePol | 238608 | 293956 | NSNW | NPWS / 2003-2006 | N/A | 2.62 | Potential Habita 91D0 |
| N/A | N/A | N/A | Meath | 72601 | WN7 | BetPsePol | 285806 | 278583 | NSNW | NPWS / 2003-2006 | N/A | 3.63 | Habitat 91D0 confirmed |
| N/A | N/A | N/A | Wicklow | 78502 | WN7 | BetPsePol | 316208 | 197608 | NSNW | NPWS / 2003-2006 | N/A | 11.02 | Potential Habita 91D0 |
| N/A | N/A | N/A | Wicklow | 80201 | WN7 | BetPsePol | 314360 | 186294 | NSNW | NPWS / 2003-2006 | N/A | 2.08 | Habitat 91D0 confirmed |
| N/A | N/A | N/A | Monaghan | 85401 | WN7 | BetPsePol | 255519 | 337504 | NSNW | NPWS / 2003-2006 | N/A | 6.05 | Habitat 91D0 confirmed |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N/A | N/A | N/A | Wicklow | 89201 | WN7 | BetPsePol | 307375 | 193418 | NSNW | NPWS / 2003-2006 | N/A | 3.37 | Potential Habita 91D0 |
| N/A | N/A | N/A | Monaghan | 122101 | WN7 | BetPsePol | 255705 | 337226 | NSNW | NPWS / 2003-2006 | N/A | 4.32 | Habitat 91D0 confirmed |
| N/A | N/A | N/A | Cavan | 125101 | WN7 | BetPsePol | 237275 | 296223 | NSNW | NPWS / 2003-2006 | N/A | NA | Habitat 91D0 confirmed |

# APPENDIX II

# SOURCES OF DATA

The following is a summary of the main sources of information employed to produce the habitat's distribution map, to evaluate its current range and extent and to carry out its conservation status assessment:

## A. Raised Bog Restoration Project - Kelly *et al*. (1995)

This project aimed to identify raised bogs that were suitable for declaration as National Reserves. It included a comprehensive ecological and hydrological investigation of a number of selected raised bogs. As a result a comprehensive report was written for each site and a series of maps (i.e. vegetation, drainage, hydrochemistry, slopes and land-use) were prepared. 45 sites were visited during the surveys. Clara (SAC 572) and Raheenmore (SAC 582) bogs were also included in the final assessment based in data collected during the Irish/Dutch Raised Bog study (Schouten, 2002).

The project botanical surveys mapped the vegetation at the community complex level. Each complex was characterised by a series of vegetation communities. These complexes were amalgamated into a series of ecotopes. These maps provided the basis for identifying the boundaries for Active and Degraded Raised Bog habitats.

This project resulted in the designation of 31 SACs.

## B. Raised Bog Restoration Project - A Continuation of the Investigation into the conservation and restoration of selected raised bog sites in Ireland - Derwin and MacGowan. (2000)

This project used the methodology established by Kelly *et al*. (1995) "Raised Bog Restoration Project" to assess 28 sites not surveyed in 1995 as potential Active or Degraded Raised Bog SACs. The sites assessed were selected from a total of 102 sites, which were assessed using aerial photography for their conservation potential.

As a result 6 sites were proposed as SACs as they contained Active Raised Bog habitat. Other 17 were also proposed as SACs as they contained Degraded Raised Bog habitat. A further 10 sites were proposed by NPWS. The latter sites were surveyed as part of the 1995 survey but were not included in that original list of proposed SACs.

## C. Raised Bog Monitoring Project - Fernandez *et al*. (2005)

This project aimed to monitor the conservation status of raised bog habitats included in the Annex I of the Council Directive 92/43/ECC. A total of 48 of designated sites that represent the habitat's range were selected for this purpose based mainly on the original sites investigated by Kelly *et al*. (1995). These sites were resurveyed using similar methods and the vegetation descriptions and maps of Kelly *et al*. (1995) were used as a baseline to identify changes which will occurred in he intervening period. The main outcomes of the project were individual site's habitat and overall habitat conservation status assessments as well as detailed impacts and habitat maps.

**D. Assessment of Impacts of Turf Cutting on Designated Raised Bogs 2003-06 Project - Fernandez *et al*. (2006)**

This project initiated in 2003 and completed in 2006, assessed the impacts of turf cutting in all designated raised bogs and proposed appropriate responses to such impacts (i.e. prioritising program to phase out this activity). Comprehensive botanical surveys were carried out in those sites not surveyed previously. Turf cutting was described for all those sites where priority habitats (i.e. Active Raised Bog or Bog Woodland) were recorded. A comprehensive turf cutting impact assessment was carried out at 93 bogs where priority habitats are present and cutting was recorded in 2003. Detailed maps of turf cutting plots and sensitive margins were produced.

**E. National Survey of Irish Native Woodland - Higgins G.T. Higgins, Martin J.R., Perrin P.M (ongoing)**

This national survey is mapping all stands of native/broadleaved woodland >1 ha, based on the Forest Service GIS system (FIPS). A stratified sampling procedure is being used to survey in detail on average 50 sites per county. At each site the details of the plant species, vegetation, forest structure and physical parameters are recorded, including releves. The project follows Fossitt (2000) woodland communities' definition. Existing information on stands are also being collated, and a large database is being developed. This project began in 2003 and will continue until 2008. A national inventory of native woodlands will result as part of this project.

**F. Habitat Assignment Project (NPWS 2006)**

This desktop project was undertaken by NPWS and the main aim was identifying and listing habitats listed in the Annex I of the Habitats Directive (92/43/EEC) reported within a series of sources. These sources included NHA site files, MPSU Plans, Natura 2000 Forms, NPWS surveys, aerial photographs, NGOs shadow list, etc.

**G. NPWS Enquiries Database**

This is a comprehensive NPWS internal database, which includes data on habitats and sites designated.

# APPENDIX III

## GLOSSARY

ACTIVE PEAT FORMING - According to the Interpretation Manual of the Habitats Directive, the term active must be taken to mean still supporting a significant area of vegetation that is normally peat forming. Bogs where active peat formation is temporarily at a standstill, such as after a fire or during a natural climatic cycle e.g., a period of drought, are also included.

ANNEX I - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

CUTAWAY BOG - This term describes areas where peat has been removed systematically by industrial means. Any peat remaining can no longer be considered as economically removable (Irish Peatland Conservation Council).

CUTOVER BOG – An NPWS habitat classification that describes areas of bog which have been previously cut (by hand or by mechanical means), although not down to the underlying mineral soils or bedrock. Remaining peat can still be an economic reserve. Cut-over areas are normally a mosaic of cut areas, face banks, pools, drainage ditches, uncut areas of peat, scrub, grassland etc.

DEHLG - Department of Environment, Heritage and Local Government

DESICCATION - Drying out.

DOMESTIC PURPOSES - Used in relation to the cutting of peat. Peat that is cut for domestic purposes is not for commercial sale and is cut at the rate of one year's supply for a household per year.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ECOTOPE - The abiotic environment or habitat of a particular biotic system (Kulcher, 1967; Whittaker et al., 1973). According to work carried out by Kelly (1993) on Clara and Raheenmore raised bogs vegetation can be assigned to five different ecotopes. Sub-central and central ecotopes with Active peat formation (Active Raised Bog habitat) and marginal, sub-marginal and facebank ecotopes with little or no peat formation (Degraded Raised Bog habitat).

ENCROACHMENT - The invasion of a species (usually plants) into areas previously uncolonised. This term is often used when an undesirable species advances at the expense of a desirable species or habitat.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as favourable when: its natural range and areas it covers within that range are stable or increasing, and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future, and the conservation status of its typical species is favourable.

FAVOURABLE REFERENCE AREA - Total surface area in a given biogeographical region considered the minimum necessary to ensure the long-term viability of the habitat type; this should include necessary areas for restoration or development for those habitat types for which the present coverage is not sufficient to ensure long-term viability. Favourable reference value must be at least the surface area when the Habitats Directive (92/43 EEC) came into force.

FAVOURABLE REFERENCE RANGE - Range within which all significant ecological variations of the habitat/species are included for a given biogeographical region and which is sufficiently large to allow the long term survival of the habitat/species. Favourable reference value must be at least the range (in size and configuration) when the Habitats Directive (92/43 EEC) came into force.

FENS AND FLUSHES - An NPWS habitat classification. Fens are peatlands fed by calcium rich water, either from groundwater or from inflowing surface water. Flushes are wet areas maintained by the seepage of water down slopes of various gradient, and are usually local features. Both are characterised by an abundance of small sedge forming species-rich mosaics with other species. Orchid species are particularly noticeable in fens and butterworts are more typical of flushes. According to Cross (1990) flushes are areas where nutrient enrichment occurs, usually as a result of more concentrated horizontal water movement. They are particularly common near the bog margin and at the base of low mineral ridges and are characterised by the presence of *Molinia caerulea, Myrica gal*e and often *Sphagnum recurvum.*

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HAND CUTTING OF PEAT. - Refers to traditional cutting of peat using a slean or spade.

HIGH BOG – This is the area of bog which have not been previously cut and generally its vegetation is characterised by the presence of ericoid and *Cyperaceae* species and an abundant of *Sphagnum* species.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

INTACT HIGH BOG: refers to uncut high bog still supporting typical high bog vegetation (Active or Degraded Raised Bog). No completely intact raised bog remains in Ireland and all have been damaged to a certain degree by activities such as turf cutting, drainage, burning and afforestation.

LAGG - A term used to describe the transition from bog to mineral soil around a raised bog.

LIMESTONE - Sedimentary rock composed predominantly of calcium carbonate, often containing fossils.

MECHANICAL PEAT EXTRACTION - Refers to the use of machinery to cut peat. This includes extrusion cutting such as by sausage machine (e.g. Difco) or any other type of mechanical cutter (e.g. Hopper).

MICROTOPOGRAPHY – This is the small scale variation in surface level and the following terms used by Kelly (1993) and Schouten (2002) are used to describe it:

- Pools - Depressions in the bog surface where the water table remains above surface level all year round or below surface level for only very short periods of time. They are characterised by the presence of aquatic plant species such as *Sphagnum cuspidatum* and *Cladopodiella fluitans*.
- Hollows - These are shallow depressions in the bog surface where surface water collects, or where the water table reaches ground level or lies just above ground level, depending on seasonal conditions. Marginal hollows tend to be elongated as they are focus points for surface water run off. They are often dominated by *Narthecium ossifragum*. On the high bog they take many forms but are often eye shaped.
- Lawns - These are shallow hollows or flat areas where one species dominates to form a lawn. This is frequently a *Sphagnum* species, such as *Sphagnum magellanicum*, which can completely fill in a hollow to form a small lawn.
- Flats - These are more or less flat areas which are intermediate between hollow and hummock communities. They tend to be drier than the above situations.
- Hummocks - These are mounds on the bog surface which can range from a few centimetres to more than a metre in height. They are usually composed mainly of *Sphagnum* species, such as *Sphagnum magellanicum, S. capilifolium, S. imbricatum* and *S. fuscum* but other bryophyte species such as *Hypnum jutlandicum* and *Leucobryum glaucum* are also important, especially as the hummock grows taller and becomes drier. *Calluna vulgaris* is another important element, as it flourishes where the water table is not at surface level.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the “health” quantity or quality of a habitat or species.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – The section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURAL RANGE – The spatial limits within which the habitat or species occurs.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NPWS - National Parks and Wildlife Service

ORTHO-RECTIFIED IMAGE – The 2000 Ordnance Survey flight colour images were used as part of this project. These images were used in TIF format and were ortho-rectified. These images have been used as base data to identify the location of raised bogs, produce the high bog boundaries and vegetation maps.

PEAT CUTTING BY HAND. - See hand cutting of peat.

PEAT CUTTING BY MACHINE - See mechanical peat extraction.

PRIORITY HABITAT - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

RAISED BOG - An NPWS habitat classification characterised by an elevated dome of peat, the surface of which is isolated from the surrounding ground water table and receiving water solely from precipitation. The peat surface is wet, often with pools and hummock hollow systems and is usually dominated by *Sphagnum* mosses and bushy heather, with Deer-grass, Bog Cottons and other associated species. Raised bogs can be distinguished from blanket bogs by their paucity of grasses which typify blanket bog.

SACs - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

SPAs - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPW is responsible for ensuring that such areas are protected from significant damage.

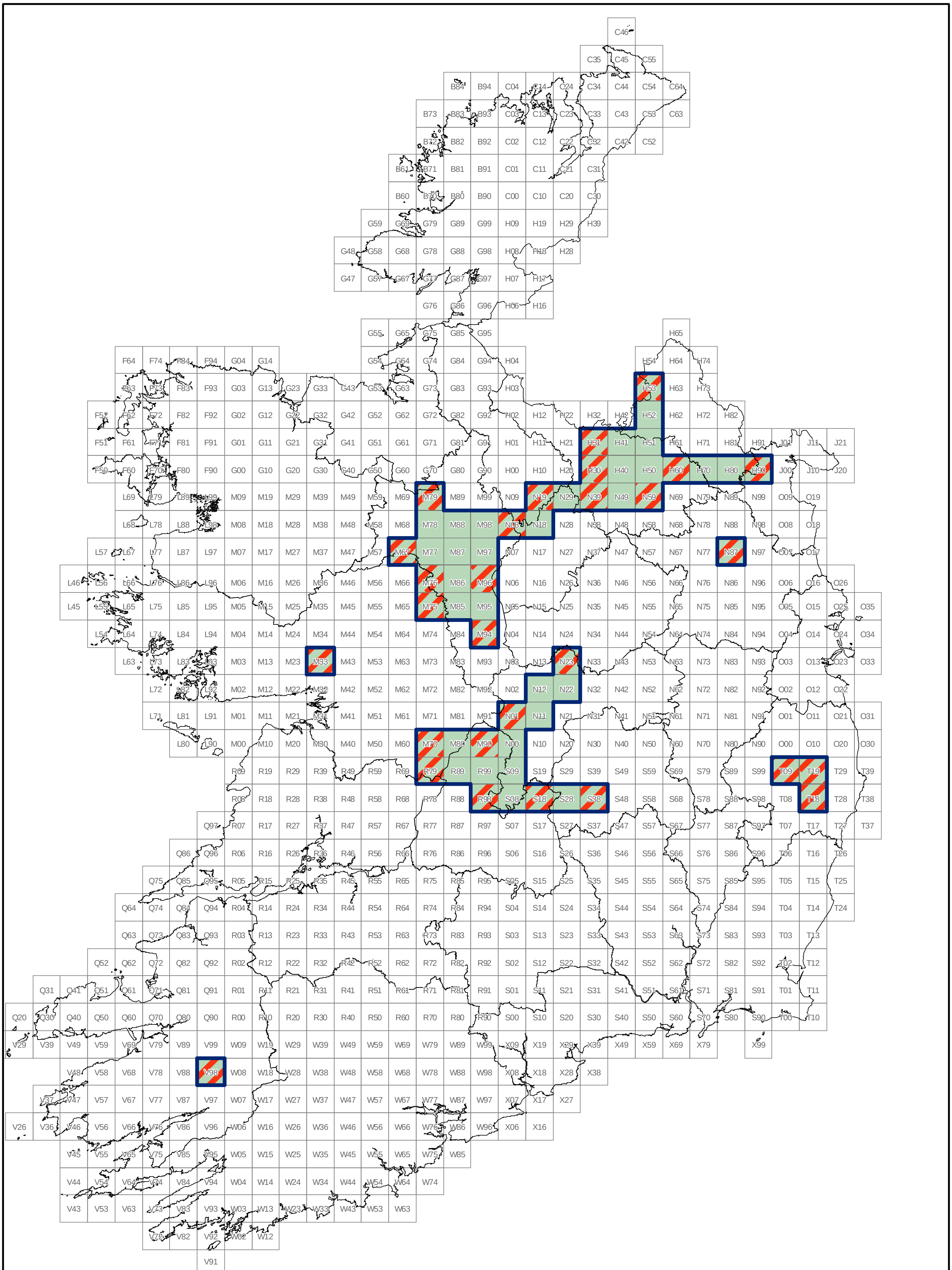
SPECIES - The lowest unit of classification normally used for plants and animals.

