

Arroo Mountain SAC (site code 1403)
Conservation objectives supporting document
- upland habitats

NPWS

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1 Introduction

Achieving Favourable Conservation Status (FCS) is the overall objective to be reached for all Annex I habitat types and Annex II species of European Community interest listed in the Habitats Directive 92/43/EEC. It is defined in positive terms, such that a habitat type or species must be prospering and have good prospects of continuing to do so.

Almost 19% of Ireland can be considered to support upland habitats (Perrin *et al.*, 2009). The importance of these areas for biodiversity conservation is unquestionable, with numerous upland habitat types listed under Annex I of the EU Habitats Directive and many rare and threatened bird and other animal species being associated with these habitats. This is reflected in the fact that over 40% of the total terrestrial area currently selected for designation as Special Areas of Conservation (SAC) in Ireland lies above 150m in altitude.

The Scoping Study and Pilot Survey of Upland Habitats (Perrin *et al.*, 2009) was commissioned by the National Parks and Wildlife Service (NPWS) with the primary remit of devising an appropriate strategy and methodologies for conducting a National Survey of Upland Habitats (NSUH). Four phases of the NSUH have subsequently been conducted between 2010 and 2014. The Annex I habitats that are the primary focus of the NSUH are listed in Table 1.

Table 1: Annex I habitats that occur in Irish uplands and which are primary focus habitats for the NSUH. Habitats in bold are those that are listed as Qualifying Interests for Arroo Mountain SAC.

Habitat code	Habitat name
4010	Northern Atlantic wet heaths with <i>Erica tetralix</i>
4030	European dry heaths
4060	Alpine and Boreal heaths
6230	Species-rich <i>Nardus</i> grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)*
7130	Blanket bogs (* if active)
7140	Transition mires and quaking bogs
7150	Depressions on peat substrates of the Rhynchosporion
7230	Alkaline fens
8110	Siliceous scree of the montane to snow levels (<i>Androsacetalia alpinae</i> and <i>Galeopsietalia ladani</i>)
8120	Calcareous and calcshist screes of the montane to alpine levels (<i>Thlaspietea rotundifolii</i>)
8210	Calcareous rocky slopes with chasmophytic vegetation
8220	Siliceous rocky slopes with chasmophytic vegetation

* Denotes a priority habitat under the EU Habitats Directive

1.1 Arroo Mountain SAC

Arroo Mountain SAC was surveyed as part of the NSUH between July and September 2012. The results of the survey are reported in Perrin *et al.* (2013).

It is a relatively small upland SAC, being 39.7 km² in extent. It lies within the Dartry Mountains between the valleys of Glenade in the west and Glenaniff in the east (O.S. Discovery Series map 16). The underlying geology in the north and west of the SAC where the main cliffs occur is limestone and calcareous shale, whilst in the south, east and centre of the SAC it is orthoquartzitic sandstone banded by shale, laminated carbonate and evaporite. The main peak is Arroo (alt. 523 m) in the north of the SAC, with a lesser peak near Lough Aganny (alt. 482 m) in the centre of the SAC. The peak of Crocknagapple in the south-east of the massif lies outside the SAC boundary.

1.2 NSUH mapping methodology

A brief description of the methodology used to map habitats by the NSUH is presented here to elucidate how area was calculated for each of the habitats and to explain how the graded distribution maps were produced. For full details, see Perrin *et al.* (2014).

The local topography of most upland areas consists of intricate patterns of hollows, rocky outcrops, flushes and terraces. The mosaics of vegetation that have developed on this varying topography is often far too complex to map as individual habitats in the manner possible for more uniform landscapes. Hence the approach adopted by the NSUH was to map units (referred to as polygons) that reflect homogeneous mosaics of vegetation and topography. Attempting to map smaller polygons representing single habitats would have greatly increased the amount of time spent mapping and the number of polygons mapped, and would not ultimately have eliminated the need for recording mosaics at smaller scales. All the habitats and non-vegetated substrates present in each polygon and the approximate percentage of the polygon they occupy were recorded. As the total area of each polygon is known from digitisation, data on the approximate extent of each habitat can be readily calculated. A provisional vegetation classification of upland vegetation types was developed to allow more detailed recording of plant communities than would be possible using a habitat classification scheme such as Fossitt (2000).

