Results of a monitoring survey of old sessile oak woods and alluvial forests

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Results of monitoring survey of old sessile oak woods and alluvial forests

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Cover photo: Annex I alluvial forest (91E0) at the Gearagh, Co. Cork. © Fionnuala O'Neill, BEC Consultants Ltd. / NPWS.

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Executive Summary

This document reports on a two-year monitoring survey that assessed the structure and functions and future prospects of two woodland types listed in Annex I of the EU Habitats Directive: 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; and 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae). A total of 101 polygons – 61 of 91A0 and 40 of 91E0 – were monitored between 2011 and 2012. In each site, four monitoring plots measuring 20 m x 20 m were used to gather data on structure and functions, including indicator species, cover of individual woodland layers, canopy height, presence of non-native species, stand structure and dead wood estimates. Future prospects were assessed by noting the pressures, threats and impacts, both positive and negative, occurring throughout the Annex I woodland area.

Sites were scored green (favourable), amber (unfavourable – inadequate) and red (unfavourable – bad) depending on the outcome of the two parts of the assessment. 20 sites overall received a green assessment, of which 11 were 91A0 and nine were 91E0 sites. A total of 33 sites received an amber assessment: 17 were 91A0 and 16 were 91E0 sites. Of the 48 sites that received a red assessment, 33 were 91A0 and 15 were 91E0 woodlands.

The structure and functions assessment criteria that failed most frequently in 91A0 woodlands were the presence of negative species regeneration and signs of grazing pressure. Insufficient native shrub layer cover and excessive negative species cover were additional, though less severe, problems. In 91E0 woodlands, negative species regeneration and excessive negative species cover were the main problems. In relation to the future prospects assessment, the main negative impacts identified in 91A0 woods were invasive species and overgrazing. The main negative impacts recorded in 91E0 woods were invasive species and over-vigorous native species due to undergrazing. Dumping was frequent in both woodland types, although the ecological impact was slight.

The monitoring criteria are discussed, recommendations for refining the methodology in future monitoring cycles are presented, and suggestions for improving the conservation status of the least favourably scored sites monitored in this cycle are made.

Acknowledgements

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Introduction

Rationale for the survey

Annex I habitats are habitats of European importance which are listed under Annex I of the EU Habitats Directive (92/43/EEC). Under Article 17 of the Habitats Directive, all EU Member States which are signatories of the Directive have a legal obligation to report on the conservation status of the Annex I habitats that occur within their boundaries. These reports are produced every six years. The next round of reporting, covering the period 2007-2012, is due in 2013.

The Woodland Monitoring Survey (WMS) was a two-year project which commenced in summer 2011 with a view to feeding into the reporting requirements for 2013. This survey assessed the structure and functions and future prospects of two Annex I woodland types: 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; and 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae).

Habitats monitored in the survey

91A0 Old sessile oak woods with Ilex *and* Blechnum *in the British Isles*

Characteristics

The acidophilous *Quercus petraea* woods that conform to Annex I habitat 91A0 in the interpretation manual of European Union habitats (European Commission 2007) correspond most strongly to three vegetation types within the *Quercus petraea – Luzula sylvatica* group described in the National Survey of Native Woodlands (NSNW) report (Perrin *et al.* 2008): *Rubus fruticosus – Corylus avellana* type; *Vaccinium myrtillus – Ilex aquifolium* type; and *Luzula sylvatica – Dryopteris dilatata* type. The interpretation manual gives little information on indicative species for this habitat beyond describing it as having "many ferns, mosses, lichens and evergreen bushes … including *Arbutus unedo*", and only three indicative taxa are listed: *Quercus petraea, Ilex aquifolium* and *Blechnum* ssp. (*sic*). Due to frequent planting of other *Quercus* species into Irish sessile oak woods, there is a case to be made for adding *Quercus robur* and particularly *Quercus petraea* x *Q. robur* (*Quercus* x *rosacea*) to this list of species (J. Cross, pers. comm.), although *Quercus petraea* should ideally still be present.

An old sessile oak wood is characterised by a number of diverse elements coming together in a fully functioning system. The soil is usually acidic, often a podzol, brown earth or grey-brown podzol, and generally well drained. This supports a characteristic flora. The woodland itself is typically multi-layered, well-developed sessile oak wood having a canopy, understorey, shrub, dwarf shrub, field and ground layers. A good proportion of the canopy should be composed of *Quercus petraea* or the hybrid

Quercus x *rosacea*, although other native species such as *Betula* spp., and *Sorbus aucuparia* also occur. The cover of non-native species should not be greater than 10%, and regeneration of non-native species should be absent.

The understorey and shrub layers, if present, are generally made up of shorter and/or younger individuals of the above species, with *Ilex aquifolium* and *Corylus avellana* generally frequent in the shrub layer. A dwarf shrub layer of low woody species such as *Vaccinium myrtillus* and *Calluna vulgaris* often occurs. In Ireland, a field layer of ferns such as *Blechnum spicant*, *Polypodium* spp. and *Dryopteris* spp., and flowering plants such as *Luzula sylvatica* and *Oxalis acetosella* is typical. *Hyacinthoides non-scripta* may be present on more nutrient-rich soils. A ground (bryophyte) layer consisting of a diverse range of mosses, including *Rhytidiadelphus* spp., *Dicranum* spp., *Polytrichastrum formosum, Hylocomium brevirostre, Mnium hornum, Plagiothecium undulatum, Pseudotaxiphyllum elegans*, and liverworts such as *Diplophyllum albicans, Saccogyna viticulosa* and *Scapania* spp., is usually well developed. Other liverwort species, such as *Calypogeia* spp., *Frullania* spp. *Plagiochila* spp., *Lepidozia* spp. and *Bazzania trilobata*, may also occur, particularly in western sessile oak woodlands, where epiphytes are typically abundant.

An oak wood should be structurally diverse, that is, it should have a range of age classes, ideally including seedlings, saplings, poles, young, old and senescent trees. Conditions suitable for the regeneration of the main tree species should be present, including canopy gaps for oak regeneration. Structural diversity is also provided by the tree species themselves, which vary from smooth-barked species such as *Ilex aquifolium* to rough-barked species such as *Quercus petraea*; this diversity in substrate is important for epiphytic lichen and bryophyte species.

A well-functioning oak wood will generally have a good quantity of dead wood and a range of dead wood types, including coarse and fine, standing and fallen, which provide a variety of niches for animals (both vertebrates and invertebrates), fungi and epiphytes. Oak woods also provide habitat for grazers and browsers while the large amounts of seeds, berries and nuts are a valuable source of food. An appropriate level of grazing is essential to maintain a proper species balance so that no single species becomes dominant. However, too much or too little grazing can disrupt the system and may have consequences such as a reduction in tree regeneration.

Extent of sessile oak woodland in Ireland

The digitisation of all woodland sites surveyed during the National Survey of Native Woodland (NSNW) (Perrin *et al*. 2008) was undertaken in 2010 (O'Neill *et al*. 2010a), with 2272 polygons of native woodland digitised; determination of the Annex I status of digitised polygons was made *post hoc*, based on relevé data. Following this digitisation process, 351 polygons measuring 32 km^2 of the surveyed woodlands were deemed to be Annex I woodland 91A0, with a further 57 polygons measuring 11 km^2 identified as containing additional 91A0 habitat in mosaic with other woodland habitats (O'Neill *et al*. 2010a). An additional 16 km^2 was mapped from other sources, including approximately 10 km^2 mapped as part of the Killarney National Park mapping project (Barron & Perrin 2011), to bring the total mapped area of 91A0 in the country to almost 59 km^2.

91E0 Alluvial forests with Alnus glutinosa *and* Fraxinus excelsior *(Alno-Padion, Alnion incanae, Salicion albae)*

Characteristics

The Annex I habitat 91E0 corresponds to four vegetation types described in Perrin *et al.* (2008). Three are in the *Alnus glutinosa – Filipendula ulmaria* group: *Fraxinus excelsior – Carex remota* type; *Alnus glutinosa – Rubus fruticosus* type; and *Salix cinerea – Equisetum fluviatile* type. The fourth type is in the *Fraxinus excelsior – Hedera helix* group: the *Salix-triandra – Urtica dioica* type.

91E0 is a priority Annex I habitat. A number of variants of this woodland habitat exist, of which riparian forests of *Fraxinus excelsior* and *Alnus glutinosa* of temperate and Boreal Europe lowland and hill watercourses (habitat 44.3 Alno-Padion of the Palaearctic habitat classification of Devillers & Devillers-Terschuren (1993), cited in European Commission (2007)) are the most common type to be found in Ireland. European Commission (2007) states that all types occur on heavy soils that are periodically inundated by the annual rise of river levels, but that are otherwise well drained and aerated during low water. The herbaceous layer includes many large species such as *Filipendula ulmaria, Angelica sylvestris* and *Carex acutiformis*, vernal species such as *Ranunculus ficaria* and *Anemone nemorosa*, and other indicative species such as *Carex remota, Lycopus europaeus, Urtica dioica* and *Geum rivale*.

A functioning alluvial forest with a good structure is, in common with sessile oak woods, a multi-layered system, although the individual layers may be less distinct than in oak woods. Non-native species should be no more than occasional, with a cover not exceeding 10%, and preferably absent, although an exception is made for gallery woodlands in which non-native species of *Salix*, such as *S. fragilis* or *S. alba*, may be frequent. Typical canopy species include *Salix* spp., *Fraxinus excelsior* and *Alnus glutinosa*, one or more of which should make up the greater proportion of the canopy. *Betula* spp. and *Crataegus monogyna* are frequently found, with other tree species such as *Quercus robur* and *Ulmus glabra* occurring in drier examples of the habitat.

As for sessile oak woods, alluvial woodlands should have a good complement of dead wood, including coarse and fine, standing and fallen dead wood, to accommodate the greatest possible range of invertebrates and other saproxylic organisms.

Alluvial woodlands in Ireland occur within the hydrological system of a river or lake and are usually periodically inundated.

Extent of alluvial woodland in Ireland

Following digitisation of NSNW sites and *post hoc* determination of the Annex I status of digitised polygons as above for 91A0 woodlands, 183 polygons measuring 8 km^2 were described as 91E0, with a further 25 polygons measuring 4 km^2 determined to contain additional 91E0 habitat in mosaic with other woodland habitats (O'Neill *et al*. 2010a and unpublished data submitted to NPWS). A further 6 km^2 of 91E0 woodland was mapped from other sources to bring the total mapped area of 91E0 woodland in Ireland to just over 18 km^2.

Assessment and monitoring of Annex I habitats

Evans and Arvela (2011) presented an evaluation matrix for assessing the conservation status of Annex I habitats. A modified version of this matrix is given in Table 1.

In some EU literature, the categories "favourable", "unfavourable – inadequate" and "unfavourable – bad" are used in place of "green", "amber" and "red". This survey assesses just two of the above parameters: structure and functions, and future prospects. Therefore, it will only be possible at this time to give a preliminary assessment of the habitat status. The survey methodology follows the approach of the sand dune survey by Ryle *et al*. (2009), grasslands survey by Martin *et al*. (2007, 2008) and upland habitats survey by Perrin *et al*. (2009) in using monitoring stops (or plots) to assess the status of structure and functions. Future prospects of sites are assessed on the basis of the occurrence and types of impacts, activities and management recorded in the Annex I habitats.

Table 1: Summary matrix of the parameters and conditions required to assess the conservation status of habitats (modified from Evans and Arvela (2011)).

Parameter	**Green**	**Amber**	**Red**
Range	Stable/increasing	>0% - <1% decline/year	≥1% decline in range /year over specified period
Area	Stable/increasing	>0% - <1% decline/year	≥1% decline in area /year over specified period
Structure & Functions	Habitat structure in good condition & functioning normally; typical species present	Any combination other than those described under green or red	>25% of habitat has structure, function or species composition in unfavourable condition
Future Prospects	Excellent, no significant impact from threats expected. Long-term viability assured	Between green and red	Bad, severe impact from threats expected; habitat expected to decline or disappear
Overall assessment of conservation status	All green	One or more amber but no red	One or more red

Scope of the project

The remit of the project, carried out between 2011 and 2012, was to monitor and assess structure and functions and future prospects within 101 Annex I woodland sites: 60 in 2011 and 41 in 2012. It is not within the remit of this report to discuss the assessment of the "range" and "area" parameters described in Table 1: these will be assessed separately. This report describes the monitoring methodology followed in 2011 and 2012 and gives the assessment results for all 101 sites monitored; the assessment criteria used are examined in detail and analysed; suggestions for improving the condition assessment of woodlands are made; and recommendations are made for the future monitoring of woodlands in Ireland.

Methodology

Polygon selection

Selection of the woodland polygons to be surveyed was carried out by NPWS, based on polygons digitised from the NSNW field maps. Locations of the surveyed polygons are given in Figure 1 (sessile oak woods 91A0) and Figure 2 (alluvial forests 91E0). Annex I status had been determined for these polygons prior to selection by examining relevé data recorded during the NSNW (Perrin *et al*. 2008, O'Neill *et al*. 2010a). Size thresholds for the monitoring polygons were set at between 5 and 10 ha for 91A0 woods, and between 4 and 8 ha for 91E0 woods. These thresholds were linked to the average polygon size of each woodland type from the NSNW.

A minimum coverage of 90% of the target Annex I habitat was required for each polygon, based on data from the NSNW digitisation procedure. Extant features including streams and pathways were used to delimit polygons where possible, to ensure that the boundary of the polygon would be identifiable in the field. These polygons were further examined prior to survey and boundaries were adjusted where deemed necessary to ensure as far as possible that representative blocks of woodland were selected. In some cases the polygons represented a sub-set of the original site surveyed during the NSNW, while in others the polygon corresponded exactly with the NSNW site boundary.

Note that, within this report, the terms "polygon" and "site" are used interchangeably to refer to the monitored polygons. The site numbers used correspond to those used in the NSNW.

Monitoring plots

Survey work was carried out between 17th June and 11th October in 2011 and between 30th April and 5th October in 2012. A number of sites could not be visited as permission to access them for survey was denied by the landowners. Alternative sites were substituted for four sites for which this was an issue. On arrival at the site an initial assessment of the woodland was made to ascertain whether it conformed to the appropriate Annex I woodland type. Alternative sites were substituted for four sites which were rejected at this stage. Rejection was on the basis that they did not conform to the Annex I type for which they were being assessed, either through a lack of target species in the canopy or lack of typical species in the field layer, or a combination of both.

Prior to survey, indicative locations for monitoring plots were mapped onto aerial photographs onto which polygon boundaries had been superimposed. These indicative locations were determined by visually examining aerial photographs and six-inch maps in GIS and plotting the stop locations in order to achieve a comprehensive spread of plots throughout the polygon while encompassing local variation (e.g. proximity to a river) but avoiding woodland edges and large tracks.

Surveyors in the field placed their monitoring plots as close as possible to the indicative points if they were suitably located; however, if they were located in an unsuitable area, such as under a canopy from which target species were absent, they were relocated to a more suitable position. Ideally, plots were placed at least 100 m apart; however, this was not always possible if access to certain parts of the wood was prevented, for example, due to flooding or because access to part of the site was denied by one of the landowners.

For sites that passed the initial assessment, detailed assessments were then carried out at four monitoring plots within the polygon, each plot measuring 20 m x 20 m. The presence of certain target tree species (*Quercus petraea* and/or *Quercus* x *rosacea* for 91A0; *Alnus glutinosa*, *Fraxinus excelsior* and/or *Salix* spp. for 91E0) was mandatory within each plot. A hand-held GPS (e.g. Garmin 72H differential GPS) was used to record the grid reference of each plot, slope and aspect were recorded and a photograph of the plot was taken.

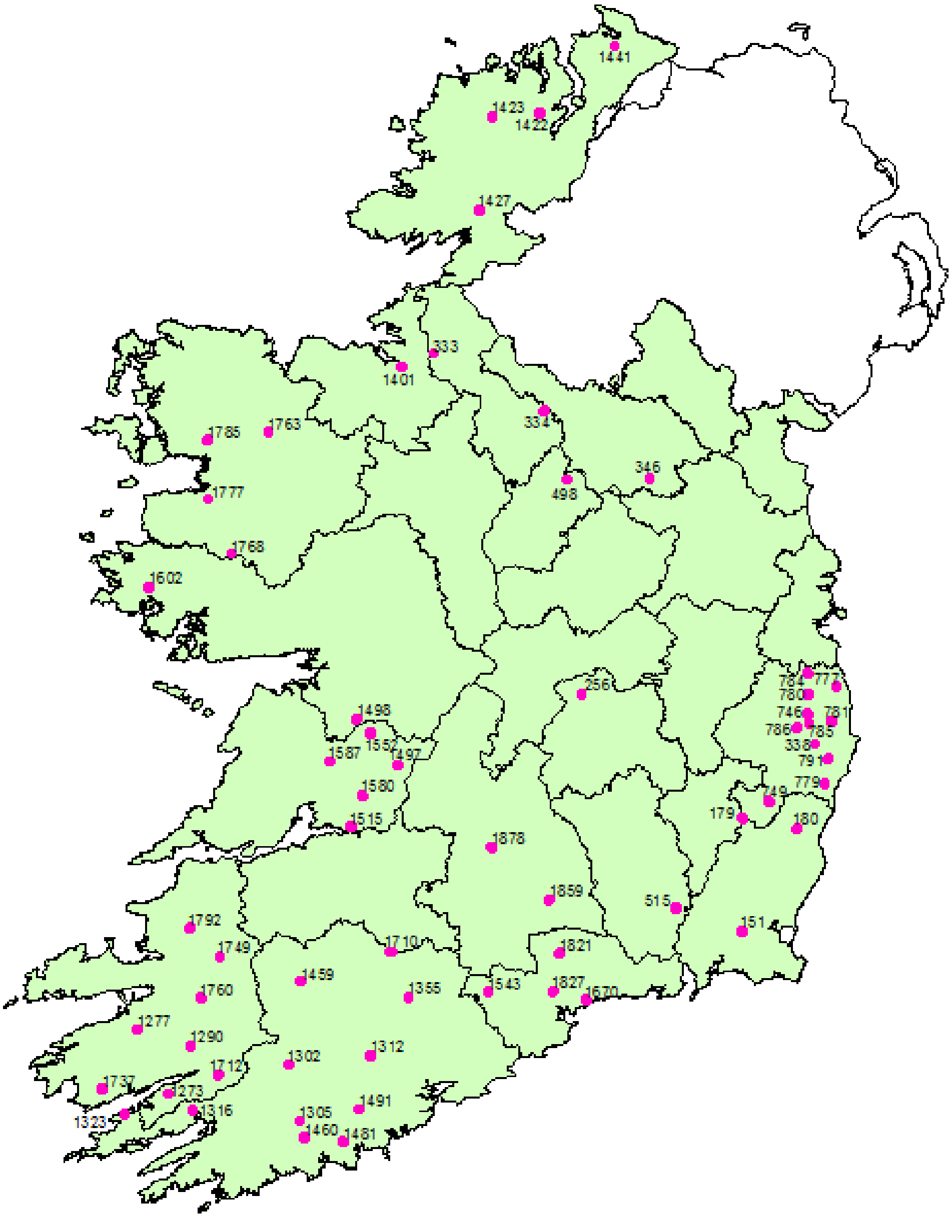

Figure 1: Location of the 61 sessile oak wood (91A0) monitoring polygons surveyed in 2011 and 2012.