## **91D0** Bog Woodland

| National Level | |
|---|---|
| **Habitat Code** | 91DO |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | . <br>▪ Cross, J.R. (1987). *Unusual stands of birch on bogs*. Irish Naturalist Journal 22: 305-310. <br>▪ Derwin, J. & MacGowan, F. 2000. *Raised Bog Restoration Project: A Continuation of the Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland.* Unpublished report, Dúchas the Heritage Service, Dublin. <br>▪ Fernandez, F., Fanning, M., Mccorry, M. & Crowley, W. 2005. *Raised Bog Monitoring Project 2004-05*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin. <br>▪ Fernandez, F., MacGowan F., Crowley, W., Farrell, M., Croal, Y., Fanning, M. & McKee, A. 2006. *Assessment of impacts of turf cutting on designated Raised Bogs 2003-06*. Unpublished report, National Parks & Wildlife Service, Department of Environment, Heritage Local Government, Dublin. <br>▪ Higgins G.T. Higgins, Martin J.R., Perrin P.M. *National Survey of Irish Native Woodland* (ongoing). Unpublished report. National Parks & Wildlife Service, Department of Environment, Heritage Local Government, Dublin. <br>▪ Kelly, L., Doak, M. & Dromey, M. 1995. *Raised Bog Restoration Project: An Investigation into the Conservation and Restoration of Selected Raised Bog Sites in Ireland.* Unpublished report, National Parks & Wildlife Service, Department of Arts, Heritage, Gaeltacht and the Islands, Dublin. |
| **Range** | The main habitat variant is developed on raised bogs in the lowlands of central and mid-west Ireland. Another variant is developed in transitional mires mainly in the northeast. Some isolated habitat records on the east and south-west. |
| Surface area | 5,800km² (58 grid cells x 100km² -area polygon derived from grid cells) |
| Date | 07/2007: 2000 - 2006 |
| Quality of data | 2 = moderate |
| Trend | Stable |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | No changes |
| **Area covered by habitat** | |
| Surface area | 1.5 km² |
| Date | 07/2007: 2000 - 2006 |
| Method used | 3 = ground based survey |
| Quality of data | 2 = moderate |
| Trend | - = decreasing |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | 3 = direct human influence |

| | |
|---|---|
| Justification of % thresholds for trends | Magnitude of decline unknown |
| Main pressures | 180 Burning<br>312 Mechanical removal of peat<br>810 Drainage |
| Threats | 180 Burning<br>312 Mechanical removal of peat<br>810 Drainage |
| ***Complementary information*** | |
| **Favourable reference range** | 5,800km² (58 grid x 100 km²). Favourable range is considered to be similar to the habitat current range. |
| **Favourable reference area** | More than 1.5 km$^2$ |
| **Typical species** | Vascular plants*: Agrostis canina, Betula pubescens, Calluna vulgaris, Carex canescens, C. echinata, C. nigra, C. rostrata, Dryopteris dilatata, Empetrum nigrum, Eriophorum vaginatum, Holcus lanatus, Juncus effusus, Molinia caerulea, Pinus sylvestris, Pteridium aquilinum, Salix aurita, Vaccinium myrtillus, V. oxycoccus.*<br>Mosses, Liverworts and Lichens: *Aulacomnium palustre, Polytrichum commune, Sphagnum capillifolium, S. fimbriatum, S. palustre, S. recurvum, S. squarrosum* and *S. teres, Cladonia portentosa.*<br><br>Indicator species: *Betula pubescens, Sphagnum capillifolium, S. fimbriatum, S. palustre, S. recurvum, S. squarrosum* and *S. teres*. |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | The National Survey of Native Woodland will finish in 2007 may elucidate further areas occupied by this habitat. |
| ***Conclusions (assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable (FV) |
| **Area** | Inadequate (U1) |
| **Specific structures and functions (incl. typical species)** | Inadequate (U1) |
| **Future prospects** | Inadequate (U1) |
| **Overall assessment of CS** | Inadequate (U1) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Bog woodland**

**91D0**

- Current Distribution (29 cells)
- Current Range (58 cells)
- Favourable Reference Range (58 cells)
- W48 10km grid cells

Date: August 2007

# CONSERVATION STATUS ASSESSMENT REPORT

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## 1. Habitat characteristics in Ireland

A number of woodland types subject to alluvial deposition have been identified in Ireland. Gallery woodland occurs along the banks and islands of some lowland rivers in the east and south of the country. These stands aretypically dominated by a mixture of willow species including *Salix cinerea*[1], *S. alba*, *S. fragilis* and *S. viminalis*. Of these, only *S. cinerea* is definitely native in Ireland. *Alnus glutinosa* and *Fraxinus excelsior* are occasional or rare. The field layer is typically dense and characterised by *Calystegia sepium*, *Urtica dioica* and *Galium aparine*. This is a well defined vegetation type classified under the Salicetum albae association by Cross & Kelly (2003) and as *Alnus glutinosa –Filipendula ulmaria – Calystegia sepium* vegetation type in an interim report of the ongoing National Survey of Native Woodlands in Ireland (hereafter NSNW; Perrin *et al.* 2006).

Willow and alder carr occurs on periodically flooded fen peats around lakes. These stands form the basis of the *Alnus glutinosa – Filipendula ulmaria – Phalaris arundinacea* vegetation type of Perrin *et al.* (2006) which occurs predominantly in the north of the country. *F. excelsior* provides only sparse cover. The field layer is a diverse mix of species including *Phalaris arundinacea, Galium palustre*, *Lythrum salicaria* and *Iris pseudacorus*. Cross & Kelly (2003) attributed similar communities to the Osmundo-Salicetum association. Note that this vegetation type can also occur in non-alluvial contexts in isolated wet hollows.

Kelly & Iremonger (1997) and Cross & Kelly (2003) describe a community of "alder-ash woodland with remote sedge" which they ascribe to the Carici remotae-Fraxinetum association. This grouping includes woodland in alluvial areas but most of these stands actually occur on non-alluvial flushed sites. Soil types include fen peats and mineral soils. Field layer species include *Carex remota, Athyrium felix-femina, Agrostis stolonifera* and *Filipendula ulmaria*. Vegetation of this type would fall within the *Alnus glutinosa – Filipendula ulmaria –Fraxinus excelsior* woodland of Perrin *et al.* (2006).

Kelly & Iremonger (1997) and Cross & Kelly (2003) also describe a community of "alder-oak-ash woodland with hazel" on mineral soils which they ascribe to the deschampsietosum subassociation of the Corylo-Fraxinetum. Again, this vegetation occurs in both alluvial and non-alluvial situations. Alluvial examples, which are rare, are generally above the normal winter flooding level, making these sites the driest of those detailed here. They are nonetheless waterlogged in winter and episodically flooded. The canopy is typically dominated by *F. excelsior* with *A. glutinosa* and *Quercus robur*. The field layer includes *Filipendula ulmaria*, *Chrysosplenium oppositifolium*, *Deschampsia caespitosum* and *Ajuga reptans*. Vegetation of this type would largely also fall within the *Alnus glutinosa – Filipendula ulmaria –Fraxinus excelsior* woodland of Perrin *et al.* (2006) with some examples possibly being in the *Fraxinus excelsior – Hedera helix – Betula pubescens* vegetation type.

The definition for 91E0 * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Pandion, Alnion incanae, Salicion albae*) (hereafter Alluvial Alder-Ash Forests) presented in the Interpretation Manual (Anon. 2003) includes three regional habitat variations. That most relevant to Ireland is: "Riparian forests of *Fraxinus excelsior* and *Alnus glutinosa*, of temperate and Boreal Europe lowland and hill watercourses (44.3: *Alno-Padion*)". Fossitt (2000) links only alluvial examples of her wet pedunculate oak-ash woodland (which is based on the Corylo-Fraxinetum deschampsietosum) to this EU Habitat type. However, a broader interpretation was employed by Cross (2005) in which riparian, alluvial willow woodlands have been included under this EU habitat type on the basis that they are (or would once have been) frequently associated with alluvial oak-ash woods. These sites match with one of the other regional habitat variations: "Arborescent galleries of tall *Salix alba, S. fragilis* and *Populus nigra*, along medio-European lowland, hill or sub-montane rivers (44.13: *Salicion albae*)". In addition, the interpretation has been further extended to include alluvial areas of carr woodland next to lakes. This broader approach has been adopted for this report.

## 2. Habitat mapping

The following data sources were used to map the occurrence of Alluvial Alder-Ash Forests in Ireland on 10km square basis:

- The National Survey of Native Woodlands in Ireland: Second Phase Report (Perrin *et al.* 2006)
- Unpublished data produced by the NSNW in 2006

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[1] Although this species is not distinguished at the subspecies level in this document, subsp. *oleifolia* is very much commoner than subsp. *cinerea* in Ireland and it may be taken that the overwhelming majority of records used in compiling this report are of the former subspecies rather than latter.

- Information on designated sites, (c)SACs and (p)NHAs held on file by the National Parks and Wildlife Service (NPWS)
- Personal communication from J. Cross, NPWS

All 10km squares overlapped by an area of Alluvial Alder-Ash Forests were included. Site synopses were used to locate and map areas of Alluvial Alder-Ash Forests within designation sites.

For areas of the country not yet surveyed and where no information could be found on the extent of Alluvial Alder-Ash Forests expert judgement and examination of GIS data was used to predict 10km squares that were likely to contain the habitat. This process involved carrying out an intersection between the digitised map of native woodland produced by Higgins *et al.* (2004), data on rivers and lakes from the Ordnance Survey of Ireland and the Teagasc soil and subsoil mapping project (Fealy *et al*. 2006), all intersects were examined individually and only where a 10km square contained intersections that were judged to be significant was it assigned as containing Alluvial Alder-Ash Forest. A list of 146 non-surveyed 10km squares that potentially contained Alluvial Alder-Ash Forest was produced. To calculate the area of Alluvial Alder-Ash Forest within these 146 squares they were multiplied by the average area of the habitat contained within surveyed 10km squares.

Range was defined by mapping a minimum polygon around the identified occurrences. Breaks in the range were justified when there was a gap of greater than two grid squares between occurrences (not counting across corners). Favourable reference range was defined as the current range, as it was deemed that this was sufficient to ensure the long term viability of the habitat and that it encompassed the range of ecological variation that occurs in this habitat type in Ireland.

## 3 Habitat range

Alluvial Alder-Ash Forests, as broadly interpreted for this report, occur across the majority of the country in a variety of contexts. There are three main areas of the country from which this habitat is absent: Cos. Meath, Kildare and Dublin (which are largely agricultural or urban land lacking woodland); parts of Cos. Mayo, Co. Galway, and Sligo and much of Co. Donegal (which are predominantly blanket bog); southern Co. Clare, northern Co. Kerry and western Co. Limerick (which lack woodland). The current range is extensive and includes the ecological variation that occurs between the west and east of the country.

### 3.1 Conservation status of habitat range

The favourable reference range has been defined as the current range. Therefore the status of the habitat range is **favourable**.

**Current range:** 49,600km$^2$ (minimum polygon around grid cells containing habitat)
**Favourable reference range:** 49,600km$^2$ (defined as current range)

# 4 Habitat extent

Woodland clearance and drainage of wetlands over the last 5000 years has drastically reduced the extent of Alluvial Alder-Ash Forests in Ireland. Alluvial Alder-Ash Forests would have once occupied a significant proportion of their range whereas the current habitat extent of 45.91 km² represents only 0.09% of the current range.

24.01 km² of the current extent of Alluvial Alder-Ash Forest habitat is located in sites that had been surveyed, mostly by NSNW and NPWS, and 21.90 km² of the current extent are areas of potential Alluvial Alder-Ash Forest (see Section 2). The figure of 21.90 km² was calculated by multiplying the 146 10km squares that potentially contained Alluvial Alder-Ash Forest by 15ha, the average area of the habitat contained within each of the surveyed squares.

## 3.2 Conservation status of habitat extent

NPWS site inspections for (c)SACs between 1998 and 2003 indicated that 2ha of Alluvial Alder-Ash Forest had been lost. In addition, during the NSNW, loss of this habitat was observed at several sites. A minimum estimate of habitat loss between 1998 and 2006 is 0.11% but the actual figure may be considerably higher.

The favourable reference area is very difficult to define as there are no figures available on the areas subject to flooding. The Favourable Reference Range is very large because alluvial woodlands occur throughout the country. However, the area of potential alluvial woodland is restricted to those areas subject to flooding and will be very much less than the FRR. The area of alluvial soils is therefore considered to be a more realistic yardstick upon which to base the Favourable Reference Area and it is these areas which should be targeted for woodland expansion. From the soils maps this is calculated as 243,700ha. In addition, there are areas of lacustrine deposits, although as we have insufficient information regarding the flooding regimes of these soils they are ignored for the purposes of this exercise.

Based on the area of alluvial soil the FRA was set at 121.85 km$^2$, which represents 0.25%% of the favourable reference range or 5% of the area of alluvial soil. On average, this translates as 25ha in every 10km square. Peterken (2002) suggests that large woods should be maintained above 25ha, with smaller woods being at least 3ha. The 0.25% level would therefore permit one sizeable wood or several smaller sites in every 10km square, thereby reducing fragmentation.

Due to the fact that the current habitat extent of Alluvial Alder-Ash Forest is only 37% of the favourable reference area the conservation assessment for habitat extent is **unfavourable bad**

**Current area:** 45.91km$^2$
**Favourable reference area:** 122km$^2$ (0.25% of favourable reference range)

# 5. Structures and functions

## 5.1 Habitat structures and functions

Within Ireland, Alluvial Alder-Ash Forests have been heavily altered by thousands of years of human activity. What remains is a modified and highly fragmented sample of the primeval forests that once covered significant areas of the island. It should therefore be noted that as Ireland no longer contains any pristine examples of Alluvial Alder-Ash Forests, any assessment of structure and function is hampered by a lack of reference points. Knowledge of ecological processes and expert opinion has thus been used to judge what constitutes favourable status for these characteristics.

In assessing the structure and function of Alluvial Alder-Ash Forests the following factors were considered:

- Habitat fragmentation
- Natural regeneration
- Stand structure
- Dead wood
- Fauna

When assessing habitat structures and functions, the Explanatory Notes and Guidelines (Anon. 2006) were interpreted where relevant so that if greater than 25% of sites surveyed by the NSNW were judged to be unfavourable as regards any one specific structure or function, then Alluvial Alder-Ash Forests in Ireland were judged to be in an unfavourable condition.

### 5.1.1 Habitat fragmentation

The Alluvial Alder-Ash Forests resource in Ireland is highly fragmented. Of the 202 sites identified by the NSNW the average size is only 5.3ha, with only 2.5% of sites covering an area of 25ha or more and 45% of sites with an area of less than 3ha. Fragmentation increases the impact of edge effects on the habitat and greatly decreases the area of core woodland habitat. One of the main effects of this on the structure and function of the habitat is that there are now very few specialist species of flora or fauna located within Alluvial Alder-Ash Forests and the number of generalist species recorded within even the core habitats of sites is large. Smaller sites can support only small populations that are more vulnerable to stochastic events. Habitat fragmentation can be regarded as **unfavourable bad**.

### 5.1.2 Natural regeneration

Natural regeneration of tree species is evidently an integral function of Alluvial Alder-Ash Forests. Regeneration status at a site can be assessed by counting the number of immature individuals (seedlings, saplings and poles). The three most common tree species within Alluvial Alder-Ash Forests are *Alnus glutinosa, Fraxinus* excelsior and *Salix cinerea* (see section 5.1.3). The data from the NSNW (Perrin *et al.* 2006, unpublished data) show that *A. glutinosa* poles, the next generation of mature trees, were recorded as absent from 12% of Alluvial Alder-Ash Forest sites where the mature tree was more than occasional, *F. excelsior* poles were recorded as absent from 7% of sites where the mature tree was more than occasional and *Salix cinerea* poles were recorded as absent from 13% of sites where the mature tree was more than occasional (Table 1).

| | **Modified DAFOR Scale** | | |
|---|---|---|---|
| ***Alnus glutinosa*** | | | |
| Regeneration class | Absent | Rare/Occasional | More than Occasional |
| Seedlings | 53% | 40% | 7% |
| Saplings | 34% | 48% | 18% |
| Poles | 12% | 44% | 44% |
| ***Fraxinus excelsior*** | | | |
| Regeneration class | Absent | Rare/Occasional | More than Occasional |
| Seedlings | 13% | 33% | 54% |
| Saplings | 18% | 43% | 39% |
| Poles | 7% | 36% | 57% |
| ***Salix cinerea*** | | | |
| Regeneration class | Absent | Rare/Occasional | More than Occasional |
| Seedlings | 88% | 9% | 3% |
| Saplings | 62% | 31% | 7% |
| Poles | 13% | 43% | 44% |

**Table 1: Frequency of *Alnus glutinosa, Fraxinus excelsior* and *Salix cinerea* regeneration at NSNW Alluvial Alder-Ash Forests sites where that same species was at least frequent as a mature tree. Seedlings are ≤ 25 cm tall, <7 cm dbh; saplings are < 200 cm tall, <7 cm dbh; pole ≥200 cm tall and dbh <7 cm.**

*F. excelsior* has greater regeneration potential than *A. glutinosa* and *S. cinerea* within Alluvial Alder-Ash Forests with seedlings, saplings and poles absent at fewer sites and more than occasional at a greater number of sites. Note that no differentiation is made here between reproduction from seed and vegetative reproduction; the latter is likely to be an important mechanism for *S. cinerea.*

It should be noted that data collected on stand structure within Alluvial Alder-Ash Forest sites (Section 5.1.3) has shown that many examples of this woodland habitat are young. As less regeneration would be expected under a young closed canopy than in a more mature stand with naturally formed canopy gaps, e.g. from large fallen trees, this fact should be considered when interpreting the regeneration data.