It is important to note that the NSUH classified and assessed habitats according to the flora and vegetation communities currently present rather than that which may previously have occurred. For example, on an area of drained deep wet blanket peat the current plant communities may be more akin to wet heath than blanket bog as species sensitive to desiccation may have disappeared after drainage. Such an area would therefore have been mapped as wet heath (current vegetation) rather than drained blanket bog. As a result of this approach, the only vegetation classified and mapped as the inactive component of 7130 Blanket bogs (* if active) was *Eriophorum angustifolium* – *Sphagnum fallax* swards on eroded bog where a reasonable depth of peat remains. The Fossitt (2000) habitat PB4 Bare peat was used for recently cutover areas of peat. Where older cutover areas had revegetated to another vegetation community, or supported a non-vegetation cover type, they were recorded under the relevant vegetation community.

Note that the NSUH used the most up to date SAC boundary dataset available at the time of survey. For Arroo Mountain SAC this was the boundary available in April 2012, which was based on the Ordnance Survey six-inch map base. Any areas calculated and presented here are based on this boundary version.

1.3 Potential for habitat restoration

There are significant areas of non-Annex I upland grasslands within Arroo Mountain SAC (Perrin *et al.*, 2013). This vegetation is particularly frequent on the north facing slopes at Gortnasillagh and Gorteendarragh and the slopes above Loughmuirran in the east of the SAC. The majority of the grassland has probably been formed by long-term degradation of 4010 Wet heaths and 4030 Dry heaths due to overgrazing and/or burning. Therefore, within this expanse there are potential areas for restoration to these habitats.

It will be clear later in this document that restoration management for 7130 Blanket bogs (* if active) is required. Areas that might be restored to active blanket bog could include inactive bog, bare eroding bog and recent cutover bog, and also areas of drained deep peat or older cutovers which currently support other types of vegetation such as heath. These latter areas may currently be classified as other Annex I habitats (e.g. 4010). Restoration of priority 7130 habitat may therefore result in loss in the area and distribution of other Annex I habitats which are Qualifying Interests. If such scenarios are identified by restoration management plans, the conservation objectives for other Qualifying Interests should be amended accordingly.

2 Conservation objectives

A site-specific conservation objective aims to define the favourable conservation condition of a habitat or species at site level. The maintenance of habitats and species within sites at favourable condition will contribute to the maintenance of favourable conservation status (FCS) of those habitats and species at a national level.

Conservation objectives are defined using attributes and targets that are based on parameters as set out in the Habitats Directive for defining favourable status, namely area, range, and structure and functions.

The *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland* (Perrin *et al.*, 2014) have been used as a basis for setting most site-specific attributes and targets for uplands habitats. Attributes and targets may change/become more refined as further information becomes available.

Objectives for habitats have been set with reference to the assessment of those habitats in Perrin *et al.* (2013). If area and structure and functions were both assessed as “Favourable” the objective for that habitat is to maintain favourable conservation condition. If either parameter was assessed as “Unfavourable – Inadequate” or “Unfavourable – Bad” the objective for that habitat is to restore favourable conservation condition.

This document provides supporting information for the attributes of the conservation objectives of upland habitats, given in the main conservation objectives document for the SAC. The two documents should be read in conjunction with each other.