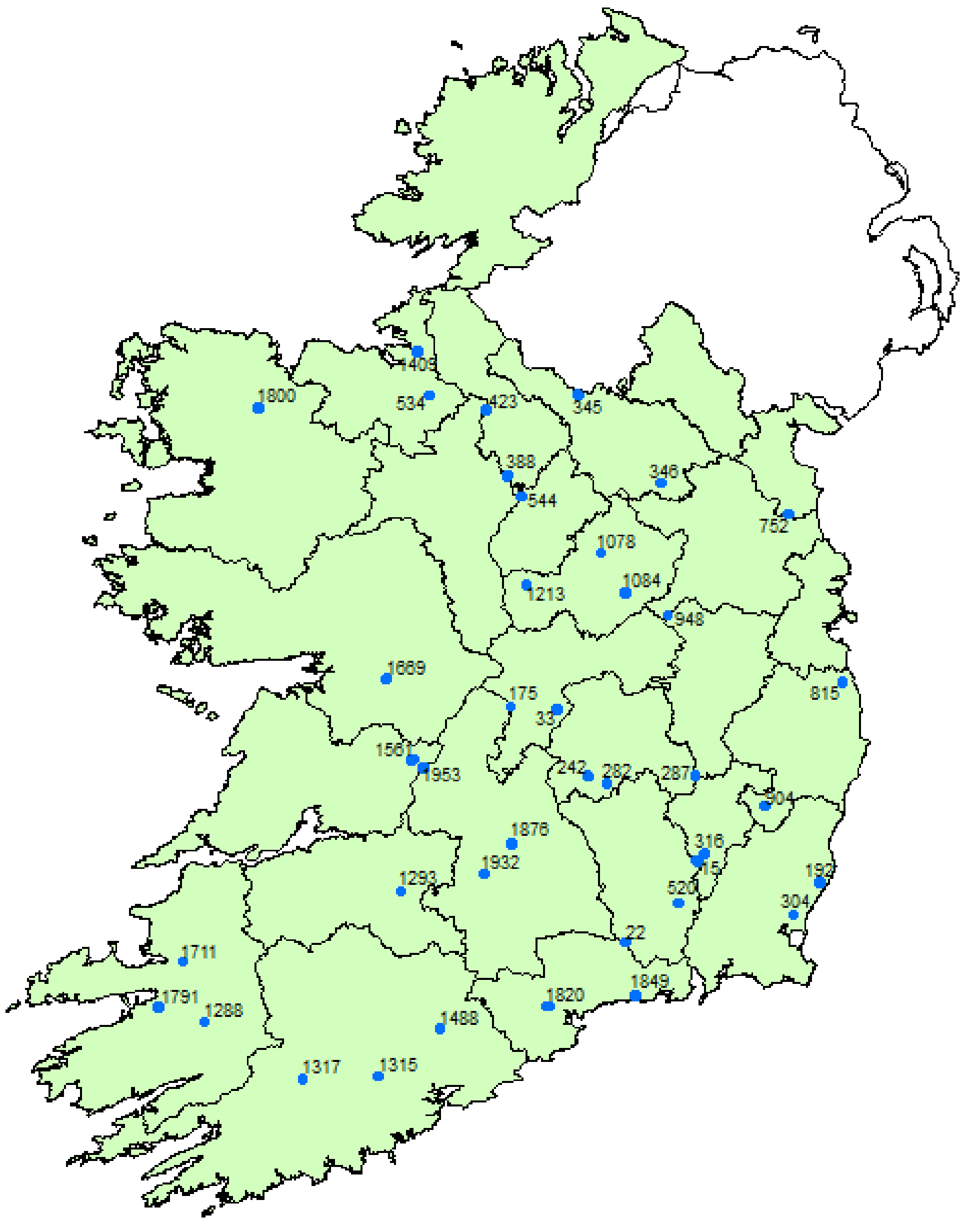

Figure 2: Location of the 40 alluvial forest (91E0) monitoring polygons surveyed in 2011 and 2012.

Structure and functions: data collected

The methodology employed for the monitoring and conservation assessment was modified from guidelines given in NPWS (2011) and Perrin *et al*. (2008).

Data sheets are given in Appendix I. Within each plot, the following structure and functions data were recorded:

Species

- Presence of positive indicator species. Table 2 gives the list of indicator species for 91A0 and 91E0 woodlands. In 2012, two additional species – *Solanum dulcamara* and *Lycopus europaeus* – were included as positive indicators for 91E0.
- Presence of negative indicator species (i.e. any non-native species, including herbaceous species).

Woodland structure

- Median canopy height in metres. Tree height was measured using a clinometer.
- Total canopy cover as percentage of plot.
- Total percentage of target species in canopy.
- Total cover of negative species as percentage of plot.
- Total native shrub layer cover as percentage of plot. Shrub layer was defined as shrub vegetation occurring 2 - 4 metres above ground.
- Total native dwarf shrub/field layer cover as percentage of plot.
- Median height in centimetres of native dwarf shrub/field layer.
- Total bryophyte layer cover as percentage of plot.

Cover scores were recorded as a percentage of the plot area to the nearest 5%, or to the nearest 1% if less than 5%. A cover score of <1% was also permitted.

Grazing pressure

- Grazing pressure (i.e. overgrazing) was recorded based on the presence of the following indicators: topiary effect on shrubs and young trees (see Plate 1), browse line on mature trees, abundant dung, recent bark stripping.
- In 91E0 woodlands, trampling was additionally recorded for grazing pressure assessment.

Free regeneration

- Number of saplings[1] of each negative tree species.
- Number of seedlings[2] of each negative tree species.
- Occurrence of free regeneration of negative shrub species such as *Rhododendron ponticum* and herbaceous invasive species such as *Impatiens glandulifera*, regardless of height.
- Number of saplings of each target species. *Quercus* spp. saplings were recorded to genus due to the difficulty in identifying young oaks to species level.
- Number of saplings of each non-target native tree species.

Free regeneration refers to regeneration that appears to have originated from seed. When counting free regeneration, only separate regenerating units were counted, i.e. several shoots arising from a single root were regarded as a single regenerating unit.

(a) (b)

Plate 1: Topiary browsing on (a) *Ilex aquifolium* and (b) *Calluna vulgaris*. Photographs © Fionnuala O'Neill, BEC Consultants Ltd. / NPWS.

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[1] The term "sapling" is used in this report to refer to young regenerating tree species with a DBH (diameter at breast height, i.e. at 1.3 m) less than 7 cm and measuring 2 m or more in height.

[2] The term "seedling" is used in this report to refer to young regenerating tree species with a DBH less than 7 cm and measuring less than 2 m in height.

Table 2: List of positive indicator species for 91A0 and 91E0 woodlands.

91A0	**91E0**
Target species:	Target species:
Quercus petraea	*Alnus glutinosa*
Quercus x *rosacea*	*Fraxinus excelsior*
	Salix cinerea
Other woody species:	*Salix* spp.
Betula pubescens	
Corylus avellana	Other woody species:
Ilex aquifolium	*Betula pubescens*
Lonicera periclymenum	*Crataegus monogyna*
Sorbus aucuparia	*Solanum dulcamara* (2012 only)
Vaccinium myrtillus	*Viburnum opulus*
Herbs & Ferns:	Herbs & Ferns:
Blechnum spicant	*Agrostis stolonifera*
Luzula sylvatica	*Angelica sylvestris*
Oxalis acetosella	*Carex remota*
Hyacinthoides non-scripta	*Filipendula ulmaria*
Polypodium sp.	*Galium palustre*
	Iris pseudacorus
Mosses & Liverworts:	*Lycopus europaeus* (2012 only)
Dicranum scoparium	*Mentha aquatica*
Diplophyllum albicans	*Phalaris arundinacea*
Hylocomium brevirostre	*Ranunculus repens*
Mnium hornum	*Rumex sanguineus*
Plagiothecium undulatum	*Urtica dioica*
Polytrichastrum formosum	
Pseudotaxiphyllum elegans	Mosses & Liverworts:
Rhytidiadelphus loreus	*Calliergonella cuspidata*
Saccogyna viticulosa	*Climacium dendroides*
Scapania gracilis	*Thamnobryum alopecurum*

Basal regeneration

Both 91A0 and 91E0, excluding prostrate Salix *trees*

- Basal shoots ≥2 m tall arising from a larger trunk with a DBH of ≥7 cm were not counted unless the tree was completely dead at breast height, i.e. 1.3 m above the ground, in which case the whole unit was counted as a single regenerating unit.

91E0 only

- Basal regeneration from *Salix* spp. was recorded if it was ≥2 m tall and arose from a totally collapsed/prostrate *Salix* sp. trunk of ≥7 cm diameter within 1.3 m of the root plate. Two size classes were used to record this regeneration: <7 cm DBH and ≥7 cm DBH. Such basal regeneration was recorded to get an indication of the occurrence of the vegetative spread of *Salix* spp.

Size class (target tree species only)

DBH of target trees was tallied within three size classes as follows:

- Lowland 91A0 woods: size class 1 = 7-<20 cm; size class 2 = 20-<40 cm; size class 3 = ≥40 cm.
- Upland 91A0 woods and all 91E0 woods: size class 1 = 7-<20 cm; size class 2 = 20-<30 cm; size class 3 = ≥30 cm.

For the purposes of this survey, an altitude of 150 m was taken to be the cut-off point between upland and lowland situations. Where one or more plots in a site were above this cut-off, all plots were treated as upland plots for data handling purposes.

- For multi-stemmed trees, only the largest trunk was counted and assigned to the appropriate DBH size class. The occurrence of large numbers of multi-stemmed trees, or trees with very numerous stems, was noted.
- Trees with forked trunks were measured below the fork if forking occurred more than 1 m up the trunk.

Dead wood

Dead wood with a diameter of 20 cm or greater was recorded in four categories: old senescent trees (some dead limbs or other signs of damage present), standing dead, fallen dead (including large, fallen tree branches) and rotten stumps (cut/broken trunks of 1 m or less, not counting stumps with basal resprouts). Dead wood was recorded regardless of whether the tree was a target, non-target native or non-native species. In 2011, dead wood data were also collected for two additional, smaller size classes: 10.0-14.5 cm and 15.0-19.5 cm but these were not used in the final assessment.

Structure and functions: assessment

Assessments were made at the individual-plot and four-plot levels, and these were combined to give an assessment at the polygon level. The criteria assessed for each woodland type are shown in Table 3 (individual-plot level criteria) and Table 4 (four-plot level criteria). Of the ten criteria assessed at the individual-plot level, eight had to reach their target to achieve a pass. Of the four criteria assessed at the four-plot level, three had to reach their target to achieve a pass. For the overall polygon level assessment, a green (favourable) assessment result could be achieved only if all plots passed at the individual-plot level and at the four-plot level (i.e. five passes achieved). One failure out of the five was allowed for a polygon to receive an amber (unfavourable – inadequate) assessment. More than one failure resulted in a red (unfavourable – bad) assessment. This process is summarised in Table 5.

Table 3: Assessment criteria at the individual-plot level for 91A0 and 91E0 woodlands.

	Assessment criterion	91A0 target for pass	91E0 target for pass
1	Positive indicator species	At least 1 target species ≥6 positive species, of which at least 2 must be bryophytes	At least 1 target species ≥6 positive species
2	Negative species cover	≤10% cover of plot	≤10% cover of plot
3	Negative species regeneration	Absent	Absent
4	Median canopy height	≥11 m	≥7 m
5	Total canopy cover	≥30% of plot	≥30% of plot
6	Proportion of target species in canopy	≥50% of canopy	≥50% of canopy
7	Native shrub layer cover	10 - 75% of plot	10 - 75% of plot
8	Native dwarf shrub/field layer	≥20% of plot, height ≥20 cm	≥20% of plot, height ≥20 cm
9	Bryophyte cover	≥4%	≥4%
10	Grazing pressure	All 4 indicators absent	All 5 indicators absent

Table 4: Assessment criteria at the four-plot level for 91A0 and 91E0 woodlands.

	Criterion	Target for pass
1	Target species size class distribution	At least 1 of each size class present over all 4 plots
2	Target species regeneration	At least 1 sapling ≥2 m tall over all 4 plots
3	Other native tree regeneration	At least 1 sapling ≥2 m tall in 2 or more plots
4	Old trees & dead wood	At least 3 from any category (DBH ≥20 cm)

Table 5: Summary of conditions required for structure and functions assessment results at the individual-plot, four-plot and polygon levels

Level	No. of criteria assessed	Required for pass	Best result	Worse result
1-plot	10	Passes in ≥8 criteria	Four Passes	Four Fails
4-plot	4	Passes in ≥3 criteria	Pass	Fail
Polygon	Four 1-plot results + one 4-plot result	Various - see below	Green	Red

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No. of 1-plot passes	4-plot result	Polygon S&F assessment result
4	Pass	Green
3	Pass	Amber
4	Fail	Amber
<3	Pass	Red
<4	Fail	Red

Future prospects: data collected

The future prospects assessment relates to the likely development and maintenance of the Annex I woodland habitat in favourable condition for the foreseeable future (Ellmauer 2010). The "foreseeable future" is suggested by Ellmauer to be two reporting phases, i.e. 12 years. However, this time-frame is more applicable to habitats subject to more rapid, short-term changes and turnover of species, such as grassland or dune habitats, than to woodlands, for which a medium to long-term view is more appropriate. In order to assess future prospects, pressures, threats and impacts throughout the polygon were recorded according to the list given by Ssymank (2011). The following details were recorded for each impact: the intensity of the impact (high, medium or low), effect (positive, negative or neutral), percentage of the polygon affected, and source of the impact (from inside or outside the polygon). The data sheet for recording impacts is shown in Appendix I. Impacts in adjacent Annex I woodland were also noted to provide additional information on the future prospects of the Annex I habitat as a whole, particularly where these could impact negatively on the monitoring polygon in the future. In addition, NSNW data (Perrin *et al*. 2008) were consulted for any sites in which invasive species were noted in 2011/2012, to check if those species had been present during the original survey in 2003-2007 or if the problem is of more recent date.

Future prospects: assessment

The surveyors' subjective assessment of the woodland polygon's future prospects was given according to the following guidelines:

- Green = excellent/good prospects; no significant impact from pressures/threats expected; long-term viability assured.
- Red = bad prospects; severe impact from pressures/threats expected; long-term viability not assured.
- Amber = between these two extremes.

To obtain an additional objective assessment of the polygon's future prospects, a scoring system was used to calculate a value for the future prospects assessment. This system, given in Table 6, was modified slightly[3] from that used in the assessment of Annex I grasslands by O'Neill et al. (2010b). Areas of Annex I woodland habitat that scored ≥0 were determined to have favourable future

[3] The modification used is in relation to the "Source" attribute of the future prospects assessment. Scoring of this attribute has been omitted from the calculations used in this report, on the basis that an impact's source does not increase or lessen the severity of the impact. This is a slight change of approach from that taken in the interim Woodland Monitoring Survey report (O'Neill & Barron 2011), in which the calculations used were identical to those used in O'Neill *et al.* (2010b).

prospects (green), while those scoring between <0 and -3 were unfavourable – inadequate (amber) and <-3 unfavourable – bad (red). The objective nature of this calculated figure means that any upward or downward trend in future prospects should be detected in subsequent visits to the same site.

The surveyors' assessment and the calculated assessment were cross-checked for agreement. If there was a difference between the two assessments, the impacts were examined in conjunction with the surveyors' notes to gauge which of the two assessments was more appropriate; thus, in some instances, the surveyors' assessment overrode the scoring system, while in other cases the scoring system was deemed to give the more appropriate assessment result.

As the data collected here are the first monitoring data to be collected for woodlands, trends of impact intensity could not be determined at this stage. However, it will be possible in any future assessments to record whether a particular impact is increasing, decreasing or static in trend by comparing with assessment data from previous years.

Overall polygon assessment

If either structure and functions or future prospects were assessed as red, the overall assessment result for the polygon was red. Both attributes had to be green for a polygon to receive a green assessment. Any other combination resulted in an amber assessment.

Table 6: Scoring system used to quantify impacts in Annex I woodland polygons (modified from O'Neill *et al*. 2010b). The future prospects score of a site is the sum of its individual impact scores.

Attribute of impact	Value	Attribute score
1. Intensity of impact	High	1.5
	Medium	1.0
	Low	0.5
2. Effect of impact	Positive	1
	Neutral	0
	Negative	-1
3. % Area of Annex I polygon impacted	<1%	0.5
	1-25%	1.0
	26-50%	1.5
	51-75%	2.0
	76-99%	2.5
	100%	3.0
Impact score is the mathematical product of all three attributes		

Results

Structure and functions

Polygon results

Table 7 gives a summary of the results for structure and functions for the 91A0 polygons surveyed over the two years of the survey, 2011 and 2012. Table 8 gives the summary for the 91E0 polygons.

In total, 20 of the 61 polygons of 91A0 (33%) achieved a green structure and functions assessment, with 15 (25%) receiving an amber assessment and 26 (43%) receiving a red assessment. A total of 24 of the 40 polygons of 91E0 (60%) achieved a green structure and functions assessment, with seven amber assessments (17.5%) and nine red assessments (22.5%) received.