The absence of *S. cinerea* poles from 13% of relevant Alluvial Alder-Ash Forest sites, *A. glutinosa* poles from 12% of relevant sites and *F. excelsior* poles from 7% of relevant sites can be considered to be **unfavourable inadequate**.

### 5.1.3 Stand structure

Optimally, woodland structure should remain diverse with a relatively closed canopy layer, a subcanopy layer composed mostly of young mature canopy species and an understorey layer. The current situation within Alluvial Alder-Ash Forests is indicated by the NSNW data set (Perrin *et al.* 2006, unpublished data). Of the three canopy species typical of Alluvial Alder-Ash Forests, *Alnus glutinosa* is frequent as a mature tree within 72% of sites, *Salix cinerea* is frequent as a mature tree at 64% of sites, and *Fraxinus excelsior* is frequent as a mature tree at 57% of sites. The structural data for mature stems of *A. glutinosa, F. excelsior* and *S. cinerea* within sites surveyed during NSNW was used to produce size class frequency curves (Figs. 1-3).

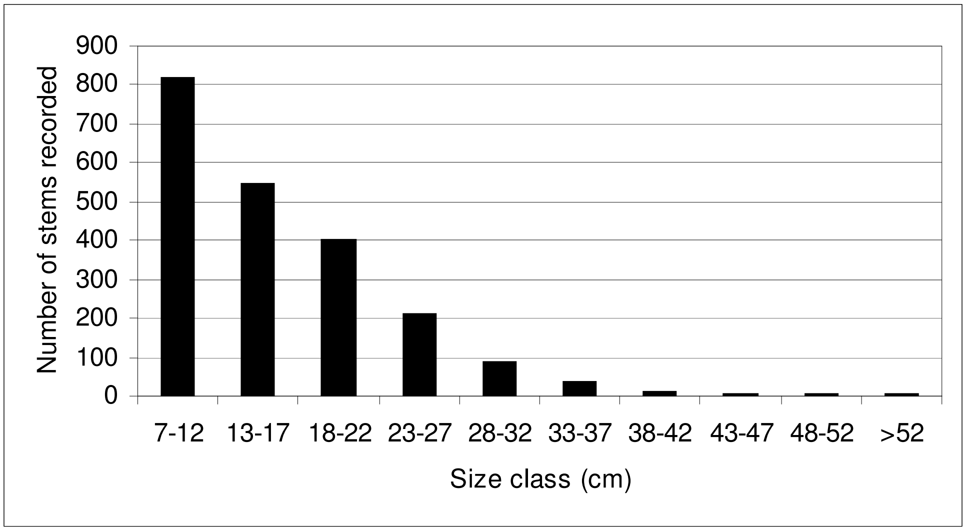


**Figure 1**: **Number of *Alnus glutinosa* stems recorded in 5cm size classes. All mature *A. glutinosa* trees recorded by NSNW within Alluvial Alder-Ash Forest relevés with a stem ≥7cm in diameter were included.**

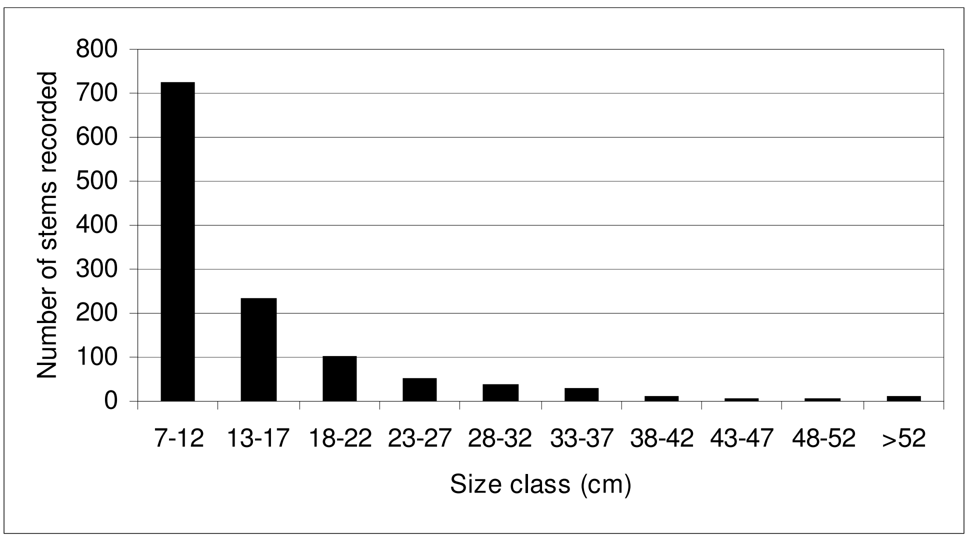


**Figure 2**: **Number of *Fraxinus excelsior* stems recorded in 5cm size classes. All mature *F. excelsior* trees recorded by NSNW within Alluvial Alder-Ash Forest relevés with a stem ≥7cm in diameter were included.**

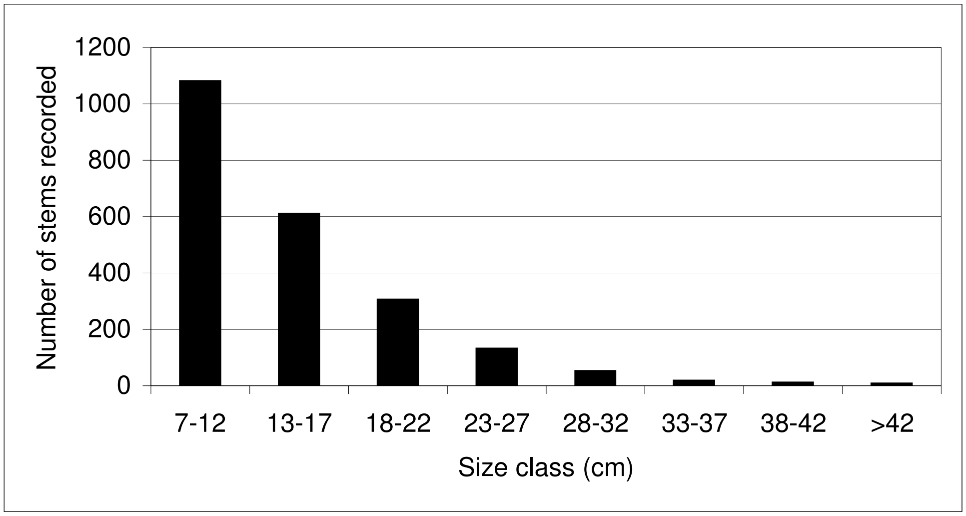


**Figure 3**: **Number of *Salix cinerea* stems recorded in 5cm size classes. All mature *S. cinerea* trees recorded by NSNW within Alluvial Alder-Ash Forest relevés with a stem >7cm in diameter were included.**

The mature stems of *A. glutinosa, F. excelsior* and *S. cinerea* are most frequent in the smaller size classes and least frequent in the larger size classes, a scenario to be expected within a sustainable population. However, in the case of *F. excelsior* (Fig. 2) the drop off in the curve after size class 7-12cm is noticeable indicating that the *F. excelsior* component of Alluvial Alder-Ash Forest in Ireland comprises mostly quite small trees. Indeed, for all three species trees over 40cm dbh are rare. This may reflect a relatively young status of Alluvial Alder-Ash Forests in Ireland. This may be a result of past clearfelling, the selective felling of larger trees, or the recent establishment of new woodland on infilling fen peat. Due to the absence of poles at many sites and the scarceness of stems greater than 40cm dbh, stand structure is regarded as **unfavourable inadequate**. (Comment: it may also reflect unfavourable conditions for the development of large trees, especially on waterlogged sites – J. Cross)

### 5.1.4 Dead wood

Dead wood increases the range of substrates available to lichens and bryophytes and provides important niches and resources for other taxa, most notably fungi and invertebrates. The accumulation of a range of dead wood types takes time and is indicative of older woodlands. The removal of large stature dead wood from intensively managed sites can reduce their conservation status.

The NSNW recorded the frequency of dead wood in Alluvial Alder-Ash Forests and found that smaller woody debris, such as branches and twigs, were the most abundant types of dead wood, being recorded as at least occasional on the DAFOR scale at 99% of sites. Larger dead wood structures such as standing dead and uprooted trees were recorded as at least occasional at 82% of sites. Such a pattern is unsurprising given the nature of the different categories: smaller woody debris may be generated by most trees in most years, whereas uprooted trees are a less frequent occurrence. The fact that larger dead wood structures are rare or absent from 18% of sites may be indicative of the young nature of some of the surveyed sites, but could also be a consequence of human removal of older trees from sites. Due to this lack of larger dead wood, the dead wood component of the habitat is regarded as **unfavourable inadequate**.

### 5.1.5 Fauna

Red deer (*Cervus elaphus*) is the only extant large herbivore native to Ireland (Mitchell 2005), wild boar (*Sus scrofa*) having been extinct since the Middle Ages. The red deer population in Ireland is much modified with the introduction of non-Irish red deer populations and some localised hybridisation between red deer and introduced sika deer (*Cervus nippon*). Due to the extinction of the wolf (*Canis lupus*) in Ireland, red deer no longer have an effective natural predator and in certain areas of Ireland this has resulted in an increase in grazing pressure on woodlands. The distribution of red deer in Ireland is also patchy with the species being absent from some areas of the current range of Alluvial Alder-Ash Forests.

The function of smaller mammals (e.g. *Sciurus vulgaris, Lepus timidus hibernicus, Lutra lutra, Meles meles, Neosciurus carolinensis*, *Martes martes*) that are found in Alluvial Alder-Ash Forests is either minimal or unclear based on present available data. For some of these species these woods are not their primary habitat although nonetheless important for some.

The number of published studies of birds in Irish woodland are limited (Batten 1976; Wilson 1977; Nairn & Farrelly 1991; Duffy *et al*. 1997) and there are no specific studies involving Alluvial Forests.

In the case of the fauna of Alluvial Alder-Ash Forests the current situation is **unfavourable bad**.

### 5.1.1. Conservation Status of Habitat Structures and Functions

Alluvial Alder-Ash Forests are an extremely fragmented habitat with 45% of sites being less than 3ha in size, a situation that is **unfavourable bad**. Natural regeneration within Alluvial Alder-Ash Forests, represented by the main canopy species *Alnus glutinosa, Fraxinus* excelsior and *Salix cinerea*, is **unfavourable inadequate** with the poles, the next generation of canopy trees, of these species absent from 12%, 7% and 13% of sites respectively. Larger dead wood structures were absent from 18% of sites a situation that is **unfavourable inadequate**. Finally, the faunal component of Alluvial Alder-Ash Forests is judged to be **unfavourable bad** with red deer suffering from out-breeding and hybridisation. Overall the conservation status of habitat structures and functions is **unfavourable bad.**

## 5.2 Typical Species

Due to the long-term and widespread nature of the modification to this habitat it is difficult to assess with confidence what may or may not have once been a “typical species”. As a result of its long history of fragmentation and greatly reduced area many species now found in this habitat can also occur in other woodland types or non-woodland habitats (e.g. freshwater marsh). There are a few species which might potentially be regarded as specialists for this habitat (e.g*. Cardamine amara, Carex elongata, Lathyrus palustris, Populus nigra* subsp*. betulifolia* and *Scrophularia umbrosa*) but they are now either geographically restricted or rare. There is insufficient information to assess whether these species were ever widespread enough to be suitable as status indicator species for the habitat as a whole. It should therefore be noted that few if any species in this list are “species which are inseparable from the habitat – other than those on which the habitat is defined” as recommended by in the assessment guidelines (Anon. 2006).

The list of typical species is presented in Table 2. This includes all species occurring in more than 60% of the samples of the *Calystegia sepium* or *Phalaris arundinacea* vegetation types of the *Alnus glutinosa – Filipendula ulmaria* woodland group as defined by Perrin *et al.* (2006), and all native species recorded in more than 60% of relevés of the Salicetum albae association or the Osmundo Salicetum association defined by Kelly & Iremonger (1997) and Cross & Kelly (2003). There are three additional vegetation groupings described by Kelly & Iremonger (1997), an *Alnus glutinosa – Carex paniculata* community, a Carici remotae – Fraxinetum association, and a Corylo-Fraxinetum deschampsietosum subassociation, but only a small number of the sites which define these groupings are Alluvial Alder-Ash Forests and hence they were not used to compile the typical species list.

The Interpretation Manual of European Union Habitats (Anon. 2003) lists 23 species as typical of Alluvial Alder-Ash Forests. Of these species, six are not native in Ireland (*Alnus incana*, *Anemone ranunculoides, Cirsium oleraceum, Corydalis solida, Salix alba* and *Salix fragilis*), two are rare in Ireland as a whole (*Cardamine amara* and *Populus nigra* subsp*. betulifolia*) and eight are not frequent within Alluvial Alder-Ash Forests as defined by this report (*Anemone nemorosa, Betula pubescens, Carex acutiformis, Carex pendula, Carex strigosa, Carex sylvatica, Ranunculus ficaria* and *Ulmus glabra*). The remaining seven species are indicated in Table 2. Note that all seven of these species are included in the selections from Perrin *et al.* (2006) and / or Kelly & Iremonger (1997).

Ireland has a depauperate native vascular plant flora in comparison with the rest of Europe due to its geographic position (Webb 1983). With regard to Alluvial Alder-Ash Forests this means that two species of willow (*Salix alba* and *Salix fragilis*) which are important features of gallery woodland on the continent are not native in Ireland. They have, however, been introduced and widely planted, alongside several other non-native *Salix* spp., within the riparian landscape in Ireland. One possible effect of the absence of native *S. alba* and *S. fragilis* populations may be that the native species *Salix cinerea* is more widespread within Irish Alluvial Alder Ash Forests than it would be in continental Europe.

**Table 2: The 30 typical species for Alluvial Alder-Ash Forests habitat in Ireland. Data from: Perrin *et al.* (2006)[1], Kelly & Iremonger (1997)[2], Anon. (2003)[3]. Frequent means present in >60% of samples.**

| Typical species | Frequent in the *Calystegia sepium* vegetation type[1] | Frequent in the *Phalaris arundinacea* vegetation type[1] | Frequent native species in the Salicetum albae[2] | Frequent native species in the Osmundo-Salicetum[2] | Relevant species from Interpretation Manual description[3] |
|---|---|---|---|---|---|
| *Alnus glutinosa* | | * | | * | * |
| *Agrostis stolonifera* | | | | * | |
| *Angelica sylvestris* | * | * | * | | * |
| *Brachythecium rutabulum* | * | * | * | | |
| *Calliergonella cuspidata* | | * | | * | |
| *Caltha palustris* | | | * | | |
| *Calystegia sepium* | * | | | | |
| *Cardamine flexuosa* | | | * | | |
| *Cardamine pratensis* | | | * | | * |
| *Carex remota* | | | * | | * |
| *Equisetum fluviatile* | | * | | | |
| *Filipendula ulmaria* | * | * | * | * | * |
| *Fraxinus excelsior* | | * | | | * |
| *Galium aparine* | * | | * | | |
| *Galium palustre* | | * | | * | |
| *Hypnum cupressiforme* | | * | * | | |
| *Iris pseudacorus* | | * | * | | |
| *Kindbergia praelonga* | * | * | * | * | |
| *Mentha aquatica* | | * | | | |
| *Oenanthe crocata* | | | * | | |
| *Oxyrrhynchium hians* | | | * | | |
| *Phalaris arundinacea* | | * | * | | |
| *Poa trivialis* | | | * | | |
| *Ranunculus repens* | | | * | | |
| *Rubus fruticosus* | * | | | | |
| *Rumex sanguineus* | | | * | | * |
| *Salix cinerea* | * | * | * | * | |
| *Thamnobryum alopecurum* | | | * | | |
| *Urtica dioica* | * | | * | | |
| *Valeriana officinalis* | | | | | |

#### 5.2.2. Conservation Status of Habitat Typical Species

Although the status of many of the typical species could be affected by the drainage of Alluvial Alder-Ash Forests (see section 6.3) and lack of natural regeneration at many important sites (see section 5.1.2) could affect the conservation status of the trees in the typical species list (e.g. *Alnus glutinosa, Fraxinus excelsior* and *Salix cinerea*), these are both effects that are assessed separately in others sections of this report. The conservation status of the 30 typical species listed in Table 2 can be regarded as **favourable.** However, there are other rarer species, such as *Cardamine amara* and *Carex elongata* that are almost exclusively restricted to Alluvial Alder-Ash Forests and have an unfavourable conservation status within Ireland.