The conservation objective for each of the Annex I habitats dealt with in this supporting document are as follows:

- To restore the favourable conservation condition of Northern Atlantic wet heaths with *Erica tetralix* in Arroo Mountain SAC.
- To restore the favourable conservation condition of European dry heaths in Arroo Mountain SAC.
- To maintain the favourable conservation condition of Alpine and Boreal heaths in Arroo Mountain SAC.
- To restore the favourable conservation condition of Blanket bogs (* if active) in Arroo Mountain SAC.
- To restore the favourable conservation condition of Calcareous and calchist screes of the montane to alpine levels (*Thlaspietea rotundifolii*) in Arroo Mountain SAC.
- To restore the favourable conservation condition of Calcareous rocky slopes with chasmophytic vegetation in Arroo Mountain SAC.

3 Area

Habitat extent is a basic attribute to be assessed when determining the condition of a particular habitat. The target is to maintain or increase the extent from the baseline which was established by Perrin *et al.* (2013) and these areas are reproduced in Table 2.

Table 2: Extent of Annex I habitats that are listed as Qualifying Interests for Arroo Mountain SAC. *denotes priority habitat.

Annex I code	Habitat	Area (ha)	% of SAC
4010	Wet heaths	304.4	7.7
4030	Dry heaths	363.4	9.2
4060	Alpine and Boreal heaths	117.0	2.9
7130	Active blanket bogs*	2096.3	52.8
7130	Inactive blanket bogs	78.6	2.0
8120	Calcareous screes	21.4	0.5
8210	Calcareous rocky slopes	6.6	0.2

As mentioned earlier, the area of habitat 7130 comprises active and inactive blanket bog. The most frequent example of the latter encountered in the NSUH is described in Perrin *et al.* (2014) as a monospecific sward of *Eriophorum angustifolium* on eroded bog where a reasonable depth of peat remains. Note however, that while examples of this community occur on re-deposited, eroded peat, these areas will not have the structural, hydrological or functional characteristics of naturally formed blanket bog.

Loss of area since 1995 was investigated as part of the NSUH through a comparison of contemporary and past aerial photographs (Perrin *et al.*, 2013). Changes in areas that can be detected through this method are limited to obvious habitat changes such as mechanised turf-cutting, agricultural improvement, afforestation, the development of windfarms, roads or tracks, and large-scale discrete

erosion events due to bog bursts or land slips. Where obvious anthropogenic losses have been identified, these are included in the area target.

In the case of 7130 Blanket bogs (* if active), it has not been practical to distinguish between habitat loss/deterioration due to chronic erosion that occurred prior to 1995 and that since 1995, or the causes of such erosion. Thus, the habitat area mapped, along with obvious losses, is likely to be an under-estimate of the total area of 7130 Blanket bogs (* if active) present in 1995. See also the peat formation attribute under structure and functions.

4 Range

A habitat's range at site level, in the form of habitat distribution, has been recorded through the mapping carried out through the NSUH and these are reproduced (see maps 1-6). The target is that there should be no decline from the current distribution.

5 Structure and functions

Structure and functions relates to the physical components of a habitat ("structure") and the ecological processes that drive it ("functions"). For upland habitats these include a range of aspects such as soil chemistry, vegetation composition, hydrological regime, community diversity, habitat quality, species occurrence, indicators of local distinctiveness, disturbed ground, evidence of burning and negative species occurrence. These structure and functions are expanded on in the sections below.

At Arroo Mountains SAC the structure and functions of 4010 Wet heaths were assessed as Unfavourable – Bad. Reasons for failure varied and included inadequate cover of desirable species including mosses and lichens and ericoids and excessive cover of the non-native moss species *Campylopus introflexus*. Disturbed bare ground due to sheep trampling caused a significant number of monitoring stops to fail.

4030 Dry heaths were assessed as Unfavourable – Bad with the reasons for failure being inadequate structural diversity of ling (*Calluna vulgaris*) and disturbed bare ground present. Grazing levels were found to be within acceptable limits at all dry heath monitoring stops.

7130/7130 Blanket bogs* were assessed as Unfavourable – Bad. Reasons for failure included excessive cover of ling (*Calluna vulgaris*), disturbed bare ground, drainage gullies caused by sheep trampling and peat erosion. Vegetation structure was good with no inappropriate grazing or burning being recorded at blanket bog monitoring stops.