The above results take account of discretionary passes, which were allowed in a number of cases where the original result was a fail. One site, 1317 the Gearagh, originally received an amber assessment for the monitoring polygon due to the failure of one plot on three criteria, including the field layer cover/height criterion. However, it was apparent to the surveyors that the low field layer height was due to the low stature of a characteristic alluvial woodland vernal species, in this case *Allium ursinum*, rather than to overgrazing, so the criterion was deemed to have passed; this resulted in a pass at the polygon level. Similarly, site 1849 Kilcannon originally received an amber assessment due to one plot failing three criteria, including the canopy height criterion. However, it was evident that taller trees were prevented from establishing here because of the very wet substrate in which the wood was growing; hence, low canopy height was not deemed to be a problem in this situation but rather, a consequence of natural conditions at the site. These two sites therefore received a green assessment for structure and functions at the polygon level.

Table 7: Summary of structure and functions results at the individual-plot level, four-plot level and polygon level for the 61 sessile oak wood (91A0) polygons surveyed in 2011 and 2012.

			1-plot level	4-plot level	Polygon level S&F
Site no.	**Site name**	**County**	**No. plots in site that passed**	**Pass/Fail**	**Green/Amber/Red**
151	Bricketstown House	Wexford	1	Pass	Red
179	Clonogan Wood	Carlow	2	Pass	Red
180	Glandoran Upper/ Carthy's Wood	Wexford	2	Pass	Red
256	Coolnamony	Laois	4	Pass	Green
333	Stonepark	Leitrim	4	Fail	Amber
334	Garadice Lough	Leitrim	2	Pass	Red
338	Vale of Clara	Wicklow	3	Pass	Amber
346	Deerpark	Cavan	0	Pass	Red
498	Erne Head	Longford	1	Fail	Red
515	Kylecorragh	Kilkenny	2	Pass	Red
746	Baltynanima	Wicklow	3	Pass	Amber
749	Tomnafinnoge	Wicklow	0	Pass	Red
777	Glen of the Downs	Wicklow	2	Pass	Red
779	Shelton North	Wicklow	3	Pass	Amber
780	Luggala Lodge	Wicklow	0	Fail	Red
781	The Devil's Glen	Wicklow	3	Pass	Amber
784	Oldboleys	Wicklow	4	Pass	Green
785	Castlekevin	Wicklow	0	Fail	Red
786	Giant's Cut	Wicklow	2	Fail	Red
791	Kilmacrea Wood	Wicklow	4	Pass	Green
1273	Uragh Wood	Kerry	4	Pass	Green
1277	Lyranes Lower Wood	Kerry	4	Pass	Green
1290	Derrycunihy Wood	Kerry	4	Fail	Amber
1302	Prohus	Cork	4	Pass	Green
1305	Manch East	Cork	1	Fail	Red
1312	Cloghphilip Wood	Cork	4	Pass	Green
1316	Glengarriff	Cork	4	Fail	Amber
1323	Cleanderry Wood	Cork	4	Pass	Green
1355	Philip's Wood	Cork	2	Pass	Red
1401	Union Wood	Sligo	4	Pass	Green
1422	Ballyarr Wood	Donegal	4	Pass	Green
1423	Mullangore Wood	Donegal	2	Pass	Red
1427	Ardnamona Wood	Donegal	4	Pass	Green
1441	Carndonagh	Donegal	3	Pass	Amber
1459	Aghaneenagh	Cork	4	Pass	Green
1460	Kilmeen Wood	Cork	3	Pass	Amber
1481	Ummera Wood	Cork	1	Fail	Red
1491	French Wood	Cork	1	Pass	Red
1497	Bealkelly Woods	Clare	4	Pass	Green
1498	Drummin Wood	Galway	3	Pass	Amber
1515	Garannon Woods	Clare	2	Pass	Red
1543	Glenmore Wood	Waterford	2	Pass	Red
1552	Cahermurphy	Clare	2	Pass	Red
1580	Ballykelly Woods	Clare	4	Pass	Green
1587	Derrymore Wood	Clare	4	Fail	Amber
1602	Ballynahinch	Galway	1	Pass	Red
1670	Stradbally Woods	Waterford	1	Fail	Red
1710	Ballintlea Wood	Limerick	2	Pass	Red

Table 7 (ctd.)

Site no.	Site name	County	1-plot level: No. plots in site that passed	4-plot level: Pass/Fail	Polygon level S&F: Green/Amber/Red
1712	Glanlough Woods	Kerry	3	Pass	Amber
1737	Graigue's	Kerry	4	Pass	Green
1749	Dooneen Woods	Kerry	4	Pass	Green
1760	Brennan's Glen	Kerry	4	Pass	Green
1763	Pontoon Woods	Mayo	4	Pass	Green
1768	Barnarinia	Mayo	3	Pass	Amber
1777	Brackloon Woods	Mayo	3	Pass	Amber
1785	Treanlaur	Mayo	0	Pass	Red
1792	Glenbalyma	Kerry	2	Pass	Red
1821	Knocknaree	Waterford	3	Pass	Amber
1827	Bohadoon South	Waterford	4	Pass	Green
1859	Grove Wood	Tipperary	1	Pass	Red
1878	Drum Wood	Tipperary	4	Pass	Green

Table 8: Summary of structure and functions results at the individual-plot level, four-plot level and polygon level for the 40 alluvial forest (91E0) polygons surveyed in 2011 and 2012.

Site no.	Site name	County	1-plot level: No. plots in site that passed	4-plot level: Pass/Fail	Polygon level S&F: Green/Amber/Red
15	Borris	Carlow	4	Pass	Green
22	Fiddown	Kilkenny	4	Pass	Green
33	Camcor Wood	Offaly	4	Pass	Green
175	Townparks	Offaly	4	Pass	Green
192	Litterbeg	Wexford	3	Pass	Amber
242	Grantstown Wood	Laois	2	Pass	Red
282	Castledurrow Demesne	Laois	4	Pass	Green
287	Knockbeg College	Laois	2	Pass	Red
304	Garrylough Lower	Wexford	2	Pass	Red
316	Ballynattin	Carlow	4	Pass	Green
345	Ballyconnell Demesne	Cavan	4	Pass	Green
346	Deerpark (Cavan)	Cavan	2	Pass	Red
388	Derrycarne Demesne South	Leitrim	4	Pass	Green
423	Inisfale Wood	Roscommon	2	Pass	Red
520	Coolnamuck 2	Kilkenny	3	Pass	Amber
534	Fidwog	Sligo	3	Pass	Amber
544	Gubroe (Castle Forbes)	Longford	4	Pass	Green
752	Yellow Island	Meath	4	Pass	Green
815	Kilmacanoge South	Wicklow	3	Pass	Amber
904	Cronelea	Wicklow	4	Pass	Green
948	Rahin Wood (Kildare)	Kildare	1	Pass	Red
1078	Lough Owel Wood	Westmeath	4	Pass	Green
1084	Gaybrook Demense	Westmeath	3	Pass	Amber
1213	Auburn	Westmeath	3	Pass	Amber
1288	Game Wood	Kerry	4	Pass	Green
1293	Glen Bog	Limerick	4	Pass	Green
1315	Coolyduff	Cork	4	Pass	Green
1317	The Geragh	Cork	4	Pass	Green
1409	Hazelwood Demesne	Sligo	1	Pass	Red

Table 8 (ctd.)

Site no.	Site name	County	1-plot level No. plots in site that passed	4-plot level Pass/Fail	Polygon level S&F Green/Amber/Red
1488	Scartbarry	Cork	4	Pass	Green
1561	Knockaphort	Clare	4	Pass	Green
1669	Cuscarrick	Galway	4	Pass	Green
1711	Ballyseedy Wood	Kerry	4	Pass	Green
1791	Farrantooreen	Kerry	4	Pass	Green
1800	Prospect	Mayo	0	Pass	Red
1820	Killeeshal	Waterford	2	Pass	Red
1849	Kilcannon	Waterford	4	Pass	Green
1876	Moyaliff	Tipperary	4	Pass	Green
1932	Marl Bog	Tipperary	4	Pass	Green
1953	Castlelough	Tipperary	3	Pass	Amber

Criteria results

Table 9 summarises the pass rates for the individual monitoring criteria measured in 2011 and 2012 for all 91A0 and 91E0 woodland sites.

Individual-plot structural criteria

This table shows broadly similar pass rates for many criteria in both Annex I woodland types, such as very high pass rates (>95%) for median canopy height and total canopy cover. Slightly lower pass rates (80-90%) were achieved for positive indicator species, proportion of target species in canopy and bryophyte cover criteria, but again these are broadly similar across both types.

Negative species cover was a contributing factor in the failure of around a quarter of monitoring plots in both Annex I woodland types. Some more significant differences in pass rates were recorded for negative species regeneration (the criterion passing in 42% of 91E0 plots, compared to 53% of 91A0 plots), native shrub layer cover (73% of 91A0 plots passing on this criterion, compared to 92% of 91E0 plots), dwarf shrub/field layer cover and height (a higher failure rate in 91A0 plots at 18%, compared to just 4% of 91E0 plots) and grazing pressure (a problem in 31% of 91A0 plots, compared to just 11% of 91E0 plots). These last two criteria are usually linked, with overgrazing commonly leading to a less luxuriant dwarf shrub/field layer.

The portion of the positive indicator species criterion that relates to the presence of bryophyte indicators in 91A0 woodlands, introduced as part of the positive indicator criterion in 2012 and retrospectively applied to all plots surveyed between 2011 and 2012, failed in 13% of 91A0 plots; just over 10% of these plots (25 plots in total) had the requisite number of positive indicator species (i.e. at least six) present in the plot, but fewer than two of these species were bryophytes.

Four-plot structural criteria

At the four-plot level, target species regeneration failed in almost 40% of 91A0 polygons, but passed in all 91E0 polygons. The criterion that assesses size class distribution was altered from 2011 (in which each size class had to contain at least 20% of target species stems from across the four monitoring plots) due to the extremely low pass rate achieved across both woodland types; it now requires each size class to contain at least one target species stem from across the four plots. This was retrospectively applied to all polygons recorded between 2011 and 2012. While this is a much less stringent threshold, there was nevertheless a 25% failure rate for this criterion in the 91A0 woodlands, most failures (13 of the 15) being caused by a lack of trees in the smallest size class (7-<20 cm). The single failure of a 91E0 plot was due to a lack of trees in the largest size class (≥30 cm). Pass rates for the four four-plot criteria were generally high in the 91E0 woodlands (although insufficient dead wood is significantly more of a problem here than in the 91A0 woodlands), and in fact all 40 of the 91E0 polygons passed their assessments at the overall four-plot level.

Some correspondence can be found between criteria at both the individual-plot and four-plot level. For example, there were several sessile oak woods where shrub layer cover was almost completely absent, particularly where there were relatively high numbers of tall, old oak trees (DBH ≥30 cm), such as 338 Vale of Clara, 786 Giant's Cut, 1481 Ummera Wood, 1552 Cahermurphy and 1777 Brackloon Woods. Grazing was sometimes, though not always, an issue at these sites and oak regeneration was frequently absent.

Table 9: Pass (and Fail) rates for individual structure and functions monitoring criteria at the individual-plot and four-plot levels for the 101 Annex I woodland polygons surveyed in 2011 and 2012.

	91A0	**91E0**
Individual-plot level criteria	**%Pass (%Fail)**	**%Pass (%Fail)**
Positive indicator species: 2+ indicator bryophytes	87 (13)	N/A
Positive indicator species: overall	86 (14)	89 (11)
Negative species cover	74 (26)	77 (23)
Negative species regeneration	53 (47)	42 (58)
Median canopy height	97 (3)	96 (4)
Total canopy cover	100 (0)	97 (3)
Proportion of target species in canopy	83 (17)	90 (10)
Native shrub layer cover	73 (27)	92 (8)
Native dwarf shrub/field layer cover & height	82 (18)	96 (4)
Bryophyte cover	82 (18)	82 (18)
Grazing pressure absent	69 (31)	89 (11)
Overall pass (individual-plot level)	*67 (33)*	*82 (18)*
Four-plot level criteria	**%Pass (%Fail)**	**%Pass (%Fail)**
Size class distribution	75 (25)	97 (3)
Target species regeneration	61 (39)	100 (0)
Other native tree regeneration	95 (5)	92 (8)
Old trees & dead wood	98 (2)	87 (13)
Overall pass (four-plot level)	*82 (18)*	100 (0)

Target tree species DBH data

The distribution of oak tree girths in three size classes in sessile oak wood (91A0) sites is given in Figure 3. This shows polygons with high numbers of small oak trees (DBH 7-<20 cm) at the left of the graph and those with low numbers of small oak trees at the right. From this graph it can be seen that there is an overall increase in the frequency of large oak trees (DBH $\geq$40 cm) as the frequency of smaller trees decreases. High numbers of smaller trees often signify younger stands, so this is not unexpected. However it should be borne in mind that this is not always the case, for example if coppicing has taken place, or if trees are stressed due to poor growing conditions.

In 30 of the 61 sessile oak sites, more oak trees were recorded in the medium (DBH 20-<40 cm) size class than in either of the other two size classes; in 9 of the 61 sites, the highest frequency was of trees in the small size class, and the large size class had the highest number of trees recorded in 21 of the 61 sites. This is shown in Figure 4. This graph does not include the single instance where there was an equal number of small and medium trees, and no large trees.

Looking at the size distribution of the 2391 oak trees measured across all 61 sessile oak sites, the medium size class had the highest number of trees, with 1115 trunks measured; the small size class was next, with 708 trees, and the lowest frequency was attained by the large size class at 568 trees (see Figure 5). Note that the same size class intervals were used for upland and lowland polygons for the graph and percentage calculations.

Figure 3: Distribution of *Quercus* sp. tree DBH in three size classes in sessile oak woods (91A0) surveyed in 2011 and 2012.

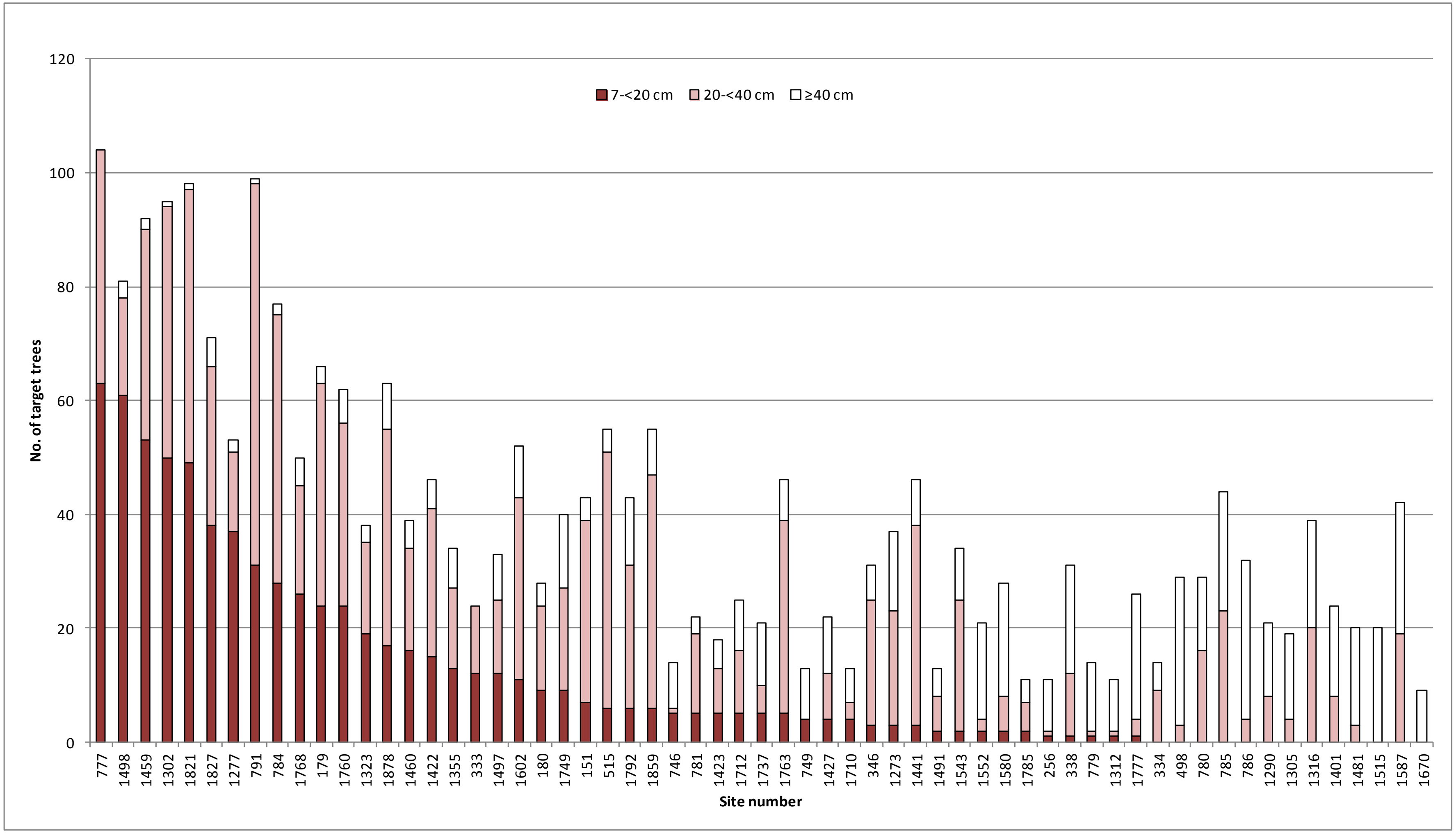


Figure 4: Proportion of sessile oak wood (91A0) sites with highest number of oak trees in various size classes.