## 6. Impacts and Threats

Alluvial Alder-Ash Forests in Ireland face both internal and external threats. Internal effects include inappropriate grazing levels and invasive species, whereas external threats include clearance for agriculture or felling for timber. The increasing number of road schemes and housing developments currently occurring in Ireland has also negatively impacted upon this habitat. There is little quantifiable data available on losses due to these activities, partly due to lack of baseline data prior to the NSNW. However, data from the NPWS site inspection reporting forms has shown that there have been recent negative impacts even on Alluvial Alder-Ash Forests within (c)SACs (e.g. the loss of 1ha from the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment (c)SAC due to the development of a golf course and housing). Currently, more information is available on internal threats to this habitat, which consist primarily of inappropriate grazing levels and invasive species. All data presented here are from the NSNW (Perrin *et al.* 2006, unpublished data).

### 6.1 Grazing

Grazing is a natural feature of Alluvial Alder-Ash Forests, but high levels of grazing can be detrimental. Heavy grazing reduces or precludes natural regeneration and impacts on the diversity and species composition of the field layer through the suppression of palatable species, e.g. *Rubus fruticosus* and the associated promotion of unpalatable or grazing-tolerant species (e.g. grasses). Conversely, a complete lack of grazing can also be undesirable as strong competitors, such as *Rubus fruticosus*, can dominate the field layer, again effecting diversity and species composition. Species favoured by disturbance of the soil and litter layers may also decline.

Overall, heavy grazing was not a feature of the Alluvial Alder-Ash Forests surveyed by the NSNW. High and severe grazing levels were infrequently encountered, occurring at 7% and 1% of sites respectively. Cattle (25% of sites) and deer (22% of sites) were the most frequently identified grazers. Sheep, rabbits, horses, goats, and hares were recorded much less frequently.

Conversely, at 53% of sites no grazing was apparent. These woods may have been ungrazed because they were enclosed by ditches and fences, or a bordering river may have made access to the site more difficult. Overall, it may be regarded that 61% of sites had suboptimal (no grazing or high/severe grazing) grazing levels.

**Grazing trend**

No comparable records are available.

## 6.2 Invasive species

The five most common invasive plant species found in Alluvial Alder-Ash Forests are *Acer pseudoplatanus, Fagus sylvatica, Rhododendron ponticum, Prunus laurocerasus,* and *Cornus sericea*.

### 6.2.1 *Acer pseudoplatanus*

*A. pseudoplatanus* was present in 75% of the Alluvial Alder-Ash Forests surveyed by the NSNW, making it the most common of the five main invasive species, and was frequent in 7% of the sites. There is very little quantitative data on the invasive potential of *A. pseudoplatanus* in Ireland. It is regarded as being a more serious invasive threat in woodlands on base-rich soils, where it may compete with *Fraxinus excelsior* as a canopy dominant.

### 6.2.2 *Fagus sylvatica*

*F. sylvatica* was present in 52% of the Alluvial Alder-Ash Forests surveyed by the NSNW and was frequent in 2% of the sites. There is very little quantitative data on the invasive potential of *F. sylvatica* in Ireland. Due to the heavy shade it casts, high shade tolerance and unpalatability it has the potential to out-compete native tree species. *F. sylvatica* also has a negative effect on the field layer by producing a deep, acidifying and smothering litter layer.

6.2.3 *Rhododendron ponticum*

Although *R. ponticum* is a problem as an invasive in Old Sessile Oak woods (Neff 1975, Cross 1982, Hayes *et al*. 1991, Barron 2000) it is only present in 14% of Alluvial Alder-Ash Forests and was deemed a high level of threat at only 5% of Alluvial Alder-Ash Forests sites. *R. ponticum* is a serious threat due to its high fecundity and the difficulties in removing it from an area once a serious infestation has occurred.

6.2.4 *Prunus laurocerasus*

Unlike *Rhododendron* the negative effects of *P. laurocerasus* within Irish woodlands have not been well documented, but the main effects on the structure and function of the woodland are similar as it can drastically reduce the amount of light reaching the herb layer preventing the growth of the native species including tree seedlings. It is viewed as a less aggressive invader then *R. ponticum*. Data from the NSNW show that *P. laurocerasus* was present in 13% of Alluvial Alder-Ash Forests and the species was a high level threat at 6% of these sites.

6.2.5 *Cornus sericea*

*C. sericea* was present in 8% of the Alluvial Alder-Ash Forests surveyed by the NSNW and the species was recorded at a high threat level at 6% of the sites. There is very little quantitative data on the invasive potential of *C. sericea* in Ireland although the potential for this plant to invade wetlands has been highlighted by Kelly (1990). The data from the NSNW show that the species almost always produced extensive thickets where it was present. Unlike *R. ponticum* and *P. laurocerasus* it is not an evergreen species and therefore it may be less detrimental as more light reaches the field layer.

**Invasive species trend**

No comparable records are available.

## 6.3 Drainage

The drainage of Alluvial Alder-Ash Forests lowers the water table leading to a drying out of the soil and a possible reduction in the incidence of flooding. Over time the drying out of Alluvial Alder-Ash Forests will lead to a change in the flora and fauna with the typical species associated with the habitat replaced by those adapted to a drier environment. During the NSNW drainage was recorded at 46% of sites, either in the form of internal drains or drains dug around the borders of a site. Arterial drainage work (the artificial deepening and widening of river channels) has been widespread in Ireland and results in a reduced incidence and / or longevity of flooding.

**Drainage trend**

No comparable records are available.

### 6.4 Planting of non-native conifers

NSNW data show that old conifer planting had occurred at 15% of sites, but new conifer planting (generally within the last 10 years) had only occurred at 3% of sites. Although some non-native conifer species that are planted within Alluvial Alder-Ash Forests can regenerate within the woodland they do not pose a significant invasive threat. However, the planting of conifers do have a negative impact on Alluvial Alder-Ash Forests primarily because of the disturbance that occurs during planting and the competitive effects on native species.

**Planting of non-native conifers trend**

No comparable records are available.

### 6.5 Felling of native tree species

Generally there should be no felling of native tree species within Alluvial Alder-Ash Forests. Canopy gaps and standing or fallen dead wood should be allowed to generate naturally. However, if felling does take place within a sustainable forest management plan it is not necessarily a threat. Data available from Alluvial Alder-Ash Forests sites surveyed during the Native Woodland Survey of Ireland show that the felling of native tree species had occurred at 6% of sites.

**Felling of native tree species trend**

No comparable records are available.

# 7 Future Prospect

## 7.1 Negative Future Prospects

Drains are present at 46% of Alluvial Alder-Ash Forests, 61% of sites have sub-optimal grazing, and the most invasive tree species *Acer pseudoplatanus* is present in 75% of sites. The future prospects with regards to these factors may be regarded as **unfavourable bad**. The presence of the invasive shrub species *Rhododendron* in 14% of sites may be regarded as **unfavourable inadequate**. Although a threat is still present until it has a score of zero, on a national scale threats that are assessed to be near zero can be considered to be having a negligible effect on the habitat across the country as a whole. For Alluvial Alder-Ash Forests this can be applied to the recent planting of conifers and the felling of native tree species with only 3% of and 6% of sites affected respectively by these threats.

## 7.2 Positive Future Prospects

Currently, 34% of Alluvial Alder-Ash Forest sites are within a (c)SAC and an additional 23% of sites are within a (p)NHA, resulting in 57% of all sites being within a designated area. This optimism must be tempered by the fact that losses of this habitat are still occurring within (c)SACs and improved enforcement is necessary.

The Native Woodland Scheme launched in 2000 provides government funding for the planting of new native woodlands and the restoration of existing sites (Anon. 2005). In August 2006, 126 restoration projects involving 590ha of woodland and 35 establishment projects involving 340ha had been approved. Approximately 51% of these projects would have involved alder-ash-willow woodland but not necessarily on alluvial sites (Forest Service, unpublished data). The Forest Service is anxious to target alluvial sites in the second phase of the Native Woodland Scheme, due to commence shortly. However, as alluvial woodlands by their nature tend to be linear features and rivers often form the boundary to land holdings, a large number of landowners will need to be involved to ensure that this expansion takes place. To achieve the favourable reference area therefore could take many years.

Coillte Teoranta (the state-sponsored forestry company) is restoring three areas of alluvial woodland under a restoration scheme financed by the EU LIFE Nature fund. These sites, at Hazelwood Demesne, Co. Sligo, Durrow, Co. Laois, and Camcor, Co.

Offaly, total 136.3ha. Work involves the removal of *Rhododendron* and non-native conifers and restoration of natural flooding regimes.

### 7.3 Overall habitat future prospects

Overall the habitat future prospects are **unfavourable bad.**

## 8 Overall Assessment of the Habitat Conservation Status

- The current habitat range is considered to be the same as the Favourable Reference Range (FRR) and is thus **favourable**.
- The current habitat extent of is more than 10% below the Favourable Reference Area (FRA) and thus **unfavourable bad**. The FRA is defined as 1% of the FRR.
- An **unfavourable bad** assessment is also given to the habitat structures and functions, with the extremely fragmented nature of Alluvial Alder-Ash Forests contributing to this assessment.
- The habitat's future prospects are deemed to be **unfavourable bad**. The presence of drains at more than 25% of sites severely threatens the viability of the habitat. Major positive management actions including the removal of drains are required.

Thus, considering the **unfavourable bad** assessment for three of the four main habitat attributes the overall conservation status for Alluvial Alder-Ash Forest within Ireland is **unfavourable bad**.

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**Appendix 1**: An index of the 222 Alluvial Alder-Ash Forests within Ireland listed alphabetically by county.

| Site Name | County | Primary Selection Criteria |
|---|---|---|
| Ballinvally Wood | Carlow | NSNW Site |
| Ballynattin | Carlow | NSNW Site |
| Ballypierce | Carlow | NSNW Site |
| Borris | Carlow | NSNW Site |
| Clogheristick Wood | Carlow | NSNW Site |
| Annaghduff | Cavan | NSNW Site |
| Ballyconnell Demesne | Cavan | NSNW Site |
| Bellamont Forest | Cavan | NSNW Site |
| Bellamont Forest Centre | Cavan | NSNW Site |
| Clontycarnaghan | Cavan | NSNW Site |
| Coragh | Cavan | NSNW Site |
| Crover | Cavan | NSNW Site |
| Cullies | Cavan | NSNW Site |
| Deerpark | Cavan | NSNW Site |
| Drumlumman | Cavan | NSNW Site |
| Garrysallagh | Cavan | NSNW Site |
| Garthylough | Cavan | NSNW Site |
| Killycramph Wood Shoreline | Cavan | NSNW Site |
| Kilnahard | Cavan | NSNW Site |
| Lavey | Cavan | NSNW Site |
| Lisdoagh | Cavan | NSNW Site |
| Newtown Wood | Cavan | NSNW Site |
| Shinan | Cavan | NSNW Site |
| Skeagh | Cavan | NSNW Site |
| Skeagh Headland | Cavan | NSNW Site |
| Trinity Island Wood | Cavan | NSNW Site |
| Tullyguide Lough | Cavan | NSNW Site |
| Craggaunowen | Clare | NSNW Site |
| Cregg | Clare | NSNW Site |
| Cullaun Woods | Clare | NSNW Site |
| Doon Island Wood | Clare | NSNW Site |
| Doonass Demesne | Clare | NSNW Site |
| Dooros | Clare | NSNW Site |
| Garrannon Woods | Clare | NSNW Site |
| Knocknageeha | Clare | NSNW Site |
| Aghaneenagh | Cork | NSNW Site |
| Bandon River | Cork | Designated Site |
| Cloheen Strand Intake | Cork | NSNW Site |
| Corbally South | Cork | NSNW Site |
| Dunbeacon Shingle | Cork | Designated Site |
| Garrycloyne Wood | Cork | NSNW Site |
| Gearagh | Cork | Designated Site |
| Glebe | Cork | NSNW Site |
| Glengarriff | Cork | Designated Site |
| Ardnamona Wood | Donegal | NSNW Site |
| Feddyglass North East | Donegal | NSNW Site |
| Keeloges | Donegal | NSNW Site |
| Glassavullaun | Dublin | NSNW Site |
| Loughlinstown Wood | Dublin | NSNW Site |
| Gortacarnaun | Galway | NSNW Site |

| Site Name | County | Primary Selection Criteria |
|---|---|---|
| Killeen Wood | Galway | Designated Site |
| Rinmaher Wood | Galway | NSNW Site |
| Ross Lake and Woods | Galway | Designated Site |
| Ballyseedy Wood | Kerry | Designated Site |
| Caragh River | Kerry | Miscellaneous |
| Castlemaine Harbour | Kerry | Designated Site |
| Game Wood | Kerry | NSNW Site |
| Killarney National Park | Kerry | Designated Site |
| Tralee Bay | Kerry | Designated Site |
| Bertbridge | Kildare | NSNW Site |
| Burtonhall Demense | Kildare | NSNW Site |
| Greatconnell | Kildare | NSNW Site |
| Martinstown | Kildare | NSNW Site |
| Moone Woodlands | Kildare | NSNW Site |
| Newbridge School Wood | Kildare | NSNW Site |
| Rahin Wood | Kildare | NSNW Site |
| Ballytobin / Ballaghtobin | Kilkenny | NSNW Site |
| Coolnamuck 2 | Kilkenny | NSNW Site |
| Fiddown | Kilkenny | NSNW Site |
| Gowran | Kilkenny | NSNW Site |
| Island on the Nore | Kilkenny | NSNW Site |
| Kilcullen | Kilkenny | NSNW Site |
| Kilfane House | Kilkenny | NSNW Site |
| Kilmacow | Kilkenny | NSNW Site |
| Murphy's of the River | Kilkenny | NSNW Site |
| Opposite Murphy's of the River | Kilkenny | NSNW Site |
| Raheendonore | Kilkenny | NSNW Site |
| Thomastown | Kilkenny | NSNW Site |
| Ashfield | Laois | NSNW Site |
| Ballhuppahane | Laois | NSNW Site |
| Capard | Laois | NSNW Site |
| Castledurrow Demesne | Laois | Miscellaneous |
| Clopook Valley | Laois | NSNW Site |
| Donore House Wood | Laois | NSNW Site |
| Glenmalyre Demesne | Laois | NSNW Site |
| Knockbeg College | Laois | NSNW Site |
| North Brow | Laois | NSNW Site |
| Rathcoffey | Laois | NSNW Site |
| River Barrow and River Nore: Abbeyleix | Laois | Designated Site |
| Ardagh | Leitrim | NSNW Site |
| Buckode | Leitrim | NSNW Site |
| Carrickarinn | Leitrim | NSNW Site |
| Conaghil | Leitrim | NSNW Site |
| Derrycarne Demesne South | Leitrim | NSNW Site |
| Derrycarne Shoreline | Leitrim | NSNW Site |
| Keelrin East | Leitrim | NSNW Site |
| Lough MacHugh Wood | Leitrim | NSNW Site |
| Mount Campbell Woods South | Leitrim | NSNW Site |
| Mullaghboy | Leitrim | NSNW Site |
| Mullaghboy South | Leitrim | NSNW Site |
| Rinn Lough Woods | Leitrim | NSNW Site |
| Roosky Hill | Leitrim | NSNW Site |