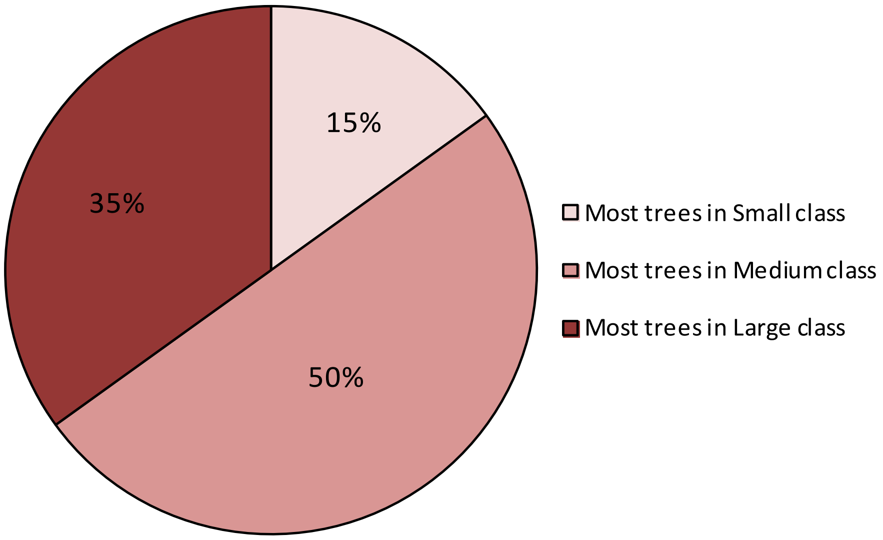
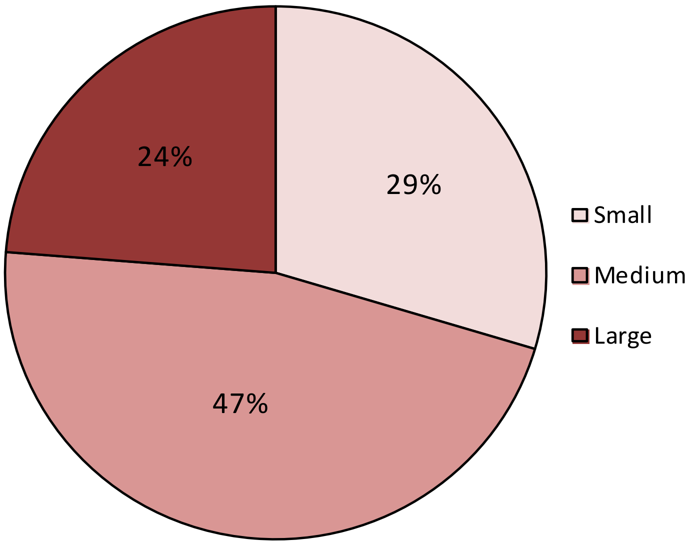


Figure 5: Proportion of oak trees measured in three size classes across all 61 sessile oak wood (91A0) sites.



There was no clear indication among the upland (>150 m) sessile oak sites surveyed that tree girths decreased with altitude. Three of the twelve upland sites had more than half of their oak trees attain a DBH of ≥40 cm. A further three upland sites had 40-50% of their DBH measurements ≥40 cm, while in the remaining six upland sites, less than 15% of the measurements were ≥40 cm

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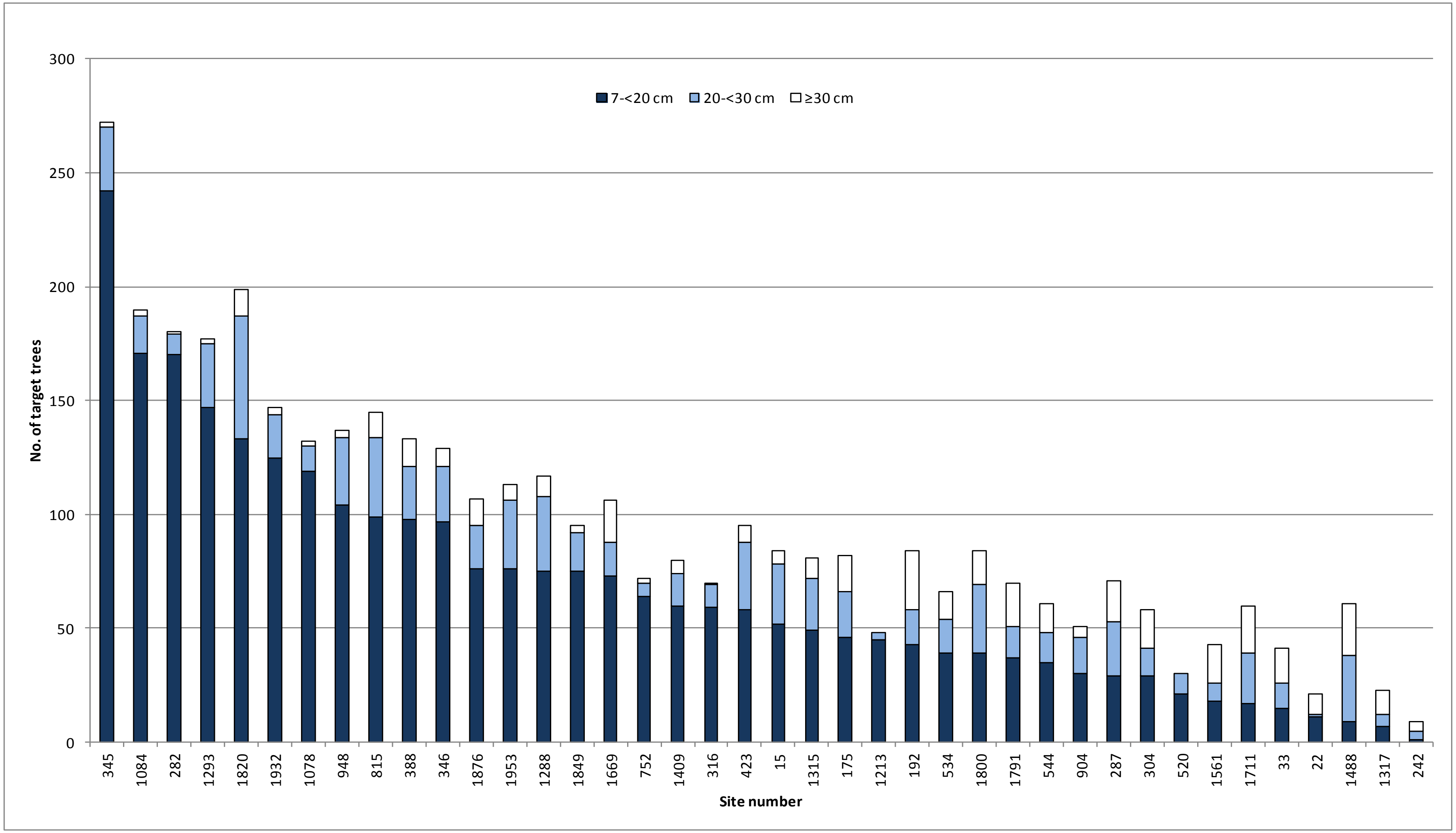
Figure 6: Distribution of tree DBH of all target species in three size classes in alluvial forests (91E0) surveyed in 2011 and 2012.



The overall trend across the alluvial woodland sites was for high numbers of small target trees (DBH 7-<20 cm), smaller numbers of medium-sized target trees (DBH 20-<30 cm) and a smaller number again of large target trees (DBH ≥30 cm) (Figure 6), although there were some exceptions, such as site 1488 Scartbarry, which had relatively few small trees but numerous medium and large trees, mostly *Alnus glutinosa*. The overall trend was common across the three main target species, *Alnus glutinosa*, *Fraxinus excelsior* and *Salix cinerea* (Table 10). For other *Salix* species (grouped together), the medium size class held the lowest percentage of trunks, with the small size class having the highest.

Figure 7: Proportion of alluvial forest (91E0) sites with highest number of target trees in various size classes.

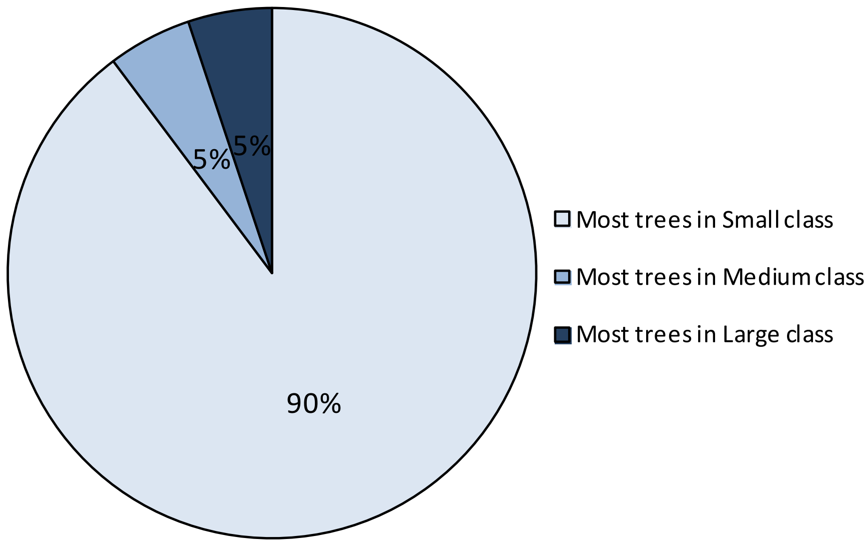
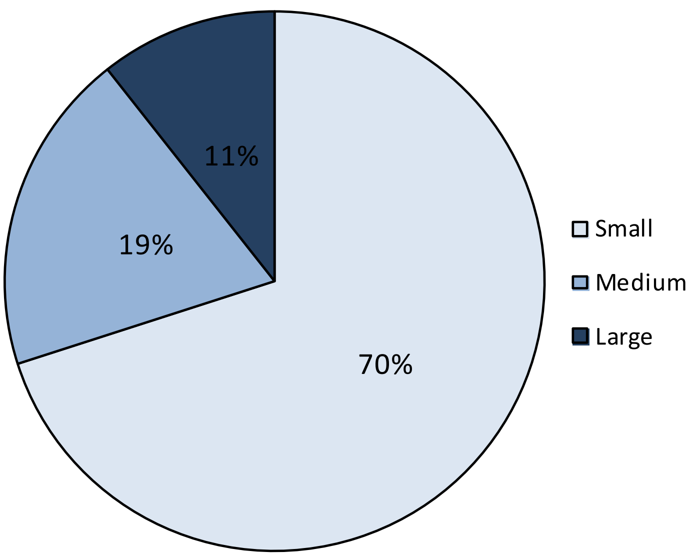


Figure 8: Proportion of target trees measured in three size classes across all 40 alluvial forest (91E0) sites.



In 35 of the 40 alluvial forest sites, small (DBH 7-<20 cm) target trees were the most frequent, with just two sites having highest frequency of trees in the medium size class (DBH 20-<30 cm), and another two sites having highest frequency of trees in the large size class (DBH ≥30 cm). This is shown in Figure 7. This graph does not include the single instance where there was an equal number of medium trees and large trees.

A similar examination of the size distribution of the 3989 target trees measured across all 40 alluvial forest sites reveals that the small size class had the highest number of trees, with 2794 trunks measured; the medium size class was next, with 771 trees, and the large size class had the lowest frequency, 424 trees (see Figure 8).

Of the three main target species, *Salix cinerea* had a distribution pattern most similar to the overall average, with 71% of trees measured falling into the small size class, 19% in the medium class and 10.5% in the large class (compared to overall averages of 70%, 19% and 11% respectively). *Fraxinus excelsior* was recorded as having the highest proportion of trees in the small size class (76%) compared to 71% for *Salix cinerea* and 62% for *Alnus glutinosa*. *Alnus glutinosa* had the greatest frequency of medium-sized trees (26.5%).

The higher number and frequency of small *Fraxinus excelsior* trees may indicate that this species has a higher rate of successful recruitment to mature trees than the other two species, but also a higher mortality rate among young trees. Alternatively, there may be a higher incidence of young *Fraxinus excelsior* stands than of either of the other two species. A similar result could also be obtained if there was a higher proportion of multi-stemmed *Fraxinus excelsior* trees sampled than either of the other two species as this would give rise to trunks with a smaller girth. No conclusions can be drawn as to whether or not this is the case as it was not systematically recorded which of the measured trunks were from multi-stemmed trees.

Table 10: Distribution of target tree DBH in three size classes among individual target species in alluvial forests (91E0) surveyed in 2011 and 2012.

	Size class			
	7-<20 cm	**20-<30 cm**	**≥30 cm**	**Total**
Fraxinus excelsior	1,244 (76%)	251 (15%)	133 (8%)	1,628 (100%)
Alnus glutinosa	714 (62%)	307 (26%)	138 (12%)	1,159 (100%)
Salix cinerea	735 (71%)	193 (19%)	109 (10%)	1,037 (100%)
Salix (other species)	101 (61%)	20 (12%)	44 (27%)	165 (100%)
Total	2,794 (70%)	771 (19%)	424 (11%)	3,989 (100%)

Negative species: Most frequent negative taxa

The most commonly recorded negative taxa are shown in Table 11. A greater range of non-native taxa was recorded in alluvial woodlands, with 15 genera of trees and 10 genera of shrubs/herbs, compared to sessile oak woods (10 tree genera and eight shrub/herb genera). *Fagus sylvatica* and *Acer pseudoplatanus* were the most frequently recorded non-native tree species in both woodland types, with *Fagus sylvatica* more frequent in sessile oak woods and *Acer pseudoplatanus* more common in alluvial woodlands. *Abies* spp. (comprising *Abies alba*, *A. grandis* and *A. procera*) was the third most common non-native taxon in sessile oak woods. *Aesculus hippocastanum* was not recorded from sessile oak wood polygons but was the third most common non-native tree in alluvial woodlands. Non-native shrubs in sessile oak woods were almost entirely represented by just two species, *Rhododendron ponticum* and *Prunus laurocerasus*, the former by far the more frequent. Other shrub taxa recorded in sessile oak woods, none in more than one site, included *Camellia* sp., *Cotoneaster* sp., *Ribes nigrum* and *Buxus sempervirens*, the last three of which were all found on the same site. In alluvial woodlands, *Prunus laurocerasus* was marginally more frequent than *Rhododendron ponticum*, and the herbaceous non-native invasive plant *Impatiens glandulifera* was recorded in four alluvial woodland sites.

Table 11: Negative taxa recorded in 91A0 and 91E0 polygons surveyed in 2011 and 2012.

Species	**Frequency in 91A0 polygons (*n*=61)**	**Species**	**Frequency in 91E0 polygons (*n*=40)**
Trees		Trees	
Fagus sylvatica	31	*Acer pseudoplatanus*	32
Acer pseudoplatanus	21	*Fagus sylvatica*	24
Abies spp.	10	*Aesculus hippocastanum*	8
Picea spp.	9	*Abies* spp.	7
Pseudotsuga menziesii	6	*Picea sitchensis*	7
Chamaecyparis lawsoniana	4	*Carpinus betulus*	2
Tsuga heterophylla	4	*Larix decidua*	2
Larix spp.	3	*Tilia* spp.	2
Castanea sativa	2	*Tsuga heterophylla*	2
Acer platanoides	1	Other (7 species)	7
Shrubs/Herbs		Shrubs/Herbs	
Rhododendron ponticum	19	*Prunus laurocerasus*	5
Prunus laurocerasus	5	*Impatiens glandulifera*	4
Other (5 species)	3	*Rhododendron ponticum*	4
		Cornus sericea	3
		Other (6 species)	4

Negative species: Cover and regeneration

Negative species cover was satisfactory (i.e. below the 10% threshold) in approximately three-quarters of the plots surveyed in both Annex I woodland types (74% of sessile oak woods and 77% of alluvial woods). As noted above in Table 9, however, regeneration of negative species was particularly prevalent in alluvial woodlands, with 58% of 91E0 plots failing this criterion. The situation in sessile oak woods was somewhat better, with 47% of 91A0 plots recorded as having non-native regeneration present.

Tables 12 and 13 show total regeneration statistics for negative species recorded in sessile oak woods (91A0) and alluvial forests (91E0) respectively. Only species of which more than one sapling (i.e. regeneration measuring 2 m or more in height) was recorded are listed. In sessile oak woods the total number of regenerating units, i.e. seedlings and saplings, was highest for *Acer pseudoplatanus* with 452 young plants; however, *Fagus sylvatica* regeneration was recorded in more sites, with seedlings and saplings of that species recorded in 15.6% and 13.9% of 91A0 plots, respectively. Seedling numbers were sometimes extremely high within individual plots, with 158 *Acer pseudoplatanus* seedlings found in a single plot in site 1670 Stradbally. Of more concern, though, is the survival rate of seedlings to saplings. In site 1481 Ummera, 46 saplings of *Acer pseudoplatanus* were recorded in a single plot, while plots in sites 1491 French Wood and 498 Erne Head both recorded a count of 15 *Fagus sylvatica* saplings.

Table 12: Negative tree species regeneration recorded in two height classes in sessile oak wood (91A0) plots in 2011 and 2012.

91A0	***Acer pseu***		***Fagu sylv***		***Abies* spp.**		***Pseu menz***		***Tsug hete***		***Picea* spp.**		***Cast sati***	
Height	<2m	>2m	<2m	>2m	<2m	>2m	<2m	>2m	<2m	>2m	<2m	>2m	<2m	>2m
Total no.	342	110	218	90	47	10	15	10	11	4	7	2	4	2
No. plots	21	16	38	34	11	4	5	2	5	1	23	4	2	1
Median	7	4	2	1	2	2.5	2	5	1	4	2	2	2	2
Max in one plot	158	46	47	15	17	4	7	6	6	4	11	3	3	2
Frequency (*n*=244)	8.6	6.6	15.6	13.9	4.5	1.6	2.0	0.8	2.0	0.4	2.9	0.8	0.8	0.4

In alluvial woods, *Acer pseudoplatanus* again showed the highest rate of regeneration, with total counts both of seedlings and of saplings higher within the 160 alluvial woodland plots than were recorded within the 244 sessile oak plots. Site 346 Deerpark recorded the highest number of seedlings in a single plot (158), while site 1351 Coolyduff had the highest number of saplings in a plot (32). *Acer pseudoplatanus* also had the highest frequency of regeneration of all negative tree species recorded in alluvial woodland. *Fagus sylvatica* is the next most frequent, and also the next most numerous (in terms of total numbers of regenerating units), followed by *Aesculus hippocastanum*. However, *Aesculus* *hippocastanum* recorded a higher number of saplings overall (23) than *Fagus sylvatica* (19), with 13 of these occurring in just one plot in site 1409 Hazelwood Demesne.

Table 13: Negative tree species regeneration recorded in two height classes in alluvial forest (91E0) plots in 2011 and 2012.

91E0	***Acer pseu***		***Aesc hipp***		***Fagu sylv***		***Abies* spp.**		***Picea sitc***		***Tilia* spp.**		***Carp betu***	
Height	<2m	>2m	<2m	>2m	<2m	>2m	<2m	>2m	<2m	>2m	<2m	>2m	<2m	>2m
Total no.	554	154	15	23	42	19	4	12	7	10	3	5	1	4
No. plots	42	36	6	7	26	12	3	3	4	7	2	1	1	2
Median	2	2.5	1	2	1	1	1	1	1.5	1	1.5	5	1	2
Max in one plot	162	32	7	13	7	5	2	10	3	3	2	5	1	3
Frequency (*n*=160)	26.3	22.5	3.8	4.4	16.3	7.5	1.9	1.9	2.5	4.4	1.3	0.6	0.6	1.3

Future prospects

Impacts

Table 14 gives a summary of the impacts recorded in 91A0 polygons surveyed in 2011 and 2012, and Table 15 gives a similar summary for 91E0 polygons. For both woodland types, the most commonly recorded impact was invasive non-native species (code I01), occurring in 75% of sessile oak woods and over 87% of alluvial forests. In sessile oak woods, grazing (code B06) was the second most recorded impact, followed by paths/tracks (code D01.01) and fences/fencing (code G05.09). Together these four impacts accounted for more than half of all impacts recorded in sessile oak woods.

In alluvial woodlands, the second most frequent impact was garbage and solid waste (code H05.01), from deliberate dumping or from being washed into the woodland as flotsam from a river or lake. This impact – largely aesthetic rather than ecological – was slightly more common than grazing and paths/tracks. These four impacts again accounted for over half of the impacts recorded across the habitat as a whole.

All occurrences of invasive non-native species were recorded as having a negative effect in both 91A0 woods (Table 16) and 91E0 woods (Table 17), with occurrences of even a single seedling regarded as being undesirable and recorded as a negative impact. In almost all cases where invasive species were noted, they had also been recorded during the NSNW between 2003 and 2007. The exception was site 784 Oldboleys, a sessile oak wood, where two *Rhododendron ponticum* seedlings were noted beside one of the monitoring plots: no invasive species had been recorded for this site when it was surveyed in 2005. The situation with regard to site 316 Ballynattin is unclear; while *Acer pseudoplatanus* regeneration recorded in 2011 was not recorded in the NSNW in 2003, neither were a number of large *Fagus sylvatica* and *Picea sitchensis* trees, recorded in 2011, which were undoubtedly present eight years before. This casts doubt on whether the *Acer pseudoplatanus* regeneration noted in 2011 was newly established or if it simply occurred in a small part of the woodland that was not walked in 2003.

Table 14: Summary of impacts recorded in the 61 sessile oak wood (91A0) polygons surveyed in 2011 and 2012.

Impact Code	**Description**	**No. of occurrences**
I01	Invasive non-native species	46
B06	Grazing in forests/woodland	40
D01.01	Paths, tracks, cycling tracks	28
G05.09	Fences, fencing	16
H05.01	Garbage and solid waste	15
G01.02	Walking, horse-riding and non-motorised vehicles	12
B02.03	Removal of forest undergrowth	11
I02	Problematic native species	10
D01.02	Roads, motorways	7
B02.02	Forestry clearance	5
B02.06	Thinning of tree layer	5
G01.08	Other outdoor sports and leisure activities	4
B02.05	Non-intensive timber production (leaving dead wood/old trees untouched)	3
B04	Use of biocides, hormones and chemicals (forestry)	3
B07	Forestry activities not referred to above	3
F03.01	Hunting	3
G01.03.02	Off-road motorised driving	3
B01.01	Forest planting on open ground (native trees)	2
B02.01.01	Forest replanting (native trees)	2
B02.04	Removal of dead and dying trees	2
F06.01	Game/bird breeding station	2
B01.02	Artificial planting on open ground (non-native trees)	1
B02.01.02	Forest replanting (non native trees)	1
D02.01.01	Suspended electricity and phone lines	1
E01.03	Dispersed habitation	1
E02.03	Other industrial/commercial area	1
F03.02.09	Other forms of taking animals	1
G01	Outdoor sports and leisure activities, recreational activities	1
G05.07	Missing or wrongly directed conservation measures	1
J02.04	Flooding modifications	1
J02.07	Water abstractions from groundwater	1
L05	Collapse of terrain, landslide	1
L07	Storm, cyclone	1
X	No threats or pressures	1

Most of the paths/tracks recorded were deemed to be having a neutral effect; this was consistent across both woodland types. However, grazing was more usually regarded as having a negative effect in 91A0 woodlands (overgrazing), whereas in 91E0 grazing was more usually recorded as having a neutral effect, on balance having neither a positive nor a negative impact. Other common impacts recorded in sessile oak woods were dumping, walking/horse-riding (almost always recorded as a neutral impact; code G01.02), removal of forest undergrowth (mainly to indicate invasive species removal and therefore usually a positive impact; code B02.03) and problematic native species (mostly dense *Rubus fruticosus*, generally a consequence of undergrazing; code I02).

Table 15: Summary of impacts recorded in the 40 alluvial forest (91E0) polygons surveyed in 2011 and 2012.

Impact Code	Description	No. of occurrences
I01	Invasive non-native species	35
H05.01	Garbage and solid waste	16
B06	Grazing in forests/woodland	14
D01.01	Paths, tracks, cycling tracks	14
I02	Problematic native species	8
B02.03	Removal of forest undergrowth	7
G05.09	Fences, fencing	5
B02.06	Thinning of tree layer	4
G01.02	Walking, horse-riding and non-motorised vehicles	4
J02.07	Water abstractions from groundwater	4
B02.02	Forestry clearance	2
B07	Forestry activities not referred to above	2
D01.02	Roads, motorways	2
D02.01.01	Suspended electricity and phone lines	2
H01	Pollution to surface waters (limnic, terrestrial, marine & brackish)	2
J02.04	Flooding modifications	2
B01.01	Forest planting on open ground (native trees)	1
B01.02	Artificial planting on open ground (non-native trees)	1
B02.01.01	Forest replanting (native trees)	1
B02.01.02	Forest replanting (non-native trees)	1
C01	Mining and quarrying	1
D05	Improved access to site	1
F03.01	Hunting	1
G05.06	Tree surgery, felling for public safety, removal of roadside trees	1
H07	Other forms of pollution	1
J02.01.03	Infilling of ditches, dykes, ponds, pools, marshes or pits	1
J02.04.01	Flooding*	1
J02.06.06	Surface water abstractions by hydro-energy	1

* Flooding as an impact in this table refers to flooding whose natural periodicity has been altered by human intervention in some way; flooding that occurs periodically as part of a natural cycle is not recorded.

Table 16: Summary of effects (positive, neutral or negative) of the 11 most frequent impacts recorded in 91A0 woodlands.

Impact Code	Description	Positive effect	Neutral effect	Negative effect	No. of occurrences
I01	Invasive non-native species			46	46
B06	Grazing in forests/woodland	9	12	19	40
D01.01	Paths, tracks, cycling tracks	1	27		28
G05.09	Fences, fencing	4	11	1	16
H05.01	Garbage and solid waste		1	14	15
G01.02	Walking, horse-riding and non-motorised vehicles		10	2	12
B02.03	Removal of forest undergrowth	8	2	1	11
I02	Problematic native species		1	9	10
D01.02	Roads, motorways		7		7
B02.02	Forestry clearance	2	1	2	5
B02.06	Thinning of tree layer	1	4		5

Table 17: Summary of effects (positive, neutral or negative) of the 10 most frequent impacts recorded in 91E0 woodlands.

Impact Code	Description	Positive effect	Neutral effect	Negative effect	No. of occurrences
I01	Invasive non-native species		1	34	35
H05.01	Garbage and solid waste		1	15	16
B06	Grazing in forests/woodland	3	9	2	14
D01.01	Paths, tracks, cycling tracks		13	1	14
I02	Problematic native species			8	8
B02.03	Removal of forest undergrowth	4	3		7
G05.09	Fences, fencing	1	4		5
B02.06	Thinning of tree layer	1	1	2	4
G01.02	Walking, horse-riding and non-motorised vehicles		3	1	4
J02.07	Water abstractions from groundwater		2	2	4

Future prospects evaluation

Tables 18 and 19 give a summary of future prospects for the 61 sessile oak wood (91A0) sites and for the 40 alluvial woodland (91E0) sites respectively. Of the 61 sessile oak wood polygons surveyed, 13 achieved a favourable green assessment (21%), 28 received an amber assessment (46%) and 20 received a red assessment (33%) for future prospects. The highest negative impacts score was -6.75, recorded in site 498 Erne Head. This was due to a combination of invasive species and undergrazing. The best score (3.00) was achieved by 1422 Ballyarr Wood, a Nature Reserve in which positive management (managed horse grazing) is being carried out. Of the 40 alluvial woodland polygons surveyed, 9 (22.5%) achieved a favourable green assessment for future prospects, 21 (52.5%) received an amber assessment and 10 (25%) received a red assessment. The highest negative impacts score was -9.25, calculated for 242 Grantstown Wood. The *Fraxinus excelsior* canopy of this woodland is dying following prolonged flooding due to a blocked culvert – now cleared – and the field layer is becoming dominated by *Urtica dioica* as a result of increased light and nutrient enrichment. The most favourable score (4.00) was achieved by 282 Castledurrow Demesne, a CoillteLIFE project site which is being positively managed to improve its conservation status by the selective removal of conifers and blocking of drains.

Table 18: Summary of future prospects results (Green, Amber or Red) for the 61 sessile oak wood (91A0) polygons surveyed in 2011 and 2012. * indicates that surveyors' future prospects assessment overrides scored assessment.

Site no.	Site name	County	FP result	Impacts score
151	Bricketstown House	Wexford	Amber	*-4.75
179	Clonogan Wood	Carlow	Red	-5.50
180	Glandoran Upper/Carthy's Wood	Wexford	Amber	-2.75
256	Coolnamony	Laois	Red	-5.00
333	Stonepark	Leitrim	Red	-5.00
334	Garadice Lough	Leitrim	Green	*-0.25
338	Vale of Clara	Wicklow	Red	-5.75
346	Deerpark (Cavan)	Cavan	Amber	-0.75
498	Erne Head	Longford	Red	-6.75
515	Kylecorragh	Kilkenny	Amber	-1.00
746	Baltynanima	Wicklow	Amber	*-4.00
749	Tomnafinnoge	Wicklow	Amber	-2.25
777	Glen of the Downs	Wicklow	Amber	-1.25
779	Shelton North	Wicklow	Red	-4.50
780	Luggala Lodge	Wicklow	Red	-5.25
781	The Devil's Glen	Wicklow	Amber	-1.50
784	Oldboleys	Wicklow	Amber	-1.00
785	Castlekevin	Wicklow	Amber	*-5.25
786	Giant's Cut	Wicklow	Red	-5.00
791	Kilmacrea Wood	Wicklow	Green	1.00
1273	Uragh Wood	Kerry	Amber	-1.50
1277	Lyranes Lower Wood	Kerry	Amber	*0.00
1290	Derrycunihy Wood	Kerry	Amber	-1.50
1302	Prohus	Cork	Green	0.00
1305	Manch East	Cork	Red	-3.75
1312	Cloghphilip Wood	Cork	Amber	-2.50
1316	Glengarriff	Cork	Amber	-0.50
1323	Cleanderry Wood	Cork	Green	0.00
1355	Philip's Wood	Cork	Red	-3.50
1401	Union Wood	Sligo	Amber	*-4.25
1422	Ballyarr Wood	Donegal	Green	3.00
1423	Mullangore Wood	Donegal	Amber	-1.75
1427	Ardnamona Wood	Donegal	Green	1.25
1441	Carndonagh	Donegal	Red	-4.50
1459	Aghaneenagh	Cork	Green	0.00
1460	Kilmeen Wood	Cork	Amber	*0.00
1481	Ummera Wood	Cork	Red	-5.00
1491	French Wood	Cork	Red	-6.00
1497	Bealkelly Woods	Clare	Green	1.00
1498	Drummin Wood	Galway	Green	*-0.25
1515	Garannon Woods	Clare	Red	-4.75
1543	Glenmore Wood	Waterford	Amber	-1.00
1552	Cahermurphy	Clare	Red	-4.25
1580	Ballykelly Woods	Clare	Green	0.00
1587	Derrymore Wood	Clare	Red	-6.25
1602	Ballynahinch	Galway	Amber	-1.00
1670	Stradbally Woods	Waterford	Amber	-2.25
1710	Ballintlea Wood	Limerick	Red	*-2.50
1712	Glanlough Woods	Kerry	Amber	1.00

Table 18 (ctd.)

Site no.	Site name	County	FP result	Impacts score
1737	Graigues	Kerry	Amber	-3.00
1749	Dooneen Wood	Kerry	Green	0.00
1760	Brennan's Glen	Kerry	Green	*-0.50
1763	Pontoon Woods	Mayo	Amber	-2.25
1768	Barnarinia	Mayo	Red	-5.00
1777	Brackloon Woods	Mayo	Amber	-1.00
1785	Treanlaur	Mayo	Red	-3.25
1792	Glanbalyma	Kerry	Red	-5.25
1821	Knocknaree	Waterford	Amber	*1.75
1827	Bohadoon South	Waterford	Amber	-0.25
1859	Grove Wood	Tipperary	Amber	-0.50
1878	Drum Wood	Tipperary	Green	1.25

Table 19: Summary of future prospects results (Green, Amber or Red) for the 40 alluvial forest (91E0) polygons surveyed in 2011 and 2012. * indicates that surveyors' future prospects assessment overrides scored assessment.

Site no.	Site name	County	FP result	Impacts score
15	Borris	Carlow	Red	*-3.00
22	Fiddown	Kilkenny	Green	0.00
33	Camcor Wood	Offaly	Amber	-3.00
175	Townparks	Offaly	Amber	-1.00
192	Litterbeg	Wexford	Red	-6.00
242	Grantstown Wood	Laois	Red	-9.25
282	Castledurrow Demesne	Laois	Green	4.00
287	Knockbeg College	Laois	Amber	-2.50
304	Garrylough Lower	Wexford	Red	-5.25
316	Ballynattin	Carlow	Green	0.00
345	Ballyconnell Demesne	Cavan	Green	0.50
346	Deerpark (Cavan)	Cavan	Red	-5.25
388	Derrycarne Demesne South	Leitrim	Amber	-0.50
423	Inisfale Wood	Roscommon	Red	-3.75
520	Coolnamuck 2	Kilkenny	Red	-4.50
534	Fidwog	Sligo	Amber	-1.75
544	Gubroe (Castle Forbes)	Longford	Amber	-2.25
752	Yellow Island	Meath	Amber	-1.75
815	Kilmacanoge South	Wicklow	Amber	-2.50
904	Cronlea	Wicklow	Amber	-2.50
948	Rahin Wood (Kildare)	Kildare	Amber	-0.50
1078	Lough Owel Wood	Westmeath	Amber	-0.50
1084	Gaybrook Demense	Westmeath	Red	-4.25
1213	Auburn	Westmeath	Amber	-1.50
1288	Game Wood	Kerry	Green	0.00
1293	Glen Bog	Limerick	Amber	-3.00
1315	Coolyduff	Cork	Green	*-1.75
1317	The Gearagh	Cork	Green	0.00
1409	Hazelwood Demesne	Sligo	Amber	-1.00
1488	Scartbarry	Cork	Amber	*-5.00
1561	Knockaphort	Clare	Amber	-2.75
1669	Cuscarrick	Galway	Amber	-2.50

Table 19 (ctd.)

Site no.	Site name	County	FP result	Impacts score
1711	Ballyseedy Wood	Kerry	Amber	*-4.50
1791	Farrantooreen	Kerry	Red	-4.50
1800	Prospect	Mayo	Green	*-0.50
1820	Killeeshal	Waterford	Amber	-1.50
1849	Kilcannon	Waterford	Green	0.00
1876	Moyaliff	Tipperary	Green	0.75
1932	Marl Bog	Tipperary	Amber	-0.50
1953	Castlelough	Tipperary	Red	-4.50

Overall condition assessment

Tables 20 and 21 show the overall condition assessments for the 101 woodland polygons surveyed in 2011 and 2012, achieved by combining the assessment results of structure and functions and future prospects for each polygon. Overall across both woodland types, a total of 20 sites out of 101 achieved a green (favourable) assessment, 33 of the 101 received an amber (unfavourable – inadequate) assessment and 48 sites out of 101 received a red (unfavourable – bad) assessment.

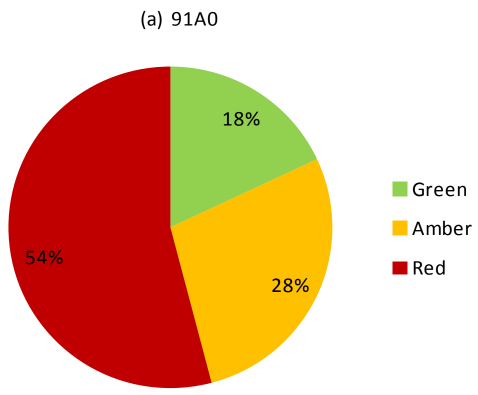
Of the 61 sessile oak wood (91A0) polygons surveyed, 11 (18%) achieved a green status, 17 (28%) were amber and 33 (54%) were red (Figure 9(a)). Nine (22.5%) of the forty alluvial woodland (91E0) polygons surveyed received a green assessment, while 16 (40%) received an amber assessment; a red assessment was assigned to 15 (37.5%) sites (Figure 9(b)).

Thus, while the proportion of sites in the best category was broadly similar for 91A0 and 91E0 (18% and 22.5% respectively), the proportion of 91E0 polygons placed in the worst category was lower than for the 91A0 polygons (37.5%, compared to 54%).

Overall condition assessment results were examined in the context of whether or not the sites were in an SAC and were in the ownership of State or semi-State bodies such as NPWS, ESB, Coillte and County Councils. Of the eleven sessile oak wood sites that achieved a green assessment, six (55%) are in an SAC and the Annex I woodland is a qualifying interest in all but one of these. Four of the eleven are at least partly State-owned. Of the 33 sessile oak woods that received a red assessment, 13 (39%) are in an SAC, and the woodland is a qualifying interest in all but two of these. Of these 33 sites, 16 are at least partly in State ownership.