| Site Name | County | Primary Selection Criteria |
|---|---|---|
| Curraghchase Woods | Limerick | Designated Site |
| Glen Bog | Limerick | Designated Site |
| Lower River Shannon | Limerick | Designated Site |
| Annagh (Castle Forbes) | Longford | NSNW Site |
| Clonguish (Castle Forbes) | Longford | NSNW Site |
| Coolnahinch | Longford | NSNW Site |
| Corlehan (Castle Forbes) | Longford | NSNW Site |
| Derrycassin | Longford | NSNW Site |
| Derrydaragh | Longford | NSNW Site |
| Gubroe (Castle Forbes) | Longford | NSNW Site |
| Larkfield | Longford | NSNW Site |
| Beaulieu | Louth | NSNW Site |
| Carracloghan | Louth | NSNW Site |
| Collon | Louth | NSNW Site |
| Rathscar Lake | Louth | NSNW Site |
| Ballykine Wood | Mayo | Miscellaneous |
| Breakey | Meath | NSNW Site |
| Derrysheridan | Meath | NSNW Site |
| Derrysheridan North Shore | Meath | NSNW Site |
| Derrysheridan South Shore | Meath | NSNW Site |
| Grove Island | Meath | NSNW Site |
| Newcastle | Meath | NSNW Site |
| Tree Island | Meath | NSNW Site |
| Yellow Island | Meath | NSNW Site |
| Black Lough & Lough Bawn Woods | Monaghan | NSNW Site |
| Capragh Lough South | Monaghan | NSNW Site |
| Corlat | Monaghan | NSNW Site |
| Corrybrackan | Monaghan | NSNW Site |
| Dromore West | Monaghan | NSNW Site |
| Drumillard Big | Monaghan | NSNW Site |
| Fairfield Demense | Monaghan | NSNW Site |
| Flagpole Lough Shore | Monaghan | NSNW Site |
| Island Bridge | Monaghan | NSNW Site |
| Lough Fea Lake | Monaghan | NSNW Site |
| Old Wood | Monaghan | NSNW Site |
| The Downs Wood | Monaghan | NSNW Site |
| Ballaun Stone | Offaly | NSNW Site |
| Camcor Wood / Glinsk | Offaly | NSNW Site |
| Charleville South | Offaly | NSNW Site |
| Cloghan Demesne Bog and Wood | Offaly | NSNW Site |
| Clooneen | Offaly | NSNW Site |
| Dovegrove Callows | Offaly | NSNW Site |
| Gloster Demesne | Offaly | NSNW Site |
| Pallas Lough | Offaly | NSNW Site |
| River Shannon Callows | Offaly | Designated Site |
| Townparks | Offaly | NSNW Site |
| Carrowroe | Roscommon | NSNW Site |
| Cloonsillagh | Roscommon | NSNW Site |
| Drumalagagh | Roscommon | NSNW Site |
| Inisfale Wood | Roscommon | NSNW Site |
| Kilcloghan | Roscommon | NSNW Site |
| Knockvicker | Roscommon | NSNW Site |

| Site Name | County | Primary Selection Criteria |
|---|---|---|
| Mount Talbot South | Roscommon | NSNW Site |
| Porteen Wood | Roscommon | NSNW Site |
| St John's Wood | Roscommon | NSNW Site |
| Cleaveragh Demesne | Sligo | NSNW Site |
| Clogher | Sligo | NSNW Site |
| Closkeybridge | Sligo | NSNW Site |
| Cullentra Wood | Sligo | NSNW Site |
| Fidwog | Sligo | NSNW Site |
| Hazelwood Demesne | Sligo | NSNW Site |
| Kilbrattan Wood | Sligo | NSNW Site |
| Knocknacross | Sligo | NSNW Site |
| Markree Castle (Markree) | Sligo | NSNW Site |
| Poulaphuca Wood | Sligo | NSNW Site |
| Tanrego | Sligo | NSNW Site |
| Toberscanavan (Markree) | Sligo | NSNW Site |
| Woodview Gate (Markree) | Sligo | NSNW Site |
| Lower River Suir: Carrick on Suir Islands | Tipperary | Designated Site |
| Blackwater River | Waterford | Designated Site |
| Auburn | Westmeath | NSNW Site |
| Ballynafid | Westmeath | NSNW Site |
| Barbavilla Demense | Westmeath | NSNW Site |
| Baronstown Demense | Westmeath | NSNW Site |
| Donore | Westmeath | NSNW Site |
| Kiltoom | Westmeath | NSNW Site |
| Lissakillen North | Westmeath | NSNW Site |
| Lough Ennell Wood | Westmeath | NSNW Site |
| Lough Iron Wood | Westmeath | NSNW Site |
| Lough Owel Wood | Westmeath | NSNW Site |
| Whinning Wood | Westmeath | NSNW Site |
| Ballybeg Mill | Wexford | NSNW Site |
| Ballyboggan Lower | Wexford | NSNW Site |
| Ballycrystal | Wexford | NSNW Site |
| Ballymore Demesne | Wexford | NSNW Site |
| Ballynabarny Wood | Wexford | NSNW Site |
| Bolamore | Wexford | NSNW Site |
| Bricketstown House | Wexford | NSNW Site |
| Courtown Dunes and Glen | Wexford | NSNW Site |
| Crane Bridge | Wexford | NSNW Site |
| Curraduff | Wexford | NSNW Site |
| Curraun | Wexford | NSNW Site |
| Garrylough Lower | Wexford | NSNW Site |
| Johnstown Castle | Wexford | NSNW Site |
| Killoughrum Forest | Wexford | NSNW Site |
| Litterbeg | Wexford | NSNW Site |
| Mackmine Wood | Wexford | NSNW Site |
| Newtown Lower | Wexford | NSNW Site |
| Stokestown Bridge | Wexford | NSNW Site |
| Tomnafunshogue | Wexford | NSNW Site |
| Altidore Demesne | Wicklow | NSNW Site |
| Askakeagh | Wicklow | NSNW Site |
| Ballard Bridge | Wicklow | NSNW Site |
| Ballinagee | Wicklow | NSNW Site |

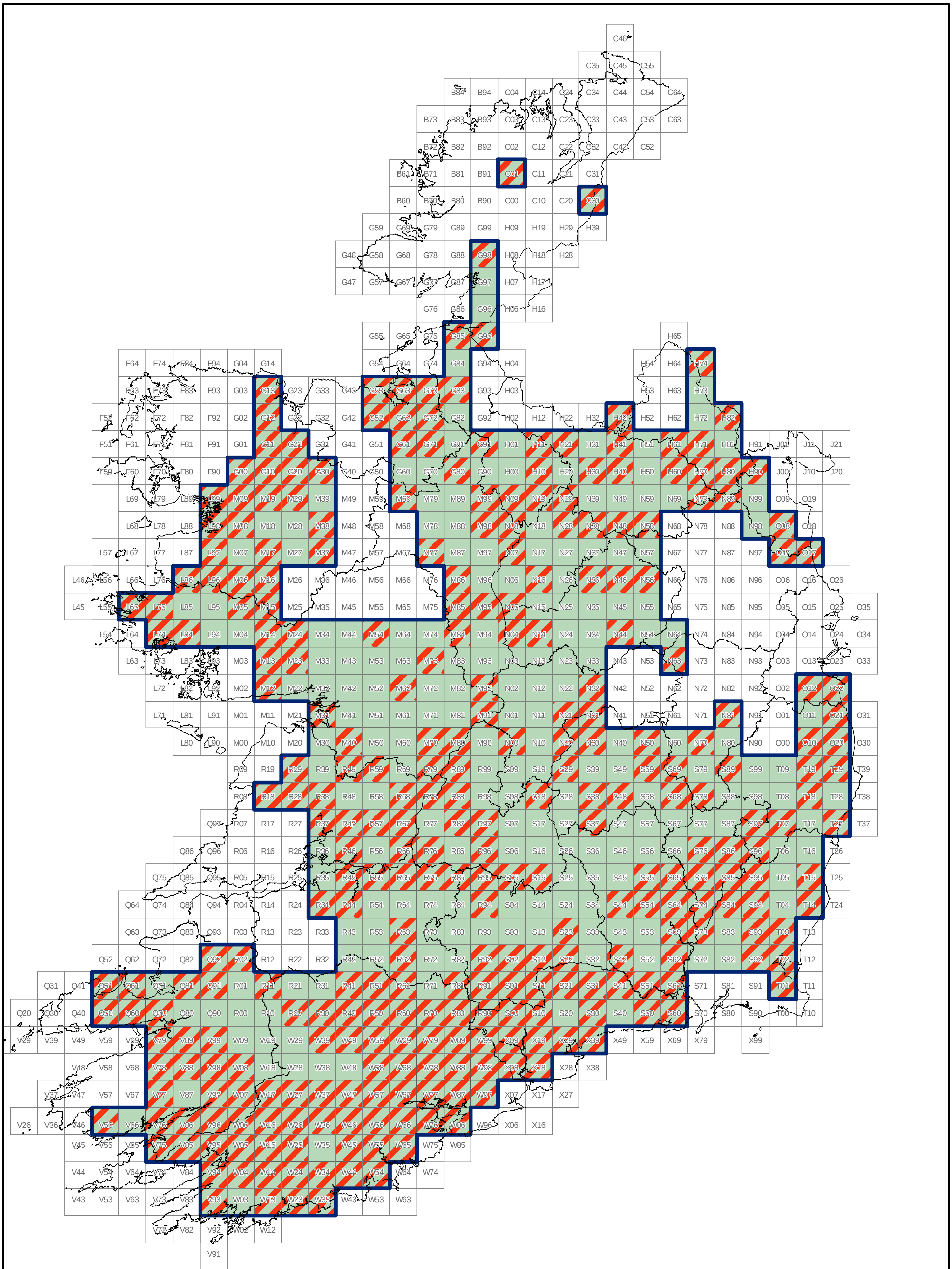
| Site Name | County | Primary Selection Criteria |
|---|---|---|
| Ballinanty | Wicklow | NSNW Site |
| Ballyman Glen | Wicklow | NSNW Site |
| Ballymarroge | Wicklow | NSNW Site |
| Baltynanima | Wicklow | NSNW Site |
| Castlekevin | Wicklow | NSNW Site |
| Coolawinnia | Wicklow | NSNW Site |
| Coolinarrig Lower | Wicklow | NSNW Site |
| Coolkenna | Wicklow | NSNW Site |
| Cronelea | Wicklow | NSNW Site |
| Fiddancoyle | Wicklow | NSNW Site |
| Glennashouk | Wicklow | NSNW Site |
| Kilmullin | Wicklow | NSNW Site |
| Kilquade | Wicklow | NSNW Site |
| Laragh | Wicklow | NSNW Site |
| Money Upper East | Wicklow | NSNW Site |
| Seabank | Wicklow | NSNW Site |

## **91E0** Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*

| National Level | |
|---|---|
| **Habitat Code** | 91E0 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | • Cross, J.R. & Kelly, D.L. (2003) Wetland woods. In *Wetlands of Ireland – Distribution, Ecology, Uses and Economic Value* (ed. Otte). University College Dublin Press, Dublin: 160-172.<br>• Perrin P.M., Barron S.J. and Martin J.R. (2006) *National Survey of Native Woodland in Ireland: Second Phase Report*. National Parks and Wildlife Service, Dublin.<br>• Kelly D.L. and Iremonger, S.F. (1997) Irish wetland woods: the plant communities and their ecology. *Biology and the Environment*: *Proceedings of the Royal Irish Academy*. Vol. 97B (1): 1-32. |
| **Range** | Found throughout Ireland, but concentrated in the south-west in Co. Cork. The four most notable gaps in the range are around Co. Dublin/ Co. Meath in the east and Cos. Clare, Mayo and Donegal in the west. |
| Surface area | 49,600 km² |
| Date | 03/2007 (data sources from 1995-2006) |
| Quality of data | 2 = moderate (based on partial survey with some extrapolation) |
| Trend | 0 = stable |
| Trend-Period | 1994 - 2006 |
| Reasons for reported trend | No change |
| **Area covered by habitat** | |
| Surface area | 45.91 km² (based on the known area plus the average area per 10 km² square that the habitat is thought to occur in) |
| Date | 03/2007 (data sources from 1995-2006) |
| Method used | 3 = ground based survey |
| Quality of data | 2 = moderate (based on partial survey with some extrapolation) |
| Trend | Decrease (-) |
| Trend magnitude | -0.11% (minimum estimate) |
| Trend-Period | 1998 - 2006 |
| Reasons for reported trend | 3 = direct human influence destruction |
| Justification of % thresholds for trends | - |
| Main pressures | 160 General forestry management<br>400 Urbanised areas, human habitation<br>500 Communication networks<br>810 Drainage<br>954 Invasion by a species |
| Threats | 160 General forestry management<br>400 Urbanised areas, human habitation<br>500 Communication networks<br>810 Drainage<br>954 Invasion by a species |
| ***Complementary information*** | |
| **Favourable reference range** | 49,600km² (=current range) |

| | |
|---|---|
| **Favourable reference area** | 122km$^2$<br>The favourable reference area is 0.25% of the favourable reference range and 5% of the area of mapped alluvial soils |
| **Typical species** | Vascular plants: *Alnus glutinosa, Agrostis stolonifera, Angelica sylvestris, Caltha palustris, Calystegia sepium, Cardamine flexuosa, Cardamine pratensis, Carex remota, Equisetum fluviatile, Filipendula ulmaria, Fraxinus excelsior, Galium aparine, Galium palustre, Iris pseudacorus, Mentha aquatica, Oenanthe crocata, Phalaris arundinacea, Poa trivialis, Ranunculus repens, Rubus fruticosus, Rumex sanguineus, Salix cinerea, Urtica dioica, Valeriana officinalis*<br><br>Bryophytes: *Brachythecium rutabulum, Calliergonella cuspidata, Hypnum cupressiforme , Kindbergia praelonga, Oxyrrhynchium hians, Thamnobryum alopecurum* |
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. |
| **Other relevant information** | • The Native Woodland Scheme is a national initiative administered by the Forest Service to encourage the planting of native tree species and restoration of native woodland habitats. Its scope includes Alluivial Alder-Ash Forest.<br>• Coillte Teoranta (the state-sponsored forestry company) is restoring three areas of alluvial woodland under a restoration scheme financed by the EU LIFE Nature fund. |
| ***Conclusions***<br>***(assessment of conservation status at end of reporting period)*** | |
| **Range** | Favourable – Range stable and not below favourable reference range |
| **Area** | Bad (U2) – More than 10% below the favourable reference area |
| **Specific structures and functions (incl. typical species)** | Bad (U2) – Structures and functions were assessed by investigating habitat fragmentation, natural regeneration, stand structure, dead wood and fauna and the overall assessment was bad |
| **Future prospects** | Bad (U2) – Invasive species were present in the majority of sites |
| **Overall assessment of CS** | Bad (U2) |



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AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

## Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* 91E0

Current Distribution (303 cells)
Current Range (496 cells)
Favourable Reference Range (496 cells)
W48 10km grid cells

Date: August 2007

**91J0** ***Taxus baccata*** **woods**

# CONSERVATION STATUS ASSESSMENT REPORT

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## 1 Habitat characteristics in Ireland

Yew woodland is a highly restricted habitat type in Ireland which occurs at a handful of sites on outcropping limestone with skeletal soils in the west, south and southwest of the country. The canopy in these stands is typically strongly dominated by *Taxus baccata* with *Corylus avellana*, *Ilex aquifolium* and *Fraxinus excelsior* often frequent. The ground is generally covered by an extensive bryophyte carpet. Where present, the field layer consists largely of herbs (e.g. *Arum maculatum, Viola riviniana/reichenbachiana, Fragaria vesca)* and ferns (e.g. *Phyllitis scolopendrium, Dryopteris filix-mas, Polystichum setiferum*). This woodland type has been classified as a facies of the Corylo-Fraxinetum association by Kelly (1981) and shares many of the same species.

The definition for 91J0 * *Taxus baccata* woods of the British Isles (hereafter Yew Woods) presented in the Interpretation Manual (Anon. 2003) is very brief but is based largely on British stands of this type. Yew woodland in Ireland differs significantly from the British variants in three key respects (Perrin 2002). Firstly, in Britain this habitat type occurs predominantly on former chalk downland whilst in Ireland it occurs principally on areas of limestone pavement or rocky limestone knolls. Secondly, the typical plant species differ markedly between British and Irish stands. *Buxus sempervirens* and *Mercurialis perennis* are not found at any Irish stands; the former species is introduced in Ireland and the latter is of dubious native status. *Sorbus aria* sens. lat. is found occasionally on the margins of some Irish stands but is not typical of the woodland interior. Thirdly, (an aspect not mentioned in the Interpretation Manual) Irish stands appear to develop from a *Corylus avellana*-dominated scrub stage whilst British stands are known to develop from scrub dominated by *Crataegus monogyna* and *Juniperus communis*.