Four (44%) of the nine alluvial woodlands that received a green assessment are in an SAC, and the woodland is a qualifying interest in all of these. Seven of these nine green sites are at least partly in State ownership. Five (33%) of the fifteen alluvial woodlands to receive a red assessment are in an SAC and the woodland is a qualifying interest in all five. Five of these fifteen red sites are at least partly in State ownership.

It therefore appears from this survey that the designation of sessile oak woodlands in particular within an SAC does lead to them receiving a better condition assessment than if they remained undesignated, and for both Annex I woodland types, there is a lower probability that they will receive a red assessment if they are within an SAC.



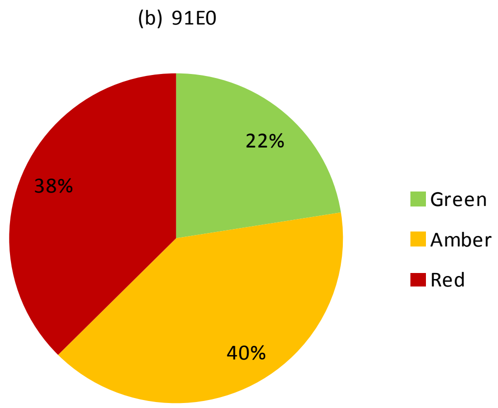


Figure 9: Proportion of polygons with overall assessments of green, amber and red for (a) sessile oak woods (91A0) and (b) alluvial forests (91E0) surveyed in 2011 and 2012.

Table 20: Overall condition assessments for the 61 sessile oak wood (91A0) polygons surveyed in 2011 and 2012. A dagger (†) after the SAC code indicates that 91A0 is a qualifying interest for the SAC.

Site no.	Site name	Structure & Functions assessment	Future Prospects assessment	Overall condition assessment	SAC	% State-owned
151	Bricketstown House	Red	Amber	Red		0
179	Clonogan Wood	Red	Red	Red		14
180	Glandoran Upper/ Carthy's Wood	Red	Amber	Red	000781†	0
256	Coolnamony	Green	Red	Red	000412	0
333	Stonepark	Amber	Red	Red	001976†	0
334	Garadice Lough	Red	Green	Red		100
338	Vale of Clara	Amber	Red	Red	000733†	100
346	Deerpark (Cavan)	Red	Amber	Red		100
498	Erne Head	Red	Red	Red		90
515	Kylecorragh	Red	Amber	Red	002162†	0
746	Baltynanima	Amber	Amber	Amber	002122†	0
749	Tomnafinnoge	Red	Amber	Red	000781†	100
777	Glen of the Downs	Red	Amber	Red	000719†	100
779	Shelton North	Amber	Red	Red		100
780	Luggala Lodge	Red	Red	Red	002122†	0
781	The Devil's Glen	Amber	Amber	Amber		91
784	Oldboleys	Green	Amber	Amber		0
785	Castlekevin	Red	Amber	Red		5
786	Giant's Cut	Red	Red	Red	002122†	100
791	Kilmacrea Wood	Green	Green	Green		0
1273	Uragh Wood	Green	Amber	Amber	001342†	100

Table 20 (ctd.)

Site no.	Site name	Structure & Functions assessment	Future Prospects assessment	Overall condition assessment	SAC	% State-owned
1277	Lyranes Lower Wood	Green	Amber	Amber	000365†	0
1290	Derrycunihy Wood	Amber	Amber	Amber	000365†	100
1302	Prohus	Green	Green	Green		0
1305	Manch East	Red	Red	Red		0
1312	Cloghphilip Wood	Green	Amber	Amber		0
1316	Glengarriff	Amber	Amber	Amber	000090†	100
1323	Cleanderry Wood	Green	Green	Green	001043†	0
1355	Philip's Wood	Red	Red	Red	002170†	19
1401	Union Wood	Green	Amber	Amber	000638†	100
1422	Ballyarr Wood	Green	Green	Green	000116†	100
1423	Mullangore Wood	Red	Amber	Red	002047†	100
1427	Ardnamona Wood	Green	Green	Green	000163†	100
1441	Carndonagh	Amber	Red	Red		0
1459	Aghaneenagh	Green	Green	Green	002170†	0
1460	Kilmeen Wood	Amber	Amber	Amber		0
1481	Ummera Wood	Red	Red	Red		0
1491	French Wood	Red	Red	Red		0
1497	Bealkelly Woods	Green	Green	Green		0
1498	Drummin Wood	Amber	Green	Amber	002181†	0
1515	Garannon Woods	Red	Red	Red		0
1543	Glenmore Wood	Red	Amber	Red	002170†	0
1552	Cahermurphy	Red	Red	Red		100
1580	Ballykelly Woods	Green	Green	Green	000030†	18
1587	Derrymore Wood	Amber	Red	Red		0
1602	Ballynahinch	Red	Amber	Red		29
1670	Stradbally Woods	Red	Amber	Red		0
1710	Ballintlea Wood	Red	Red	Red		4
1712	Glanlough Woods	Amber	Amber	Amber		0
1737	Graigues	Green	Amber	Amber	000365†	0
1749	Dooneen Wood	Green	Green	Green		0
1760	Brennan's Glen	Green	Green	Green	000343	0
1763	Pontoon Woods	Green	Amber	Amber	002298†	10
1768	Barnarinia	Amber	Red	Red		0
1777	Brackloon Woods	Amber	Amber	Amber	000471†	100
1785	Treanlaur	Red	Red	Red	000534	50
1792	Glanbalyma	Red	Red	Red		0
1821	Knocknaree	Amber	Amber	Amber	000668†	0
1827	Bohadoon South	Green	Amber	Amber		0
1859	Grove Wood	Red	Amber	Red		0
1878	Drum Wood	Green	Green	Green		96

Table 21: Overall condition assessments for the 40 alluvial forest (91E0) polygons surveyed in 2011 and 2012. A dagger (†) after the SAC code indicates that 91E0 is a qualifying interest for the SAC.

Site no.	Site name	Structure & Functions assessment	Future Prospects assessment	Overall condition assessment	SAC	% State-owned
15	Borris	Green	Red	Red	002162†	0
22	Fiddown	Green	Green	Green	002137†	100
33	Camcor Wood	Green	Amber	Amber	000412†	4
175	Townparks	Green	Amber	Amber		0
192	Litterbeg	Amber	Red	Red		0
242	Grantstown Wood	Red	Red	Red		100
282	Castledurrow Demesne	Green	Green	Green	002162†	100
287	Knockbeg College	Red	Amber	Red	002162†	0
304	Garrylough Lower	Red	Red	Red		0
316	Ballynattin	Green	Green	Green		0
345	Ballyconnell Demesne	Green	Green	Green		80
346	Deerpark (Cavan)	Red	Red	Red		84
388	Derrycarne Demesne South	Green	Amber	Amber		77
423	Inisfale Wood	Red	Red	Red		0
520	Coolnamuck 2	Amber	Red	Red	002162†	0
534	Fidwog	Amber	Amber	Amber	001898†	0
544	Gubroe (Castle Forbes)	Green	Amber	Amber	001818	0
752	Yellow Island	Green	Amber	Amber	002299†	100
815	Kilmacanoge South	Amber	Amber	Amber		40
904	Cronelea	Green	Amber	Amber		0
948	Rahin Wood (Kildare)	Red	Amber	Red		90
1078	Lough Owel Wood	Green	Amber	Amber	000688	0
1084	Gaybrook Demense	Amber	Red	Red		0
1213	Auburn	Amber	Amber	Amber		0
1288	Game Wood	Green	Green	Green	000365†	100
1293	Glen Bog	Green	Amber	Amber	001430†	0
1315	Coolyduff	Green	Green	Green		100
1317	The Gearagh	Green	Green	Green	000108†	100
1409	Hazelwood Demesne	Red	Amber	Red	001976†	80
1488	Scartbarry	Green	Amber	Amber		0
1561	Knockaphort	Green	Amber	Amber		4
1669	Cuscarrick	Green	Amber	Amber	000304	0
1711	Ballyseedy Wood	Green	Amber	Amber	002112†	100
1791	Farrantooreen	Green	Red	Red	000343†	0
1800	Prospect	Red	Amber	Red		0
1820	Killeeshal	Red	Amber	Red		0
1849	Kilcannon	Green	Green	Green		0
1876	Moyaliff	Green	Green	Green		100
1932	Marl Bog	Green	Amber	Amber		100
1953	Castlelough	Amber	Red	Red		100

Discussion

Overall condition assessment

From the results shown, 19% of woodland sites surveyed between 2011 and 2012 are in favourable conservation status (green), while 50% were assigned an unfavourable – bad conservation status (red). There is usually a correspondence between an Annex I woodland's structure and functions and future prospects, and both frequently share the same conservation status, whether green, amber or red, or differ by just one status category. Situations where future prospects are more favourable than structure and functions may be caused by cessation of a negative impact (e.g. through improved management, introduction of appropriate grazing or the removal of an invasive species) which has yet to bring about the desired improvements to the structure of the woodland. For example, the removal of an invasive species such as *Rhododendron ponticum* usually creates clearings (often completely bare of vegetation) and causes a sudden increase in the amount of light reaching the woodland floor. This can result in the proliferation of native species such as *Ilex aquifolium* or *Rubus fruticosus*, both of which have the ability to achieve high cover in a few years and may temporarily form a barrier to the germination of other native tree species and to the development of a more species-diverse herb and moss layer. In such situations, it may take a number of years, perhaps more than one reporting period (>6 years) for the structure and functions to improve to the next conservation status level, and it may not be possible to expedite this process, given that ecological processes – and particularly those in woodlands – operate slowly.

Where the future prospects assessment is less favourable than the structure and functions assessment, this may simultaneously be a cause for optimism and concern. Poor structure and functions may, as noted above, take some time to ameliorate, whereas negative impacts, often the result of poor or no management, should – in theory at least – be relatively easy to correct. Many poor future prospects results are a consequence of poor management (such as incorrect grazing levels or failure to remove invasive species), so there is scope for quickly improving a site's overall conservation status simply by implementing good management practices which should, in turn, consolidate the favourable status of the woodland's structure and functions. However, any delay in bringing in such management practices could cause a worsening of the site's structure and functions, making the task of improving the overall conservation status of the habitat even more difficult.

Annex I woodland sites that have a green structure and functions assessment but an amber or red future prospects assessment are examples of sites that should be prioritised for conservation management. From the current survey, these include nine sessile oak woods: 256 Coolnamony, 1273 Uragh Wood, 1277 Lyranes Lower Wood, 1401 Union Wood, 1737 Graigues, 1763 Pontoon Woods, 784

Oldboleys, 1312 Cloghphilip Wood and 1827 Bohadoon South, the first six of which are in SACs (with 91A0 listed as a qualifying interest in five of these). Site 256 Coolnamony in particular is in need of urgent attention as its structure and functions assessment was evaluated as favourable (green), but its future prospects assessment was unfavourable – bad (red), primarily due to overgrazing by deer across the entire site. A single oak sapling was recorded across the four plots for this site; while this is enough to pass the target species regeneration criterion, it is the absolute minimum requirement, so prolonged grazing is in danger of eliminating both current and future oak sapling regeneration. Fifteen alluvial woodlands have a green structure and functions assessment but amber or red future prospects: 15 Borris, 33 Camcor Wood, 544 Gubroe (Castle Forbes), 752 Yellow Island, 1078 Lough Owel Wood, 1293 Glen Bog, 1669 Cuscarrick, 1711 Ballyseedy Wood, 1791 Farrantooreen, 175 Townparks, 388 Derrycarne Demesne South, 904 Cronelea, 1488 Scartbarry, 1561 Knockaphort and 1932 Marl Bog. The first nine of these are in SACs (with 91E0 listed as a qualifying interest in six of them). Sites 15 Borris and 1791 Farrantooreen, similar to 256 Coolnamony, both received a green structure and functions assessment but a red future prospects evaluation; these are therefore in urgent need of remedial management as the woodlands have a problem with invasive tree species such as *Acer pseudoplatanus* and invasive herbs such as *Impatiens glandulifera*, which are not yet, however, seriously affecting structure and functions. Dumping and pollution are further problems in Farrantooreen, while in Borris, trees have been removed at the western end of the woodland around an old boathouse and quay. Borris woodland is already compromised as it exists as a narrow strip of habitat, and any further habitat losses due to felling or successional changes due to invasive species could cause its area to decrease to a critical level below which the habitat is no longer viable.

As a general guideline, every effort should be made to maintain favourable structure and functions, as this parameter is more difficult to improve than future prospects if its condition deteriorates and its status becomes unfavourable.

Structure and functions

Individual-plot level criteria

Positive indicator species

One of the key features of 91A0 habitat noted in the brief description in the interpretation manual of EU habitats (European Commission 2007) is its "many ferns, mosses [and] lichens". Bryophyte diversity is acknowledged as being particularly well developed in sessile oak woods (e.g. Kelly 1981, O'Neill 2003). Therefore, following discussions with NPWS a new requirement was introduced in 2012 as part of the positive indicator species criterion, for a minimum of two positive indicator bryophytes to be present in 91A0 monitoring plots.

The failure of the positive indicator species criterion on the basis of insufficient bryophyte species in over 10% of plots, as noted in the results, is an indication that these woodlands are perhaps too dry for the development of the high bryophyte diversity noted in the interpretation manual. The moss species *Isothecium myosuroides, Eurhynchium striatum, Hypnum cupressiforme* and *H. jutlandicum* have been removed from the initial list of positive indicator species for 91A0 as they are relatively ubiquitous in woodlands and not particularly strong indicators of good quality sessile oak habitat. In fact, if present at a relatively high abundance they may indicate a sub-set of less diverse woodlands. This is suggested by data from site 1427 Ardnamona Wood in Donegal, an excellent example of the extreme oceanic variant of the 91A0 habitat. Here, *Hypnum cupressiforme* was largely absent but western species of the liverwort *Plagiochila* (e.g. *Plagiochila spinulosa*, *P. punctata*) tended to dominate those niches typically occupied by *H. cupressiforme* in less oceanic woodlands (e.g. on tree trunks). Similarly, the indicator species *Dicranum scoparium* was less frequent in Ardnamona Wood than the more Atlantic *Dicranum majus*, a species typical of the extreme western sessile oak woodlands, which itself is not currently on the list of positive species. It is recommended that a secondary list of positive indicator bryophytes be compiled to include species more typical of the western Atlantic sessile oak wood habitat, so as to identify sites with this more species-rich variant of the 91A0 habitat.

The presence of at least some of the typical species for the Annex I habitat (positive indicator species) should be regarded as a minimum requirement, as the species largely define the habitat. Failure of this criterion, even if other structural measures are favourable, may indicate that the woodland is not only not of Annex I quality, but may not be an example of the habitat at all. Some woodlands surveyed failed the positive indicator species criterion in at least two plots and were deemed by the surveyors to be, at best, marginal examples of the habitat. Some sessile oak woods that fell into this category include 346 Deerpark, 1312 Cloghphilip Wood and 1491 French Wood, while alluvial woodlands such as 948 Rahin Wood and 1800 Prospect were thought to be too dry to be classed as true alluvial woodlands. It remains to be seen whether such woodlands will improve over the next two or three monitoring periods, or whether they should, in fact, be removed from the monitoring programme and replaced by other sites.

Negative species cover and regeneration

Negative (i.e. non-native) species were an issue for both woodland types. *Acer pseudoplatanus* was particularly prevalent in alluvial woodlands, recorded from monitoring plots in 32 of the 40 sites surveyed. While it is preferable that non-native species are absent from native woodlands altogether, the presence of individual trees, such as specimen conifers in demesne woodlands, is less critical if their cover is confined to isolated individuals and if they are not regenerating. In this respect, based on the results of this survey, alluvial woodlands appear to suffer from negative species regeneration more than the drier sessile oak woods, despite their often relatively undisturbed nature. It is possible that periodic flooding may cause not only dispersal of seeds of invasive species into alluvial woodlands, but also sufficient disturbance to aid their establishment. Problem species include both woody and herbaceous species. For example, the introduced broadleaved herb *Impatiens glandulifera* produces large numbers of seeds that are spread along river channels which act as conduits; this species was recorded in monitoring plots from four alluvial woodland sites. A greater variety of non-native species was also recorded in alluvial woodlands, perhaps again due to dispersal and periodic disturbance by water. However, the problem of regenerating non-native species should not be underestimated in sessile oak woods either, with *Fagus sylvatica* and *Acer pseudoplatanus* regeneration the main cause for concern, particularly in 346 Deerpark, 498 Erne Head, 1481 Ummera Wood, 1491 French Wood, 1515 Garannon Woods and 1670 Stradbally Woods. Non-native conifers seeding in from adjacent mature stands may also pose a problem, such as in 1316 Glengarriff and 785 Castlekevin.

From an examination of the invasive species data recorded during the NSNW in 2003-2007 (Perrin *et al.* 2008) for sites surveyed again in 2011/2012, it would seem that the situation with regard to invasive species is relatively stable. Of the 81 sites in which invasive species were recorded as a pressure, only one had a record of an invasive species that had not been recorded in the NSNW.

Canopy structural criteria

Criteria thresholds for the canopy are set to ensure sufficient canopy cover as well as a good presence of target species. Canopy height is also examined, with alluvial woodlands having a lower threshold than sessile oak woods. Canopy structural characteristics were generally in good condition in the woodlands surveyed. Canopy cover was especially good in sessile oak woods, with all plots passing this criterion. A small number of plots failed this criterion in alluvial woodlands, site 242 Grantstown Wood in particular having severe canopy die-back problems due to persistent flooding caused by a blocked culvert which had a serious negative effect on *Fraxinus excelsior* trees in the wood. A small percentage of plots failed the criterion that examines the percentage of canopy composed of target species, such as 1317 the Gearagh (a 91E0 site), 1785 Treanlaur and 1491 Ummera Wood (both 91A0 sites). In the last two sites, the problem was due to competition from non-native species such as *Acer pseudoplatanus* and *Fagus sylvatica*. The issue in the Gearagh, however, was due to a higher proportion of non-target native species such as *Betula pubescens*. This could be caused by a slight difference in soil or drainage conditions in part of the polygon (e.g. drier), or could be due to part of the site being at a different successional stage from the rest of the woodland. This is of less concern, particularly as there is no shortage of target species throughout the woodland as a whole.