## 2 Habitat mapping

Information on designated sites, (c)SACs and (p)NHAs held on file by the National Parks and Wildlife Service (NPWS) and information provided by Coillte Teoranta (S. Quealy pers. comm.) was used to map occurrences of Yew Woods in Ireland on a 10km square basis. Range was defined by mapping a minimum polygon around the identified occurrences. Breaks in the range were justified when there was a gap of greater than 2 grid squares between occurrences.

## 3 Habitat range

Yew Woods in Ireland are restricted to 10 sites in the south, west and southwest of the country with a range totalling 1,200km$^2$. Palynological evidence suggests that this habitat was probably never a major woodland type in this country, being somewhat transient in nature and developing when several factors such as grazing cessation and an opening of the canopy co-occurred (Perrin 2002). There are however significant areas of karstic limestone in the west of the country (e.g. the Burren, Co. Clare) which could support this habitat and are likely to have done so in the past (Perrin 2002; Molloy & O'Connell 2005).

### 3.1 Conservation status of habitat range

See section 4.1.

## 4 Habitat extent

The current area of Yew Woods in Ireland is 0.86km$^2$. [It there really this much?]The majority of this occurs in the Killarney National Park in Co. Kerry (Reenadinna Wood and Monks Wood), with only 0.24km$^2$ of habitat occurring in total at the other 9 sites (Cahir Park, Corville and Cornalack, Co. Tipperary, Curraghchase, Co. Limerick, Castletaylor, Garryland and Kylenamelly, Co. Galway, Dromana and Shanbally, Co. Waterford).

### 4.1 Conservation status of habitat extent

Favourable reference range and area are very difficult to define, but it is considered that the current area is insufficient to viably sustain the population in the long-term. This is based on the low total extent and the fact that seven of the existing sites consist of small stand less than 3ha in size, although at some sites these stands form part of larger woodlands. A further concern is that at some of the sites the Yew Wood habitat occupies all or the majority of the available suitable substrate (karstic limestone). Evidence from Britain suggests that this habitat is a single generation, but long living, migratory community which requires adjacent areas of suitable substrate and developing scrub for long-term survival. A lack of adjacent suitable substrate also means that the area of this habitat cannot be significantly expanded without expanding the range to include new areas with expanses of karstic limestone.

The favourable reference range was set as the current range plus a section of the Burren in northern Co. Clare immediately adjacent to the stands in County Galway, totalling 11,400km$^2$. This region was selected for several reasons. Firstly, there is palynological evidence to suggest that it falls within the historical range of Yew Woods in Ireland (Perrin 2002; Molloy & O'Connell 2005) and two of the existing sites are located on its periphery. Secondly, a scattered, population of *Taxus baccata* still occurs in this area (for example, at Mullaghmore) and locally appears to be regenerating. Thirdly, the large expanse of karstic limestone in this area means that it could support viable areas of new Yew Wood habitat without significantly impacting on the extent of other important habitat types (e.g. 8240 *Limestone pavement), although Yew Woods may have precedence anyway over these habitats in Ireland. Fourthly, there are significant areas of hazel scrub and hazel woodland in this area and this habitat appears to be the seral precursor to Yew Wood in Ireland (Perrin 2002); this increases the potential for developing new Yew Woods in the medium term.

The current habitat range is 85% of that of the favourable reference range and within the current reporting period the habitat range is stable. As the current habitat range is more than 10% less than the favourable reference range the conservation status of the habitat range is **unfavourable bad**.

In the absence of dependable information on what would represent a sustainable area, this was set at 3.5km$^2$, which represents 0.25% of the favourable reference range. On average, this translates as 25ha in every 10km square. Peterken (2002) suggests that large woods should be maintained above 25ha. However, particularly in the case of yew woods such large stands are unlikely to develop and they are more likely to be part of complexes of woodland habitats.
Due to the fact that the current habitat extent of Yew Woods is only 24% of the favourable reference area the conservation assessment for habitat extent is **unfavourable bad**.

## 5 Structures and Functions

Irish woodlands in general have been much modified by human activity over thousands of years. What remains is a modified and highly fragmented sample of the primeval forests that once covered large areas of the island. Due to a distinct lack of reference, knowledge of ecological processes and expert opinion has thus been used to judge what constitutes favourable status for these characteristics.

The largest area of Yew Wood in Ireland is Reenadinna Wood in the Killarney National Park, Co. Kerry. This has also been the subject of a long-term monitoring project (Perrin 2002, Perrin *et al.* 2006). There is little data available on the structure and function of the other nine sites, therefore most of the information presented in this section pertains to Reenadinna Wood.

### 5.1 Habitat Structures and Functions

**Habitat fragmentation**

Fragmentation increases the impact of edge effects on the habitat and greatly decreases the area of core woodland habitat. Smaller sites can support only small populations that are more vulnerable to stochastic events. The Yew Wood resource in Ireland consists of only ten sites and most of these sites are geographically isolated. At seven of these sites only 3ha or less of the habitat exists. This situation can therefore be regarded as **unfavourable bad**.

**Natural regeneration**

At Reenadinna, exclusion experiments demonstrate that natural regeneration of several native species (*Ilex aquifolium*, *Fraxinus excelsior* and *Sorbus aucuparia*) has been effectively precluded for a long period by heavy deer grazing (Perrin *et al.* 2006). Natural regeneration of *Taxus baccata* in the woodland interior is essentially absent, but the naturally heavy shade cast by the canopy is potentially the limiting factor for this species. As mentioned above, these stands may be single generation migratory communities. Therefore regeneration of yew around the margins rather than under canopy may be a more pertinent criterium. This type of regeneration, however, is also absent, due to grazing and lack of suitable terrain. Some small areas of potentially developing scrub do occur at two of the other sites (Garryland Wood and Cornalack). However, these are very small in extent and grazing is limiting development. Yew is regenerating at the site at Curraghchase but overall, the situation with regards to natural regeneration must be regarded as **unfavourable bad**.

**Stand structure**

Reenadinna Wood in its current form probably dates back to the abandonment of agricultural / industrial activities at that location at the end of the 18th century. An analysis of interior stand structure changes over a 20-year period indicated that this was still an aggrading stand with self-thinning of smaller yew stems and trees occurring (Perrin *et al.* 2006). The size class frequency distribution indicates the chronic lack of yew recruitment over recent decades and the general absence of more mature trees (Fig. 1). Again, the lack of recruitment may be a natural feature of these stands which may recruit new adult trees only around the margins and in neighbouring scrub. This is, however, not occurring either. With regards to other tree species, exclusion experiments have demonstrated that an understorey of *Ilex aquifolium*, *Fraxinus excelsior* and *Sorbus aucuparia* can develop in the absence of heavy grazing, but this is absent from the wood in general, although on a positive note there is considerable variation in the stand composition with regards to *Corylus avellana*. Stands at Garryland Wood are generally lacking in any substantial understorey. The stands at Curraghchase, Cahir Park and Garryland all have a sizeable non-native element to the canopy (largely *Fagus sylvatica*). The status of this factor may be regarded as **unfavourable bad**.

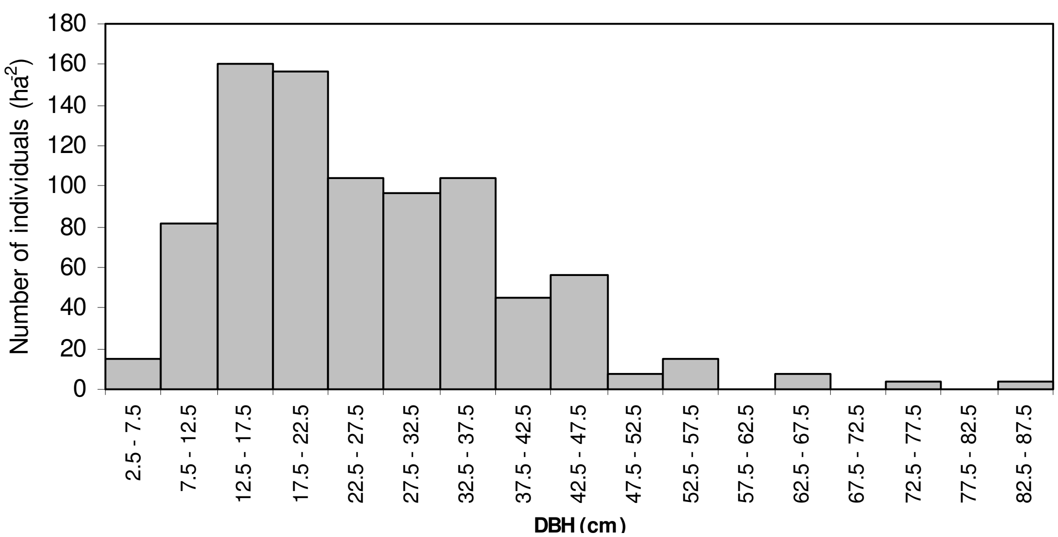


**Fig.1** Size distribution graph for *Taxus baccata* stems in interior of Reenadinna Wood, Co. Kerry.

### 5.1.1 Conservation Status of Habitat Structures and Functions

Overall the status of habitat structures and functions must be regarded as **unfavourable bad**.

## 5.2 Typical Species

Due to the rarity and modified nature of this habitat it is difficult to assess with confidence what may or may not have once been a "typical species". There are few species found in this habitat that are not also found in other woodland types (e.g. *Corylus avellana* dominated stands) or non-woodland habitats (e.g. limestone pavement). There appear to be no vascular plant species which may be regarded as specialists for this habitat, except possibly *Taxus baccata* itself. It should therefore be noted that few if any species in this list are "species which are inseparable from the habitat – other than those on which the habitat is defined" as recommended by in the assessment guidelines (Anon. 2006).

Ireland has a depauperate vascular flora in comparison with the rest of Europe due to its geographic position (Webb 1983) and Yew Woods in Ireland are species-poor in terms of vascular plants even in comparison with other native woodland types (although grazing is an important factor). Much of the species diversity lies in the bryophyte component. The following list of typical species contains those species recorded with a frequency of >70% in Reenadinna Wood by Kelly (1981).

*Brachypodium sylvaticum*
*Corylus avellana*
*Ctenidium molluscum*
*Eurhynchium striatum*
*Hedera helix*
*Hypnum cupressiforme*
*Ilex aquifolium*
*Isothecium alopecuroides*
*Isothecium myosuroides*
*Loeskeobryum brevirostre*
*Lonicera periclymenum*
*Marchesinia mackaii*
*Neckera complanata*
*Phyllitis scolopendrium*
*Plagiochila asplenoides*
*Plagiomnium undulatum*
*Rhynchostegiella tenella*
*Rhytidiadelphus triquetrus*
*Rubus fruticosus*
*Taxus baccata*
*Thamnobryum alopecurum*
*Thuidium tamarascinum*
*Tortella tortuosa*
*Viola riviniana / reichenbachiana.*

## 6 Impacts and Threats

### 6.1 Grazing

Grazing is a natural feature of Yew Woods, but high levels of grazing can be detrimental. Heavy grazing reduces or precludes natural regeneration and impacts on the diversity and species composition of the field layer through the suppression of palatable species (e.g. *Rubus fruticosus*) and the associated promotion of unpalatable or grazing-tolerant species (e.g. grasses). Conversely, a complete lack of grazing can also be undesirable as strong competitors, such as *Rubus fruticosus*, can dominate the field layer, again effecting diversity and species composition. Species favoured by disturbance of the soil and litter layers may also decline.

At Reenadinna Wood, there has been a chronic problem with heavy grazing over several decades (Perrin *et al.* 2006). The main grazer is the introduced sika deer (*Cervus nippon*). This has been addressed to some degree in recent years by shooting and fencing. There is no substantial information available on grazing at the other sites.

**Grazing trend**

No baseline records are available.

### 6.2 Invasive species

Non-native species at Cahir, Castletaylor and Curraghchase are being removed as part of an ongoing restoration project. These include *Fagus sylvatica* and *Prunus laurocerasus*. In Reenadinna Wood, *Rhododendron ponticum* and *Cotoneaster* spp. both occur, but primarily in marginal areas and are not frequent. There is an ongoing programme of Rhododendron eradication in the area. *Fagus sylvatica* occurs at Garryland and Reenadinna but is not frequent. Monks Wood contains several non-native tree species.

**Invasive species trend**

No comparable records are available.

## 7 Future Prospects

### 7.1 Negative Future Prospects

Due to the chronic grazing problems at Reenadinna, status with regard to grazing is **unfavourable bad**. The situation with regards to invasive species may be regarded as **unfavourable inadequate**.

### 7.2 Positive Future Prospects

Three of the ten existing sites, at Cahir Park, Co. Tipperary, Castletaylor, Co. Galway and Curraghchase, Co. Limerick, are being restored by Coillte Teoranta (the state-sponsored forestry company) as part of a project funded by the EU LIFE-Nature.

As part of the People's Millennium Forest Project, substantial areas of Reenadinna Wood were fenced to exclude deer in 2000-2001. However, total exclusion of deer is not regarded as a long-term solution to grazing problems (Perrin *et al.* 2006).

There are sites, such as Woodford Forest, Co. Galway and Clonbur, Co. Mayo, that have the potential to develop into Yew Woods as they have a well-developed yew shrub layer.

The current management operations being undertaken to restore Yew Woods must be regarded as **favourable** as must the fact that there are sites that have the potential to develop areas of Yew Wood.

## 8 Overall Assessment of the Habitat Conservation Status

- The current habitat range is 85% of the favourable reference range, therefore the conservation status of the habitat range is **unfavourable bad**.
- The current habitat extent of Yew Woods is only 24% of the favourable reference area, the conservation assessment for habitat extent is **unfavourable bad**.
- Due to the fragmented and isolated nature of the Yew Wood resource, the lack of natural regeneration and poor stand structure, the status of structure and functions in the habitat may be regarded as **unfavourable bad.**
- Positive management steps are being taken at three Irish sites, but it remains to be seen if these operations will be effective. There are currently no plans to expand the area of this habitat. The future prospects are therefore **unfavourable inadequate**.

As three of the four assessments for Yew Woods are **unfavourable bad**, the overall habitat conservation status is **unfavourable bad.**

## References

Anon. (2003) *Interpretation Manual of European Union Habitats*. EUR 25. European Commission, DG Environment.

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Kelly, D.L. (1981) The native forest vegetation of Killarney, south-west Ireland: An ecological account. *Journal of Ecology*, 69, 437-472.