Vigilance should be maintained throughout alluvial woodlands in Ireland for ash die-back disease (the fungus *Chalara fraxinea*), which is spreading throughout the UK and Europe, and has recently been recorded in Ireland. First confirmed in Co. Leitrim in October 2012, the number of confirmed cases now stands at 31 (as of 27th March 2013), with most of the infected trees being found in horticultural nurseries or plantations established within the last four years (Dept. of Agriculture, Food and the Marine 2013).

Woodlands which have too low a canopy may have problems passing other criteria. For example, in site 388 Derrycarne Demesne South, the canopy and shrub layers graded into each other forming a single layer measuring about 6 m in height. In such a situation the dense shrub layer is a characteristic of the woodland because of its low canopy, and is unlikely to be ameliorated over time if the canopy height is being dictated by conditions such as inundation or, in the case of sessile oak woods, exposure or slope. Failure of a site to reach the canopy height threshold may not in itself signify a serious problem for the woodland. In site 1849 Kilcannon, for example, the woodland canopy failed to reach the 7 m threshold in any of the four monitoring plots, most likely because of the extremely waterlogged nature of the substrate, but the woodland was in all other respects a good example of a natural alluvial woodland, and so the site was deemed to have passed this criterion.

Shrub layer cover

One of the problems noted for sessile oak woods in particular is insufficient shrub layer cover. A lack of shrub layer (defined in this study as woody vegetation occurring between 2 and 4 m above the ground) may be traceable back to problems with overgrazing, past or present, or to infestations of invasive species such as *Rhododendron ponticum,* which have a similar effect to overgrazing by suppressing native seedling regeneration. The removal of an invasive shrub frequently results in previously suppressed native regeneration, particularly *Ilex aquifolium*, quickly establishing, much the same way as when overgrazing is controlled. Improved results for shrub layer cover may be expected in future monitoring cycles if impacts that negatively affect the shrub layer, such as grazing and invasive species, are controlled, allowing native seedlings to grow tall enough to reach the shrub layer (2 m in height). However, if sites continue to fail on low shrub layer cover after two or three monitoring cycles, then other factors (e.g. edaphic) may be responsible. In such cases it may be necessary to examine the specific situation to determine if this represents a genuine structural problem or is simply the nature of an otherwise good quality Annex I woodland.

The issue of too dense a shrub layer is encountered less frequently and may occur as a result of successional changes; for example, a clear-felled area in transition to a woodland may go through a seral phase where large numbers of saplings completely fill the shrub layer before they aggrade to a less dense understorey and canopy of mature trees. Occasionally the problem may be caused by too low a canopy, in which case the shrub and canopy layers form a single layer (see above). The shrub layer criterion thresholds were amended in 2012 to allow woodlands with a shrub layer covering between 10% and 75% of a monitoring plot to pass, while failing those with either too scant or too dense a shrub layer. While no explicit optimum thresholds could be found in the literature, these upper and lower criteria seem reasonable for well-developed, mature woodlands where layers are characteristic and indicative of a healthy system. Those woodlands that fail on either end of the scale may be going through a period of adjustment (e.g. after a negative impact is removed, as noted above). A number of woodlands surveyed failed, or were at the upper threshold of, the shrub layer criterion and in most of these instances it was caused by high numbers of native saplings (e.g. the sessile oak woods 1323 Cleanderry Wood and 1587 Derrymore Wood, and the alluvial woods 175 Townparks and 282 Castledurrow Demesne). It is likely that future monitoring periods will see the problem resolved through continued growth of saplings or self-thinning of species such as *Ilex aquifolium* or *Fraxinus excelsior*, which regenerate well and may temporarily cause the shrub layer to become very dense.

Dwarf shrub/field layer cover and height

The field layer criterion may fail for a number of reasons. One is overgrazing, which negatively affects the ability of the field layer to reach the 20 cm threshold. Another is invasive species, which often suppress existing field layer vegetation or prevent the establishment of new plants and thus usually cause a failure on the basis of lack of cover. Seasonal effects may also have an impact on whether a monitoring plot passes or fails this criterion. Many vernal species, such as *Allium ursinum* and *Ranunculus ficaria*, are small in stature, failing to attain any great height. They may often be abundant in the field layer in spring but disappear quickly to leave a less profuse field layer in late summer and autumn. Site 1711 Ballyseedy Wood was one instance where it was apparent to the surveyors that the field layer had been more abundant earlier in the year, as evidenced by dead leaves of *Allium ursinum*. As well as recording the field layer cover and height that prevailed at the time of the survey, the surveyors also estimated the cover and height that would have occurred in spring, based on the presence of dead foliage, and these estimated values were used to assess the criterion. Site 1317, the Gearagh, which has a similar vernal flora, was surveyed in spring and recorded high field layer cover in all four monitoring plots, but the average height of the field layer vegetation was slightly below the minimum threshold in one plot due to the low stature of *Allium ursinum*, the main field layer species growing at the time. Because the failure to reach the height threshold was due to the characteristics of the species rather than due to overgrazing, this was not judged to be a failure of the criterion. It is therefore important to exercise some flexibility in the application of the assessment criteria and to examine the reasons for failure, to determine whether they are due to a genuine problem in the woodland or to natural circumstances peculiar to that woodland.

Problems can arise if the field layer is too vigorous due to the proliferation of one or more species, such as *Rubus fruticosus* or *Urtica dioica*, which can cover high percentages of plots if light amounts at ground level increase for some reason, e.g. due to forestry thinning, invasive species removal or canopy die-off. There may be some justification for imposing an upper limit on field layer height in future monitoring programmes, as over-vigorous native species may temporarily reduce opportunities for regeneration by native tree and field layer species.

Bryophyte layer cover

The minimum threshold for cover of the bryophyte layer is set low at 4%. For 91A0 woodlands in particular, which are characterised by high bryophyte cover and diversity, it may be too low. However, some plots failed even with this low a threshold. At some sites this was as a consequence of invasive species, such as the 91A0 woods 346 Deerpark, 779 Shelton North and 1491 French Wood. Other sites failed because of a vigorous field layer, often due to undergrazing and the proliferation of native species such as *Rubus fruticosus*. Such sites include 498 Erne Head, 1859 Grove Wood, 1515 Garannon Woods and 1792 Glenbalyma, all sessile oak woods, and the alluvial woodlands 1849 Kilcannon, which had a luxuriant field layer dominated by *Osmunda regalis*, and 287 Knockbeg College and 242 Grantstown Wood (one plot failed), in which *Urtica dioica* was the problem species. A sparse bryophyte layer may also be caused by conditions which are too dry, which may indicate an alluvial woodland in decline.

Grazing pressure

Currently, only symptoms of overgrazing are specifically recorded. Signs such as topiary browsing, abundant dung and evidence of a browse line are good indicators of grazing pressure, with recent bark stripping also recorded. Indications of undergrazing are not currently recorded, although it is recognised that a certain amount of grazing is beneficial to woodlands (Perrin *et al*. 2006). An over-luxuriant field layer is often a symptom of undergrazing, and placing an upper limit on this structural feature, as suggested above, would highlight plots where undergrazing is a problem.

Four-plot level criteria

Tree size classes

In 2012, because of overly stringent thresholds, the tree size class criterion, measured over the four monitoring plots within a polygon, was amended so that a pass could be attained by having just one of each size class present. Despite the fact that this makes the criterion easier to pass, a number of sites still failed on this basis. As noted above in the presentation of results, the failure in sessile oak woods was usually caused by a lack of target trees in the smallest size class. This points towards a relatively recent problem with oak saplings failing to develop into mature trees. Some possible reasons for this have already been discussed, for example, invasive species and overgrazing. The future viability of woodlands that fail to produce new target trees is in question if the problems are not addressed.

In the current methodology, the largest trunk in a multi-stemmed tree is measured to obtain tree girth data. For woodlands that were coppiced in the past, this may give a misleading estimate of the age structure of the woodland, with such stands appearing to be young and even-aged. Coppiced oak trees with large coppice stools (up to 2 m diameter at base) were found in site 1459 Aghaneenagh in Cork, and a large number of multi-stemmed trees were recorded at site 1820 Killeshal, Waterford. Future monitoring could take fuller account of this by recording all trunks from multi-stemmed trees.

Regeneration of target species and other native tree species

Insufficient regeneration of target species was a particular problem noted in sessile oak woods. The lack of oak regeneration, in common with that of insufficient shrub layer as discussed above, may be linked to overgrazing or invasive species. Undergrazing may also cause this problem if the field layer becomes too vigorous, preventing the germination of target and other native tree species. The problem may not become apparent for a number of years. A certain amount of light is required for successful oak regeneration (Kelly 2002), and may not become available until a light gap is created. A lack of oak saplings may not necessarily be immediate cause for concern, particularly if over-mature or senescent trees are present. A wind throw may trigger the germination of a high number of acorns, particularly in a good mast year. However, the critical factor is the number of seedlings that progress to the sapling stage; that is often much lower, and control of activities that have a negative impact on this natural progression, such as overgrazing, is critical.

Target species regeneration in alluvial woodlands does not appear to be a problem as all sites surveyed passed this criterion, *Fraxinus excelsior* in particular having excellent regeneration rates. *Salix cinerea* is more likely to spread vegetatively; collapsed *Salix* trunks in alluvial woodlands usually give rise to smaller vertical trunks which eventually fill the gap in the canopy caused by the tree fall. However, data taken in the course of this survey indicate that the spread of *Salix cinerea* occurs both by seed and vegetatively.

There is no evidence from the current monitoring survey of any problems with the regeneration of other native species in woodlands, with non-target native trees such as *Ilex aquifolium, Corylus avellana* and *Crataegus monogyna* appearing to regenerate well, even in the absence of target species regeneration.

Dead wood

The dead wood criterion was examined in 2011, in an effort to determine whether a minimum diameter threshold of 20 cm was too high. The conclusion drawn then, based on the survey of 60 sites, was that the criterion did not appear to be unduly severe, with only four sites of the 60 failing on the dead wood criterion. That conclusion is borne out by the survey of the remaining 41 sites. Of the 101 sites surveyed between 2011 and 2012, only six failed the dead wood criterion, five of these in alluvial woodlands. A lack of dead wood may occasionally be caused by practices such as the collection of firewood by landowners or other woodland users; on the whole, however, this does not appear to affect dead wood amounts significantly. The inclusion of "fixed" categories of dead wood, such as old senescent trees, standing dead and rotten stumps, should ensure continuity of supply of dead wood for saproxylic species. However, the practice noted in a number of woodlands of removing dead or dying trees (e.g. 1515 Garannon) should be discouraged. Different species of invertebrates and fungi favour different types and sizes of dead wood habitat (Jonsson *et al*. 2005), and standing dead wood will play host to a different suite of species than fallen dead wood. Kirby *et al*. (1998) noted that managed woodlands contained less fallen dead wood than unmanaged ones, and there is a danger that managers of woodlands that are used as an amenity by walkers may be tempted to "tidy up" larger pieces of dead wood. Coppiced woodlands may suffer from a lack of fallen dead wood but this depends largely on how they are managed and whether or not the cut wood is left on site.

Failure of criteria across several monitoring cycles

Repeated failure of one or more criteria across several monitoring cycles need not always be cause for concern, assuming that suitable management is taking place. The slow nature of woodland processes has already been commented on, and it may take two or even three monitoring cycles for structure and functions to return to favourable status in the aftermath of the removal of a high-intensity negative impact such as overgrazing. As noted above, failure of some criteria, such as the shrub layer, may take some time to correct. Other criteria, such as the presence of positive indicator species, should correct themselves relatively quickly if the woodland is within the range of a seed source. However, isolated woodlands may not recover to their former state, and this is potentially a serious problem in Ireland where native woodland cover is low and many sites are fragmented. Continued failure of a site on this criterion may require a re-evaluation of the Annex I status of the woodland. If after a few monitoring cycles several criteria continue to fail (especially if they fail badly), it may be necessary to re-examine the sites to determine whether they represent good examples of the Annex I habitat. There may be a possibility that the woods will never, for a combination of reasons (e.g. edaphic), conform to the definition of the Annex I habitat, even after every management effort has been made to bring this about.

Future prospects

Positive measures to reduce or remove a negative impact have a two-fold effect on the future prospects evaluation of a site. Firstly, the very act of implementing good management practices immediately increases the future prospects score, as the management activity will be scored as a positive impact. Secondly, the instigation of good management will have a beneficial effect on the structure and functions of the woodland in the longer term.

One issue with future prospects evaluation arises as a consequence of the "snapshot" nature of monitoring surveys. Surveyors visiting a woodland once every few years may miss impacts that more frequent visits would pick up, e.g. occurrence of hunting (recorded in the two years of this survey only twice, from the presence of spent cartridges on the ground). Conversations with landowners do not always reveal every activity that takes place on a site. Repeated visits, however, will be more likely to detect such activities.

Other considerations

A number of the woodlands that received an unfavourable – bad (red) assessment in this survey are within SACs (13 sessile oak woods and 5 alluvial woods), and in most cases the woodland is a qualifying interest. The reasons for the poor assessment results for these 18 sites should be examined and they should become a priority for rehabilitation. The issue of State ownership was also examined. There is some overlap between State-owned sites and sites within SACs, with nine SAC-designated sessile oak woods and one SAC-designated alluvial woodland also at least partly in State ownership. A total of 20 sites (15 sessile oak woods and 5 alluvial woods) that received a red assessment are at least partly within State ownership, ranging across such bodies as government departments (e.g. NPWS), semi-state bodies such as Coillte and ESB, and county councils. Problems in these cases are sometimes due to over-management for amenity purposes (e.g. removing dead wood, planting non-native trees and shrubs). There are several instances (e.g. 1785 Treanlaur, 1409 Hazelwood Demesne) where active remedial management is currently taking place but either conditions in the woodland have not yet improved sufficiently for it to receive a favourable assessment, or else the management is not being carried out throughout the entire site.

It is encouraging to note that several of the sites that received a favourable (green) assessment are also within SACs (six sessile oak and four alluvial woods) or at least partly in State ownership (four sessile oak and seven alluvial woods). These should be examined by woodland managers to identify measures that are working well, so that they can be implemented in other sites. SACs within State ownership that received green assessments – such as 1422 Ballyarr Wood and 1427 Ardnamona Wood among the sessile oak woods, and 22 Fiddown and 282 Castledurrow Demesne of the alluvial woodlands – would be particularly good examples to visit as there are no difficulties with access and the woods themselves are excellent examples of the habitats they represent.

Evaluation of the "polygon" method of woodland monitoring

This monitoring survey was carried out by means of surveying Annex I woodland polygons of similar size throughout the country: 5-10 ha for 91A0 sessile oak woods, and 4-8 ha for 91E0 alluvial forests. This had the advantage of standardising the number of monitoring plots to be recorded (four), and also making it easier to determine how long each survey would take: in most cases sessile oak woods took a day to survey, while wet woodlands, usually more difficult to navigate through than the oak woods, generally took up to two days. This approach facilitated a countrywide spread of sites in the survey.

However, the disadvantage is that only part of a large woodland is surveyed. This means that variations in woodland quality may not be detected. For instance, the monitoring polygon of site 780 Luggala Lodge had a severe problem with *Rhododendron ponticum* infestation, but most of the rest of the woodland was Rhododendron-free. Also, not all impacts or activities taking place in a woodland may be recorded; for example, in site 1273 Uragh Wood, the monitored polygon was not deemed to suffer from overgrazing, whereas the greater part of the woodland outside the polygon does.

A compromise to allow more comprehensive surveys of larger woodlands would be to survey two separate polygons in woodlands that contain 20 ha or more of any one Annex I woodland type. This would allow a measure to be obtained of at least some of the variation in large woodlands. However, it might not be the best use of resources as there are likely to be some sites that are relatively uniform, such as 1427 Ardnamona Wood, which would yield very similar results for both polygons. To circumvent this problem, a general walk through the wood could be undertaken to ascertain whether the polygon is indicative of the overall condition of the site; if it is not, then a survey of a second polygon within the site might be advisable. From a statistical viewpoint, though, it would be better practice to add new sites from different geographical areas to the monitoring programme than to double the area surveyed in one site.

Recommendations

Indicator species

The inclusion of a bryophyte component to the positive indicator species criterion of 91A0 woodlands is an improvement on the 2011 positive indicator criterion, which lacked this component. However, the recommendation made in the interim report for this project (O'Neill and Barron 2011) to run some form of indicator species analysis on NSNW relevés that have been classified as 91A0 and 91E0 is reiterated; this should give a better indication of what species characterise the two Annex I woodland types. As noted above, it is also recommended that a secondary list of positive indicator bryophytes be compiled to include species more typical of the western Atlantic sessile oak wood habitat, to facilitate identification of sites with this variant of the 91A0 habitat.

Urtica dioica has proved to be a frequent indicator species found in the alluvial woodlands surveyed; however, in some exceptional cases it may become a problem. For example, in sites 242 Grantstown Wood and 287 Knockbeg College, both in Co. Laois, it has become dominant in the field layer following flooding that enriched the soil; the death of many canopy ash trees in the wake of prolonged flooding has also led to increased light levels at ground level in both sites, conditions which favour the proliferation of *Urtica dioica*. In these instances it may create a barrier to native species regeneration, both herbaceous and woody. *Rubus fruticosus* may create similar problems following light increases to the woodland floor following a windthrow or removal of an invasive species. While *Rubus fruticosus* is not a positive indicator species for 91A0 habitat, it is nevertheless characteristic of many sessile oak woods. There may be a need to impose an upper limit on the cover of species such as *Urtica dioica* in alluvial woodlands and *Rubus fruticosus* in sessile oak woodlands, and/or an upper limit on the height of the field layer to capture such over-vigorous growth; although characteristic of the habitats, such species are not always desirable above a certain level of cover or height.

Tree size classes

The tree size class criterion has been adjusted from the more severe thresholds imposed in 2011. A review of the NSNW timber data, as suggested in O'Neill and Barron (2011), may still be instructive in the setting of thresholds. Younger woodlands that have not yet built up significant numbers of large trees, or coppiced woodlands that may appear even-aged but are otherwise of good Annex I quality, may still fail on this criterion, but such cases may have to be individually examined and assessed.