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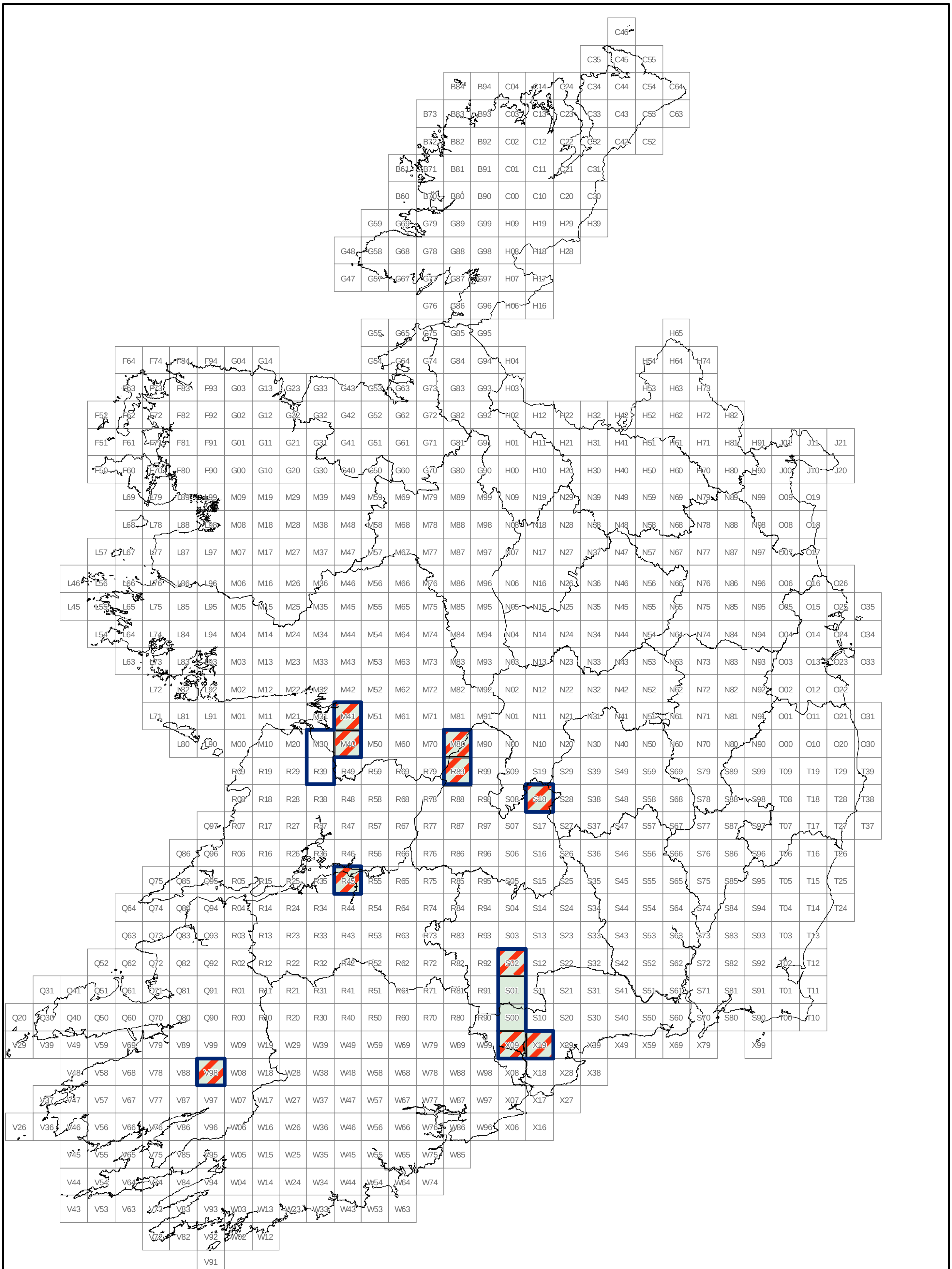
## 91J0 *Taxus baccata* Woods

| National Level | |
|---|---|
| **Habitat Code** | 91J0 |
| **Member State** | Ireland, IE |
| **Biogeographic region concerned within the MS** | Atlantic (ATL) |
| **Range** | Atlantic (ATL) |

| Biogeographic level | |
|---|---|
| **Biogeographic region** | Atlantic (ATL) |
| **Published sources** | ▪ Kelly, D.L. (1981) The native forest vegetation of Killarney, south-west Ireland: An ecological account. *Journal of Ecology*, **69**, 437-472.<br>▪ Perrin P. M. (2002) The ecology of yew (*Taxus baccata*) in Ireland, Ph.D. thesis, University of Dublin<br>▪ Perrin P. M., Kelly D.L. & Mitchell F.J.G (2006) Long-term deer exclusion in yew-wood and oakwood habitats in southwest Ireland: Natural regeneration and stand dynamics. *Forest Ecology and Management.* **236**: 356–367. |
| **Range** | Occurs at scattered locations mostly in the southwest of the country. |
| Surface area | 1,200 km²  (12 grid cells x 100km²) |
| Date | 02/2007 (Data sources from 1995 to 2006) |
| Quality of data | 3 = good (based on extensive survey) |
| Trend | 0 = stable |
| Trend-Period | 1994-2006 |
| Reasons for reported trend | No change |
| **Area covered by habitat** | |
| Surface area | 0.86km² |
| Date | 02/2007 |
| Method used | 3 = ground based survey |
| Quality of data | 3 = good (based on extensive survey) |
| Trend | 0 = stable |
| Trend-Period | 2001-2006 |
| Reasons for reported trend | No change |
| Justification of % thresholds for trends | - |
| Main pressures | 140 Grazing<br>954 Invasion by species |
| Threats | 140 Grazing<br>954 Invasion by species |
| ***Complementary information*** | |
| **Favourable reference range** | 1,400km² (14 grid cells x 100 km²) |
| **Favourable reference area** | 3.5km² (0.25% of the favourable reference range) |
| **Typical species** | Vascular plants*: Brachypodium sylvaticum, Corylus avellana, Hedera helix, Ilex aquifolium, Lonicera periclymenum, Phyllitis scolopendrium, Rubus fruticosus, Taxus baccata, Viola riviniana / reichenbachiana.*<br><br>Bryophytes: *Ctenidium molluscum, Eurhynchium striatum, Loeskeobryum brevirostre, Hypnum cupressiforme, Isothecium alopecuroides, Isothecium myosuroides, Marchesinia mackaii, Neckera complanata, Plagiochila asplenoides, Plagiomnium undulatum, Rhynchostegiella tenella, Rhytidiadelphus triquetrus, Thamnobryum alopecurum, Thuidium tamarascinum, Tortella tortuosa* |

| | |
|---|---|
| **Typical species assessment** | The list of typical species submitted was derived using best expert judgement. Species lists may be compiled during field-based surveys, however all surveys that assess habitat condition focus on changes in or presence/absence of indicator species. Therefore the conservation status of all typical species is rarely assessed apart from assessments derived from best expert judgement. Expert judgement assessed typical species as unknown. |
| **Other relevant information** | • Three sites are currently being restored by Coillte Teoranta (semi-state forestry company) under EU LIFE project.<br>• Fencing of one site occurred under the People's Millennium Forest Project. |
| ***Conclusions (assessment of conservation status at end of reporting period)*** | |
| **Range** | Bad (U2) – More than 10% less than favourable reference range |
| **Area** | Bad (U2) – More than 10% less than favourable reference area |
| **Specific structures and functions (incl. typical species)** | Bad (U2) |
| **Future prospects** | Bad (U2) |
| **Overall assessment of CS** | Bad (U2) |



AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

1:1,800,000

0 12.5 25 50 Kilometers

**Taxus baccata woods of the British Isles 91J0**

Current Distribution (10 cells)

Current Range (12 cells)

Favourable Reference Range (14 cells)

W48 10km grid squares

Date: July 2007

# Background to the conservation assessment for Pollan *Coregonus autumnalis* in the Republic of Ireland

## 1. Introduction

The pollan, *Coregonus autumnalis* Pallas, is confined in W. Europe to a series of large lakes on the island of Ireland. These lake populations are physically separated, and genetically isolated, from one another (Griffith 2003). The Irish populations are in turn isolated from, but most closely related to, Arctic cisco populations and are considered to constitute the southern extreme of that taxon's range. Rosell *et al.* (2004) summarised the taxonomic status of pollan as follows: "*After a long period of repeated re-classification and doubt over the pollan's identity, protein analysis by starch gel electrophoresis eventually identified pollan as belonging to the arctic cisco species grouping and settled the classification of pollan as C. autumnalis ….. Following this, pollan were described in the literature as C. autumnalis pollan Thompson* (1856). *The currently accepted classification is simply C. autumnalis Pallas 1776.*"

The Arctic populations have an anadromous habit whereas the Irish populations are landlocked. The pollan inhabit cold water habitats and in Ireland are found in five large lakes. Three of these, L. Derg, L. Ree, L Allen and Lower L. Erne, have areas of deep water while the fourth, L. Neagh, does not have deep water areas but is exposed to wind action on all sides. Stratification occurs in Lower L. Erne in summer and pollan are able to descend to cooler water at greater depths in the water column. Stratification is not a feature of the other large lakes and the water column is uniformly warmed in summer.

More work is required on the breeding biology of pollan in Irish lakes. However, from L. Neagh it is known that pollan spawn in December and deposit their eggs on stony areas of the lake shore. Fry grow quickly and reach 7cm in July of their first year (Rosell *et al.* 2004).

Wilson (1984) reviewed the accounts of pollan stomach content analysis. These and all recent accounts point to pollan being primarily zooplankton feeders, taking mainly copepods and cladocerans, although larger items are taken, including chironomid larvae and *Mysis relicta*, particularly in winter (Rosell *et al.* 2004).

The pollan was considered endangered by Whilde (2003) and has been the subject of an All-Ireland Species Action Plan (SAP) (Anon 2005).

## 2. Range

Recent studies and reviews have indicated the presence of pollan in five locations on the island of Ireland – L. Neagh and Lower L. Erne in Northern Ireland and L. Derg, L. Ree and L. Allen in the Republic of Ireland.

The comments below refer to pollan's range within the Republic of Ireland only. Rosell *et al.* (2004) is the most current reference and commentary on ecology and range in this document is based primarily on their review. Records and references to pollan tend to cluster around a series of lakes in the Shannon-Erne hinterland. Rosell *et al.* (op. cit.) quote Thompson (1856) in respect of presence of pollan in L. Derravaragh and L. Iron on the Inny system discharging to L. Ree. They also provide an anecdotal reference to pollan in L. Garadice, within living memory. Rosell *et al.* (2004) discounted historical references to pollan in L. Melvin and in L. Corrib on the grounds that, had such records been valid, the pollan should still be extant in these waters as the waters would not appear to have so altered as to account for such extinctions. Given the clustered historical and currently-extant records or references to pollan, Rosell *et al.* (2004) expressed surprise that no fish had been reported from L. Oughter and L. Gowna on the Erne system or from L. Allen on the Shannon system.

Subsequent to the review of Rosell *et al.* (2004), pollan have been taken in the upper reaches of the R. Shannon near the Shannon-Erne navigation confluence (Mc Carthy and Blaszkowski 2005) and in L. Allen (T.K. Mc Carthy personal communication; T. Champ, R. Rosell, F. Kelly personal communication). **Thus the current range of pollan within the Republic of Ireland is comprised of the three major lakes on the Shannon system – Derg, Ree and Allen – a total of 442 km$^2$.**

### *2.1 Trends*

The recent confirmation of pollan in L. Allen and in the upper Shannon River may be perceived as an increase in range for pollan (from 389km$^2$ to 442km$^2$). However, this can be put down to improved data as a result of increased survey effort as it more than likely that the species has long been present in L. Allen, though unreported (Rosell *et al.* 2004).

The findings from the upper R. Shannon, downstream of L. Allen, may be indicative of individual fish being washed or dispersed downstream. This phenomenon has been reported for L. Ree (F. Igoe pers. comm.) and L. Derg (T.K. McCarthy pers. comm.; Rosell *et al.* (2004) quoting Roycroft pers. comm.). In the light of the L. Allen findings further surveys using the same technique (hydroacoustics with linked ground-truthing via multi-mesh gill nets) on other lakes in the Republic of Ireland identified by Rosell *et al.* (2004) may uncover additional populations.

## 3. Population

The consensus of literature reports is that pollan status has declined considerably in the lakes in the Republic (Whilde 1993; Rosell *et al.* 2004). Bowman (1998) cites reports of pollan occurring "in large numbers" in Loughs Ree and Derg prior to 1946. In the 1960s, pollan were occasionally abundant, with hundreds per night being taken in flood conditions as a nuisance by-catch in eel nets at the outflow from Lough Derg. (N. Roycroft pers. comm., quoted in Rosell *et al.* 2004)). Geraghty (1996) (quoted in Rosell *et al.* 2004) obtained a total of 17 specimens from these eel nets as by-catch in January 1996. The present day recorded catch numbers perhaps 3-4 specimens per year (F. Igoe pers. comm.). While such by-catch data may not be considered quantitative it can often provide a reasonable indicator of fish status and abundance.

Whilde (1993) reported that there had been no recent reports from L. Ree. However, recent investigations have confirmed the continued existence of pollan in this lake (Rosell *et al.* 2004; T. K. Mc Carthy pers comm.). Rosell *et al.* (2004) reported that the Shannon populations were down to 1% or less of total fish biomass from known former levels of at least 5 to 9%.

Whilde (1993) quotes tonnage catches of pollan from L. Neagh indicating output levels of up to 400 tonnes up to 1900, with major declines in the 20th century. However, recovery did occur, with catches of up to 200 tonnes reported in the early 1970s and a population estimate of 14 million pollan in the lake. Further subsequent fluctuations occurred. Such fluctuations may reflect natural processes in whitefish (to which the pollan belongs), attributable to intra-specific competition for zooplankton food (Winfield *et al.* 1989). Given the proportional imbalances in size between the extant population in L. Neagh and those in L. Ree, L. Allen and L. Derg, it is likely that the current populations in the Shannon lakes may number in the hundreds or very low thousands (J. King, pers. comm.). TK. McCarthy (pers. comm.) has indicated that while pollan populations in L. Derg and L. Ree comprise a very small proportion of the total fish population in each lake, nevertheless the pollan remain at a level above that of terminal decline. **Without more detailed investigations to provide accurate population estimates we can only conclude that there are three distinct populations of pollan in the Republic of Ireland, each of them probably supporting hundreds or low thousands of individuals.**

### *3.1 Pressures and threats*

The principal pressures are considered to be Eutrophication (Code No. 952) and Climate change and global warming (Code No. 990 – other natural processes). Both of these are considered to be future threats as well, as is the potential biological impacts from introduced fish species and from Zebra mussel (Code No. 954. 961, 966).

- Eutrophication:

Rosell *et al.* (2004) highlight the fact that pollan is at the southern extremity of its distribution on the island of Ireland; they refer to the use by pollan of deep-water thermal refuges in summer in these lakes. If deep lakes stratify thermally then the lower layer remains relatively cool. However, if a lake has become enriched then the oxygen levels below the thermocline fall as the summer progresses. Thus with increase in water temperature and increase in eutrophication the pollan may have difficulty in finding a within-lake habitat with appropriate water temperature and oxygen conditions. Although lake water quality in general is improving and measures under the Water Framework Directive should accelerte this process, occasional incidents of eutrophication in the future cannot be ruled out (see below in Habitat for further details of water quality on the Shannon lakes).

- Climate change and global warming:

These factors may pose a major threat to survival of pollan, particularly in view of the fact that pollan is at the southern extremity of its distribution in Ireland. Increased ambient temperature will lead to rise in water temperature in summer in lakes, forcing the pollan to seek deeper, cooler water. If the lake is enriched and stratifies then the pollan may experience both thermal and oxygen pressures. Increases in winter temperature could affect pollan spawning behaviour and success. Pollan spawning in Lough Neagh now occurs up to one month later than two decades ago, possibly due to delayed winter cooling (Harrod *et al.* 2002). The full implications of these changes have yet to be elucidated.

- Biological impacts from other fish species and from Zebra mussel:

The lakes of the Shannon system have been subject to invasion by Zebra mussel (*Dreissena polymorpha*) in recent years. This invasion could impact on pollan through colonisation of spawning grounds (Rosell *et al.* 2004; Maguire *et al.* 2006) and through modification of the zooplankton resources available to the pollan (Maguire *et al.* 2006). One impact of this invasion has been the increase in water clarity within these lakes, caused by filter feeding of the mussels on phytoplankton. Such phytoplankton decrease, it was assumed, would lead to reduced zooplankton levels. However, there is no evidence to date of pollan numbers being adversely affected by the Zebra mussel invasion (TK. Mc Carthy pers. comm.).

Roach was identified as a significant competitor with pollan for zooplankton food (Rosell *et al.* 2004). Roach, which was absent as recently as 1950, is now the dominant fish species, by biomass, of all lakes containing pollan. Nonetheless, Wilson and Pitcher (1984) did not find evidence that annual growth rates for pollan in L. Neagh had changed over the period 1966 – 1984, a time when roach would have first invaded this lake. This might suggest limited competition between roach and pollan for feeding at the various life history stages. However, the arrival of Zebra mussel appears to have introduced an additional factor into the mix, as roach populations have decreased substantially in certain lakes where Zebra mussels have colonised (MF. O'Grady pers. comm.). It would appear that roach is favoured by the reduced water clarity conditions prevalent in eutrophic waters and is disadvantaged when water clarity increases through Zebra mussel filter feeding action.

Thus, curiously, the Zebra mussel 'invasion' may be of some benefit to the extant pollan populations. This may be mediated, in part, through reduction in phytoplankton levels and hence, reduction in deposition into the hypolimnion during stratification. Such reduction would lead to reduction in levels of oxygen depletion – rendering the hypolimnion more suited for pollan. However, the interactions of these alien species and their full impact on pollan remains unclear and they are included as potential threats until new data is collected which show otherwise.

## 4. Habitat

In general terms, pollan use the shallow areas of lakes in winter, when spawning occurs, and move into deeper areas when temperatures rise, seeking out deep-water thermal refuges in summer. More detailed work is required to establish the specific areas of L. Derg, L. Ree and L. Allen that are used by pollan, and how this varies seasonally. In the meantime **the entire waterbodies of these three lakes are taken to represent the habitat of the pollan in the Republic of Ireland – 442 km$^2$.**

### *4.1 Trend*

Further work is requried to establish the details of habitat usage by pollan in Irish lakes. However, despite concerns about the potential impact of the zebra mussel on pollan spawning grounds, there is no evidence to suggest that negative effects have occurred. Some improvements in water quality have also been recorded over the last 10 years. Monitoring carried out on the Shannon lakes by the EPA indicate that the key symptoms of eutrophication, viz. high chlorophyll concentration and reduced water transparency, have been improved significantly – the average annual maxima for 1991-1994 were 54 mg/$m^3$ in Lough Derg and 33 mg/$m^3$ in Lough Ree compared to just 10 and 9 mg/$m^3$ respectively from 2001 – 2003 (Toner *et al.* 2005).