Grazing criterion

A fuller assessment of grazing, to include indicators of both undergrazing and overgrazing, would give a more holistic picture of the grazing situation in plots. Recent bark stripping was the only indicator of overgrazing recorded in some sites, which otherwise passed such criteria as target species regeneration. It is suggested that this component of grazing be dropped, or changed to include only very severe bark stripping which is causing the death of trees, or only scored as a negative if recorded in conjunction with a similarly less severe indicator of grazing, such as browsing of palatable woody species.

Polygon remapping

It has been necessary in a number of sites to reduce the size of the monitoring polygon due to the presence of non-Annex I habitat. There may be a need to extend some of these polygons in future monitoring cycles, if a size below the minimum area has been reached. However, extension may not be possible in all instances.

Removal of some sites from monitoring programme

Four sites were surveyed that were not deemed by the surveyors to be genuine Annex I woodland. Two 91A0 sites, 346 Deerpark, Cavan and 1312 Cloghphilip Wood, Cork, were regarded as having too base-rich a flora to be 91A0 woodland. In each of these two sites, just one of the four plots passed on indicator species, and moss diversity was also very low.

Site 948 Rahin Wood, Kildare, was surveyed as 91E0 woodland but despite proximity to the River Boyne was regarded as being too dry for 91E0 woodland, even after the driest parts were excluded from the survey; conifers were also a problem here.

Site 1800 Prospect, Mayo, was also surveyed as 91E0 woodland. However, while alder was present in the canopy, all trees were tall and straight as though planted. Specimen oak and beech trees were also present. None of the monitoring plots passed on indicator species and the surveyors considered the woodland to be too dry and more typical of oak-ash-hazel woodland than Annex I alluvial woodland.

Priority sites for conservation management

Of the sites surveyed as part of this monitoring project, there are a number of sites that should be a high priority for rehabilitation. These include those sites in SACs that received a red overall assessment result, 13 sessile oak woods (Table 22) and five alluvial woodlands (Table 23). In particular, the three sites 256 Coolnamony, 15 Borris and 1791 Farrantooreen, which received green structure and functions assessments but red future prospects assessment, should be attended to as a matter of urgency so that their structure and functions do not deteriorate to unfavourable status due to poor / lack of management.

Additional criteria

Consideration should be given to incorporating into the scoring system the implementation of a management plan for a site. This would be a positive factor that could increase the score for a site by improving its future prospects.

Table 22: Sessile oak woods (91A0) within SACs that received a red overall assessment. A dagger (†) after the SAC code indicates that 91A0 is a qualifying interest for the SAC.

Site no.	Site name	Structure & Functions assessment	Future Prospects assessment	Overall condition assessment	SAC	% State-owned
180	Glandoran Upper/ Carthy's Wood	Red	Amber	Red	000781†	0
256	Coolnamony	Green	Red	Red	000412	0
333	Stonepark	Amber	Red	Red	001976†	0
338	Vale of Clara	Amber	Red	Red	000733†	40
515	Kylecorragh	Red	Amber	Red	002162†	0
749	Tomnafinnoge	Red	Amber	Red	000781†	100
777	Glen of the Downs	Red	Amber	Red	000719†	100
780	Luggala Lodge	Red	Red	Red	002122†	0
786	Giant's Cut	Red	Red	Red	002122†	100
1355	Philip's Wood	Red	Red	Red	002170†	19
1423	Mullangore Wood	Red	Amber	Red	002047†	100
1543	Glenmore Wood	Red	Amber	Red	002170†	0
1785	Treanlaur	Red	Red	Red	000534	50

Table 23: Alluvial forests (91E0) within SACs that received a red overall assessment. A dagger (†) after the SAC code indicates that 91E0 is a qualifying interest for the SAC.

Site no.	Site name	Structure & Functions assessment	Future Prospects assessment	Overall condition assessment	SAC	% State-owned
15	Borris	Green	Red	Red	002162†	0
287	Knockbeg College	Red	Amber	Red	002162†	0
520	Coolnamuck 2	Amber	Red	Red	002162†	0
1409	Hazelwood Demesne	Red	Amber	Red	001976†	80
1791	Farrantooreen	Green	Red	Red	000343†	0

Table 24: Sessile oak woods (91A0) that received a green structure and functions assessment but an amber future prospects assessment. A dagger (†) after the SAC code indicates that 91A0 is a qualifying interest for the SAC.

Site no.	Site name	Structure & Functions assessment	Future Prospects assessment	Overall condition assessment	SAC	% State-owned
784	Oldboleys	Green	Amber	Amber		0
1273	Uragh Wood	Green	Amber	Amber	001342†	100
1277	Lyranes Lower Wood	Green	Amber	Amber	000365†	0
1312	Cloghphilip Wood	Green	Amber	Amber		0
1401	Union Wood	Green	Amber	Amber	000638†	100 (8% Coillte)
1737	Graigues	Green	Amber	Amber	000365†	0
1763	Pontoon Woods	Green	Amber	Amber	002298†	10
1827	Bohadoon South	Green	Amber	Amber		0

Table 25: Alluvial forests (91E0) that received a green structure and functions assessment but an amber future prospects assessment. A dagger (†) after the SAC code indicates that 91E0 is a qualifying interest for the SAC.

Site no.	Site name	Structure & Functions assessment	Future Prospects assessment	Overall condition assessment	SAC	% State-owned
33	Camcor Wood	Green	Amber	Amber	000412†	4
175	Townparks	Green	Amber	Amber		0
388	Derrycarne Demesne South	Green	Amber	Amber		77
544	Gubroe (Castle Forbes)	Green	Amber	Amber	001818	0
752	Yellow Island	Green	Amber	Amber	002299†	100
904	Cronelea	Green	Amber	Amber		0
1078	Lough Owel Wood	Green	Amber	Amber	000688	0
1293	Glen Bog	Green	Amber	Amber	001430†	0
1488	Scartbarry	Green	Amber	Amber		0
1561	Knockaphort	Green	Amber	Amber		4
1669	Cuscarrick	Green	Amber	Amber	000304	0
1711	Ballyseedy Wood	Green	Amber	Amber	002112†	100
1932	Marl Bog	Green	Amber	Amber		100

An additional eight sessile oak woods (Table 24) and 13 alluvial woodlands (Table 25) with favourable (green) structure and functions but unfavourable-inadequate (amber) future prospects should be regarded as being of medium priority within the national native woodland conservation objectives. This is because, in common with the three sites listed above, their structure and functions, currently favourable, run the risk of deteriorating due to poor management or lack of management, although the pressures on these sites are less severe or are being offset to some extent by management.

It should be noted, however, that even though the assessment results of the monitored sub-set of Annex I woodland sites will undoubtedly improve as a result of this remedial management, this should not distract from the necessity of carrying out such management on the entire national woodland resource, particularly where the negative impacts noted in this report are known to occur. This should ensure the continued viability of Annex I woodland habitats in Ireland well into the future.

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Appendix I: Data sheets

91A0: Old Sessile Oak Woods

Site no:	**Recorders:**	**Slope:**
Grid ref: ±	**Mon. Stop:**	**Aspect:**
Date:	**Photo (Initials):**	**Altitude:**

91A0 Positive indicator species: (✓ if present)

Target species:			
Quercus petraea			
Quercus x *rosacea*			
		Mosses & Liverworts:	
Other Woody:		*Dicranum scoparium*	
Betula pubescens		*Diplophyllum albicans*	
Corylus avellana		*Eurhynchium striatum*	
Ilex aquifolium		*Hylocomium brevirostre*	
Lonicera periclymenum		*Hypnum cupressiforme*	
Sorbus aucuparia		*Hypnum jutlandicum*	
Vaccinium myrtillus		*Isothecium myosuroides*	
		Mnium hornum	
Herbs & Ferns:		*Plagiothecium undulatum*	
Blechnum spicant		*Polytrichastrum formosum*	
Luzula sylvatica		*Pseudotaxiphyllum elegans*	
Oxalis acetosella		*Rhytidiadelphus loreus*	
Hyacinthoides non-scripta		*Saccogyna viticulosa*	
Polypodium sp.		*Scapania gracilis*	

Negative indicator species: (✓if present)*

Non-native trees:	
Acer pseudoplatanus	
Fagus sylvatica	
Other (specify):	
1.	
2.	
3.	
4.	
Non-native shrubs:	
Cotoneaster spp.	
Prunus laurocerasus	
Rhododendron ponticum	
Symphoricarpos albus	
Other (specify):	
1.	
2.	
3.	

** Scots pine counted as neutral rather than negative species; Isolated conifers not counted as negative but shouldn't be in plot*

All cover values to nearest 5%, or nearest 1% if < 5%

Median canopy ht (m):	
Total canopy cover (%):	
Total cover of *Quer petr* & *Quer* x *ros* (%):	
Total cover of negative species (%):	
Total native shrub layer (2-4m) cover (%):	
Total native dwarf shrub/field layer cover (%):	
Median ht of dwarf shrub/field layer (cm):	
Total bryophyte layer cover (%):	

Non-native tree free regen. (dbh <7cm)

Species	Ht < 2m	Ht ≥ 2m
TOTAL:		

***Non-native shrub regen. present?* (Y/N)**:

Evidence of grazing pressure

Topiary effect (Y/N):	
Browse line (Y/N):	
Abundant dung (Y/N):	
Bark stripping (Y/N):	

Tally other native saplings >2m tall within species

Species	*Tally*	Total
TOTAL:		

Tally* Quercus *sp. saplings >2m tall

TOTAL:	

Tally* Quercus *sp. stem DBH data within size classes

7-19.5cm dbh (small)		20-29.5cm dbh (medium1)		30-39.5cm dbh (medium2)		≥40cm dbh (large)	
TOTAL:		TOTAL:		TOTAL:		TOTAL:	

Dead wood (Tally items ≥ 20cm only; species name not required)

Old / senescent		Standing dead (>1m tall)		Fallen dead		Rotten stump (≤1m tall)	
Total:		Total:		Total:		Total:	

Assessment scores:

Criterion	Target	Result	Pass/Fail
Individual plot level			
Positive species	6 species		
	Target species (Y/N)		
Negative species cover (not incl. isol'd conifers)	Total cover < 10%		
Negative species regen.	Absent		
Median canopy ht.	>11 m		
Total canopy cover	>30% of plot		
Proportion of *Quercus* in canopy	>50% of canopy		
Native shrub layer cover	20-50%		
Native dwarf shrub/field layer cover	>20%		
Native dwarf shrub/field layer height	>20 cm		
Bryophyte cover	>4%		
Grazing pressure	No overgrazing		
4-plot level			
Target sp. dbh	At least one of each of the three† size classes present	Total stems: (a) 7-19.5cm: (b) 20-29.5cm†: (c) 30-39.5cm†: (d) >40cm†:	
Quercus sp. regeneration	>1 sapling >2m tall*		
Other native tree sp. regeneration	>1 sapling >2m tall in 2 or more plots*		
Old trees & dead wood	>3 from any category with dbh >20cm	Old/senesc.: SDW**: FDW**: Stumps:	

† If wood is in upland situation (>150m), size classes are 7-19.5cm, 20-29.5cm, 30+ cm, so add (c)+(d) for 3rd size class total.
If wood is not in upland situation (<150m), size classes are 7-19.5cm, 20-39.5cm, 40+ cm, so add (b)+(c) for 3rd size class total.

* **If no target or native saplings present, were light gaps present for regeneration to occur? (Y/N):**

** SDW=Standing dead wood; FDW=Fallen dead wood

Additional notes:

91E0: Alluvial Woods

Site no:		**Recorders:**		**Slope:**
Grid ref:	±	**Mon. Stop:**		**Aspect:**
Date:		**Photo (Initials):**		**Altitude:**

91E0 Positive indicator species: (✓ if present)

Target species:		**Herbs & Ferns:**	
Alnus glutinosa		*Agrostis stolonifera*	
Fraxinus excelsior		*Angelica sylvestris*	
Salix cinerea		*Carex remota*	
Other *Salix* sp. (specify):		*Filipendula ulmaria*	
1.		*Galium palustre*	
2.		*Iris pseudacorus*	
3.		*Lycopus europaeus*	
4.		*Mentha aquatica*	
5.		*Phalaris arundinacea*	
		Ranunculus repens	
		Rumex sanguineus	
		Urtica dioica	
Other Woody:			
Betula pubescens		**Mosses & Liverworts:**	
Crataegus monogyna		*Calliergonella cuspidata*	
Solanum dulcamara		*Climacium dendroides*	
Viburnum opulus		*Thamnobryum alopecurum*	

** Scots pine counted as neutral rather than negative species*

Negative indicator species: (✓if present)*

Non-native trees:	
Acer pseudoplatanus	
Fagus sylvatica	
Picea sitchensis	
Larix decidua	
Other (specify)	
1.	
2.	
3.	
Non-native shrubs:	
Cotoneaster spp.	
Prunus laurocerasus	
Rhododendron ponticum	
Symphoricarpos albus	
Cornus sericea	
Other (specify):	
1.	
2.	

All cover values to nearest 5%, or nearest 1% if < 5%

Median canopy ht (m):	
Total canopy cover (%):	
Total cover of target species (%):	
Total cover of negative species (%):	
Total native shrub layer (2-4m) cover (%):	
Total native dwarf shrub/field layer cover (%):	
Median ht of dwarf shrub/field layer (cm):	
Total bryophyte layer cover (%):	

Non-native tree free regen. (dbh <7cm)

Species	Ht < 2m	Ht ≥ 2m
Total:		

***Non-native shrub regen. present* (Y/N):**

Evidence of grazing pressure

Topiary effect (Y/N):	
Browse line (Y/N):	
Abundant dung (Y/N):	
Bark stripping (Y/N):	
Trampling (Y/N):	

Tally basal regeneration >2m tall from collapsed* Salix *trunks only

<7cm dbh		*>7cm dbh*	
Total:		Total:	

Tally free target saplings >2m tall within species

Species	*Tally*	*Total:*
TOTAL:		

Tally other native saplings >2m tall within species

Species	*Tally*	*Total:*
TOTAL:		

Tally target species stem DBH data within size classes (For* Salix*, only count rooted trunks, not basal regen)

Species	7-19.5cm dbh (small)		20-29.5cm dbh (medium)		≥30 cm dbh (large)	
TOTAL:						

Dead wood (Tally items ≥ 20cm only; species name not required)

Old / senescent		Standing dead		Fallen dead		Rotten stump	
Total:		Total:		Total:		Total:	

Assessment scores:

Criterion	**Target**	**Result**		**Pass/Fail**
Individual plot level				
Positive species	6 species			
	Target species (Y/N)			
Negative species cover	Total cover ≤ 10%			
Negative species regen.	Absent			
Median canopy ht.	≥7m			
Total canopy cover	≥30% of plot			
Proportion of target species in canopy	≥50% of canopy			
Native shrub layer cover	10-50%			
Native dwarf shrub/field layer cover	≥20%			
Native dwarf shrub/field layer height	≥20 cm			
Bryophyte cover	≥4%			
Grazing pressure	No overgrazing			
4-plot level				
Target sp. dbh	At least one of each of the three size classes present	Total stems:		
		7-19.5 cm:		
		20-29.5 cm:		
		≥30cm:		
Target sp. free regeneration	≥1 sapling >2m tall*			
Other native tree species free regeneration	≥1 sapling >2m tall in 2 or more plots*			
Old trees & dead wood	≥3 from any category with dbh≥20cm	Old/senesc.:		
		SDW**:		
		FDW**:		
		Stumps:		

*** If no target or native saplings present, were light gaps present for regeneration to occur? (Y/N)**

**SDW=Standing dead wood; FDW=Fallen dead wood

Additional notes:

Site no:	Annex habitat:	Recorders:	Date:

Impacting activities affecting selected polygon

Impact Code	Intensity			Effect			% Habitat	Source	Notes
	High	Med	Low	Pos	Neu	Neg		Inside/Outside	

Impacting activities affecting adjacent Annex I habitat

Impact Code	Intensity			Effect			% Habitat	Source	Notes
	High	Med	Low	Pos	Neu	Neg		Inside/Outside	

List of the most likely impacts is recorded on reverse of this sheet. If impact not listed refer to main list provided and choose most suitable code.
% Habitat impacted: record to ≤1% or to nearest 5%

Summary of your opinion of site's Future Prospects
in the short-term (next 12 years:)

in the medium/long-term (next 50 years:)

Assessment result: Green/Amber/Red?

Green = Excellent/good; no significant impact from pressures/threats expected; long-term viability assured
Red = Bad; severe impact from pressures/threats expected; long-term viability not assured
Amber = Between these two extremes

List impacting activites for Annex I woodland

Code	Description
B	**Sylviculture, forestry**
B01	Forest planting on open ground
B01.01	Forest planting on open ground (native trees)
B01.02	Planting on open ground (non-native trees)
B02	Forest and Plantation management & use
B02.01	Forest replanting
B02.01.01	Forest replanting (native trees)
B02.01.02	Forest replanting (non native trees)
B02.02	Forestry clearance
B02.03	Removal of forest undergrowth
B02.04	Removal of dead and dying trees
B02.05	Non- intensive timber production (leaving dead wood/ old trees untouched)
B02.06	Thinning of tree layer
B03	Forest exploitation without replanting or natural regrowth
B04	Use of biocides, hormones and chemicals (forestry)
B05	Use of fertilizers (forestry)
B06	Grazing in forests/ woodland
B07	Forestry activities not referred to above
C01	Mining and quarrying
D	**Transportation and service corridors**
D01	Roads, paths and railroads
D01.01	Paths, tracks, cycling tracks
D01.02	Roads, motorways
D01.03	Car parks and parking areas
E	**Urbanisation, residential and commercial development**
E01	Urbanised areas, human habitation
E02	Industrial or commercial areas
E03	Discharges
E03.01	Disposal of household / recreational facility waste
E03.02	Disposal of industrial waste
E03.03	Disposal of inert materials
E03.04	Other discharges
I	**Invasive, other problematic species and genes**
I01	Invasive non-native species
I02	Problematic native species
J	**Natural System modifications**
J01	Fire and fire suppression
J02	Human induced changes in hydraulic conditions
J02.01	Landfill, land reclamation and drying out, general
J02.01.02	Reclamation of land from sea, estuary or marsh
J02.01.03	Infilling of ditches, dykes, ponds, pools, marshes or pits
J02.02	Removal of sediments (mud...)
J02.03	Canalisation & water deviation
J02.04	Flooding modifications
J02.04.02	Lack of flooding
J02.07.01	Groundwater abstractions for agriculture
X	**No threats or pressures**