These improvements have coincided with the infestation of the River Shannon system by the Zebra mussel, but also with the introduction of a comprehensive catchment management plan which included the completion of a major programme of remedial measures at the 17 larger waste treatment works in the catchment. However, the reduction of phosphorus concentrations in the lakes has not been significant and is still at a level sufficient to sustain populations of phytoplankton comparable with those which existed during the peak of eutrophication in the early 1990s (Toner *et al.* 2005). There has been no change in the extent of habitat available to the pollan in recent decades. And while the quality of the habitat available to the pollan has remained stable since the Directive came into force, it is clear that further reductions in nutrient levels are required in L. Derg and L. Ree to return these lakes to true mesotrophic status.

## 5. Future prospects

Any climate change resulting in increased summer temperatures is likely to put pressure on the already depleted pollan populations. The upper thermal limits for pollan are variably estimated at around 20-22$^o$C; large Irish lakes currently attain summer maxima of around 18 $^o$C. Harrison *et al.* (2001) predict temperature increases of between 1.2 and 2.8 $^o$C for Ireland by 2080. The tendency of deep water to de-oxygenate when stratified summer conditions occur in eutrophic lakes clearly reduces the quality of any deep cool refuge available to pollan. Reduced nutrient levels in the Shannon lakes may help mitigate the impact of increased temperatures to some extent.

The All-Ireland species action plan (SAP) for the pollan (Anon 2005) identifies numerous actions aimed at delivering favourable conservation status for the species in Ireland. One of the first actions is to assess, using hydroacoustics linked with ground-truth netting, the distribution of pollan among known and candidate waterbodies. Status assessment, via some form of population size assessment, will also be required.

The SAP also identifies the need to develop reservoir gene pools for each of the extant populations of pollan. It is also proposed to develop husbandry expertise in order to artificially propagate pollan from individual lakes. Work on this with L. Neagh fish has already begun and some initial success has been recorded (see: http://www.cfb.ie/fisheries_research/pollan/index.htm).

Implementation of the pollan SAP should greatly enhance the conservation status of the pollan in Ireland. However, progress has been slow to date; there is some reluctance in Government Departments to assume responsibility for the species and funding will need to be committed if the plan's targets are to be delivered.

**Given the critically low population levels of this species in the Shannon lakes, concerns about water quality, the potential threat posed by increased water temperatures and the slow progress towards implementation of the**

**recommendations of the SAP, the prospects for the pollan must be considered poor**.

## 6. Complementary information

### *6.1 Favourable reference range*

The discovery of the L. Allen population in 2006 indicates the possibility that additional relict populations may be present in other lakes and it would be appropriate to carry out relevant surveys in lakes identified by Rosell *et al.* (2004) to confirm or otherwise such presence. Nonetheless, the pollan occurs in three of the largest lakes in the Republic of Ireland. There is no strong evidence to suggest that the species has ever been more widespread, certainly not in recent decades, and there is little scope for a natural expansion of this range in Ireland.

**The current range is taken to be the favourable reference range – 442 km2 – and this parameter is considered to be Favourable.**

### *6.2 Favourable reference population*

There are no reliable historic population estimates for the pollan in Ireland and the size of the current populations in the three known lakes in the Republic is unknown. However, there are firm indications that numbers have decreased significantly, at least in L. Derg and L. Ree: Rosell *et al.* (2004) reported that those populations were down to 1% or less of total fish biomass from known former levels of at least 5 to 9%. Although exact figures cannot be estimated, it would appear that the populations of pollan need to increase at least 5 fold in L. Derg and L. Ree before they approach favourable reference values. It is also reasonable to assume that similar increases are required in L. Allen.

**In conclusion, while FRP remains Unknown, the current population is certainly more than 25% below favourable levels and this parameter is considered Unfavourable – Bad.**

### *6.3 Habitat for the species*

The extent of suitable pollan habitat is naturally circumscribed, being confined to large lakes with extensive deep-water areas providing thermal refuge in summer. Such lakes should not be subject to eutrophication but should be of Mesotrophic status, or better.

Monitoring carried out on the Shannon lakes by the EPA indicates that the key symptoms of eutrophication, viz. high chlorophyll concentration and reduced water transparency, have been improved significantly – the average annual maxima for 1991-1994 were 54 mg/m$^3$ in Lough Derg and 33 mg/m$^3$ in Lough Ree, compared to just 10 and 9 mg/m$^3$ respectively from 2001–2003 (Toner *et al.* 2005). These improvements have coincided with the infestation of the River Shannon system by the Zebra mussel and also the introduction of a comprehensive catchment management plan which included the completion of a major programme of remedial measures at the 17 larger waste treatment works in the catchment. However, the reduction of phosphorus concentrations in the lakes has not been significant and is still at a level sufficient to sustain populations of phytoplankton comparable with those which existed during the peak of eutrophication in the early 1990s. This constitutes strong evidence that Zebra mussels and not nutrient reduction are now controlling the size of populations of planktonic algae and Cyanobacteria in these lakes (Toner *et al.* 2005).

Thus, while Loughs Derg and Ree are classified as being in a satisfactory mesotrophic status based on chlorophyll concentrations, a higher trophic status, in line with the phosphorus concentrations, might be more appropriate for some of these waters. Evidence of significant localised enrichment was observed at a number of shoreline sites examined on these lakes, further supporting the high trophic status designation for these waters (Toner *et al.* 2005). By contrast, the status of L. Allen continues to be classified by the EPA as oligotrophic.

The current extent of habitat available for the pollan (442 km2) is sufficient, however improvements in the quality of the habitat is required to allow the long term survival of the species. Specifically, reductions in nutrient inputs into L. Derg and L. Ree are required to bring phosphorus levels to mesotrophic status and reduce the risk of localised eutrophication.

**Consequently, Habitat is considered to be Unfavourable – Inadequate.**

## 7. Conclusions

| | |
|---|---|
| Range: | Favourable |
| Population: | Unfavourable – Bad |
| Habitat: | Unfavourable – Inadequate |
| Future prospects: | Unfavourable – Inadequate |
| Overall: | Unfavourable – Bad |

## References

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## Pollan (*Coregonus autumnalis*)

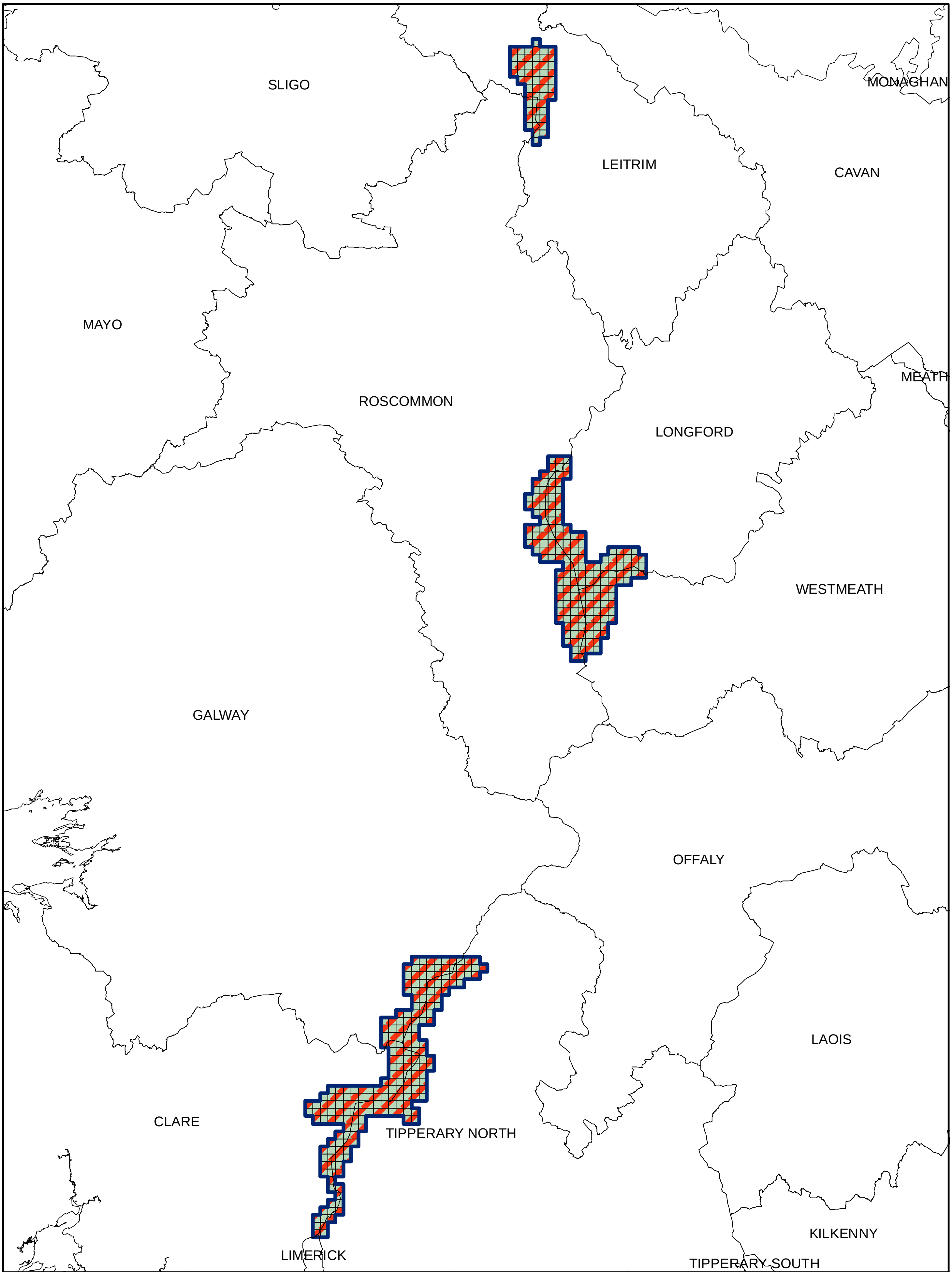
| 1. National Level | |
|---|---|
| **Species code** | NA |
| **Member State** | IE |
| **Biogeographic regions concerned within the MS** | Atlantic (ATL) |

| 2. Biogeographic level (complete for each biogeographic region concerned) | |
|---|---|
| **2.1 Biogeographic region** | Atlantic (ATL) |
| **2.2 Published sources** | **Anon (2005)** *All Ireland Species Action Plans Irish Lady's-tresses* Spiranthes romanzoffiana*; Pollan* Coregonus autumnalis*; Hare* Lepus timidus hibernicus*; Corncrake* Crex crex*.* National Parks and Wildlife Service, Ireland and Environment & Heritage Service, Northern Ireland.<br>**Bowman, J.J. (1998)** *River Shannon - Lake Water Quality Monitoring 1995 to 1997*. Environmental Protection Agency, Wexford.<br>**Harrod, C., Griffiths, D., Rosell, R. S. & Mc Carthy, T. K. (2002)** Current status of the pollan (*Coregonus autumnalis* Pallas 1776) in Ireland. *Archiv fur Hydrobiologie: Special Issues advances in Limnology*. 57, 627-638.<br>**Mc Carthy, T K. & Blaszkowski, M. (2005)** Pollan *Coregonus autumnalis* Pallas in Lough Allen and the upper river Shannon. *Irish Naturalists' Journal*, 28, 269-271.<br>**Rosell R.S., Harrod, C., Griffiths, D. & Mc Carthy, T. K. (2004)** Conservation of the Irish populations of the pollan *Coregonus autumnalis*. *Biology and Environment: Proceedings of the Royal Irish Academy*. 104B, 67-72.<br>**Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MacCárthaigh, M., Craig M. & Quinn R. (2005)** *Water Quality in Ireland 2001-2003*. EPA, Ireland<br>**Whilde, A. (1993)** Threatened mammals, birds, amphibians and fish in Ireland. Irish Red Data Book 2: Vertebrates. Belfast. H.M.S.O. |
| **2.3 Range** | |
| 2.3.1 Surface area | 442 km$^2$ |
| 2.3.2 Date | July 2007 |
| 2.3.3 Quality of data | 2 = moderate |
| 2.3.4 Trend | +14% (from 389km$^2$ to 442km$^2$) |
| 2.3.6 Trend-Period | 1994 - 2007 |
| 2.3.7 Reasons for reported trend | 1 = improved knowledge / better data |
| **2.4 Population** | |
| 1.2 Distribution map | |
| 2.4.1 Population size estimation | 3 populations |
| 2.4.2 Date of estimation | 2007 |
| 2.4.3 Method used | 1 = based on expert opinion |
| 2.4.4 Quality of data | 1 = poor |
| 2.4.5 Trend | -ve, but extent unknown |
| 2.4.7 Trend-Period | 1960-2007 |
| 2.4.8 Reasons for reported trend | 3 = direct human influence<br>4 = indirect anthropogenic influence |
| 2.4.9 Justification of % thresholds for trends | In case a MS is not using the indicative suggested value of 1% per year when assessing trends, this should be duly justified in this free text field |
| 2.4.10 Main pressures | 952 – Water pollution (eutrophication)<br>990 – specifically climate change / global warming |
| 2.4.11 Threats | 952 – Water pollution (eutrophication)<br>954 – Invasion by a species<br>961 - Competition<br>966 – Antagonism arising from an introduced species<br>990 – Specifically climate change / global warming |
| **2.5 Habitat for the species** | |

| | |
|---|---|
| 2.5.2 Area estimation | 442 $km^2$ |
| 2.5.3 Date of estimation | July 2007 |
| 2.5.4 Quality of data | 1 = poor |
| 2.5.5 Trend | + 14% |
| 2.5.6 Trend-Period | 1994 - 2007 |
| 2.5.7 Reasons for reported trend | 1 = improved knowledge / better data |
| **2.6 Future prospects** | 2 = poor prospects |

| ***2.7 Complementary information*** | |
|---|---|
| **2.7.1 Favourable reference range** | 442 $km^2$ |
| **2.7.2 Favourable reference population** | Unknown |
| **2.7.3 Suitable Habitat for the species** | 442 $km^2$ |
| **2.7.4 Other relevant information** | Range / Habitat<br><br>With the discovery of pollan in L. Allen (2005), the known range expanded by 14% (from 389$km^2$ to 442$km^2$)<br><br>Population:<br><br>There are 3 populations of pollan in the Republic of Ireland, their size is unknown but variously estimated as 1% of fish biomass in the relevant lakes and hundreds – low thousands per lake. The GIS tool will not accept these figures, consequently "3 populations" is utilised instead. The number of populations is not, however, a useful unit to monitor change and surveillance of individual population sizes (either in number of individuals or in biomass) will need to take place.<br><br>The pollan, *Coregonus autumnalis* Pallas, is confined in W. Europe to a series of large lakes on the island of Ireland. These lake populations are physically separated, and genetically isolated, from one another (Griffith 2003). The Irish populations are in turn isolated from, but most closely related to, Arctic cisco populations and are considered to constitute the southern extreme of that taxon's range. Rosell *et al.* (2004) summarised the taxonomic status of pollan as follows: "*After a long period of repeated re-classification and doubt over the pollan's identity, protein analysis by starch gel electrophoresis eventually identified pollan as belonging to the arctic cisco species grouping and settled the classification of pollan as C. autumnalis* …... *Following this, pollan were described in the literature as C. autumnalis pollan Thompson* (1856)*. The currently accepted classification is simply C. autumnalis Pallas 1776."*<br><br>The species does not correspond with *Coregonus autumnalis autumnalis* (5053). The species reported does not have Natura 2000 code. |

| ***2.8 Conclusions (assessment of conservation status at end of reporting period)*** | |
|---|---|
| **Range** | Favourable (FV) |
| **Population** | Unfavourable – Bad (U2) |
| **Habitat for the species** | Unfavourable – Inadequate (U1) |
| **Future prospects** | Unfavourable – Inadequate (U1) |
| **Overall assessment of CS** | Unfavourable – Bad (U2) |




1:650,000

0 5 10 20 Kilometers

**Pollan**

**5078**

Current Distribution (442 1km grid squares)
Current Range (442 1km grid squares)
Favourable Reference Range (442 1km grid squares)

Date: August 2007

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