The structure and functions of 8210 Calcareous rocky slopes were assessed as Unfavourable – Bad due to excessive cover of the non-native New Zealand willowherb (*Epilobium brunnescens*).

The structure and functions of 4060 Alpine and Boreal heaths and 8110 Siliceous scree at Arroo Mountain were assessed as Favourable.

5.1 Ecosystem function

Ecosystem function is assessed primarily through consideration of soil nutrient levels. For 7130 Blanket bogs (*if active), additional consideration is given to peat formation and hydrology.

5.1.1 Ecosystem function: soil nutrients

An attribute to assess the soil nutrients is common to each of the upland habitats with a view to maintaining the soil nutrient status within the natural range suited to the habitat. Relevant nutrients and natural ranges have yet to be defined. Nitrogen deposition and associated acidification are noted as being relevant to all upland habitats in NPWS (2013). The target for each habitat is to maintain the soil nutrients status within the natural range.

5.1.2 Ecosystem function: peat formation

Ecosystem function of 7130 Blanket bogs (* if active) is further assessed through peat formation. Perrin *et al.* (2014) established an overriding assessment of blanket bog structure and functions based on the proportion of degraded bog within a site which includes eroding bog and cutover bog which would previously have been this Annex I habitat. If more than 1% of the combined area of active bog (Annex I habitat *7130), inactive bog (Annex I habitat 7130), eroded bog (habitat category PB5 – Fossitt 2000) and recently cutover bog (habitat PB4 – Fossitt 2000) is inactive, eroded or cutover then it should be assessed as Unfavourable – Inadequate even if the result of the monitoring stops were more positive. If more than 5% of the combined area is inactive, eroded or cutover it is assessed as Unfavourable - Bad.

The EU habitats interpretation manual (EC, 2013) defines active blanket bog as “still supporting a significant area of vegetation that is normally peat-forming”. For the purposes of defining favourable conservation condition of the Annex I habitat, the target is that at least 99% of the total Annex I blanket bog area is active bog.

5.1.3 Ecosystem function: hydrology

Ecosystem function of 7130 Blanket bogs (* if active) is further assessed through assessment of hydrology. Drains (cut for purposes of peat cutting, afforestation etc.) and erosion gullies impact on the hydrology of blanket bog in the local vicinity. The target is for the natural hydrology to be unaffected by drains and erosion gullies. The process of restoring hydrological integrity may impact areas of heath habitats as discussed in Section 1.3.

5.2 Community diversity

Perrin *et al.* (2013) recorded habitat information based on a provisional list of vegetation communities which is detailed in the NSUH manual (Perrin *et al.*, 2014). Data is presented in the following tables on the abundance of the various communities that comprise Qualifying Interest habitats at Arroo Mountain SAC together with the area of each of these communities and the percentage of the SAC that these communities cover (hepatic mats associated with Qualifying Interests are considered under the indicators of local distinctiveness attribute). The rocky Annex I habitats within the SAC (8120 and 8210) are each defined by just one provisional vegetation community; therefore the community diversity attribute is not applied to these habitats.

The target is to maintain the variety of vegetation communities subject to natural processes.

5.2.1 Community diversity data for 4010 Wet heaths

NSUH code	NSUH community	Area (ha)	% of SAC
WH1	<i>Schoenus nigricans</i> – <i>Erica tetralix</i> wet heath	0.3	0.006
WH2	<i>Trichophorum germanicum</i> – <i>Cladonia</i> spp. – <i>Racomitrium lanuginosum</i> wet heath	0.2	0.005
WH3	<i>Calluna vulgaris</i> – <i>Molinia caerulea</i> – <i>Sphagnum capillifolium</i> wet/damp heath	35.9	0.9
WH4	<i>Trichophorum germanicum</i> – <i>Eriophorum angustifolium</i> wet heath	225	5.6
WH5	<i>Trichophorum germanicum</i> – <i>Nardus stricta</i> – <i>Racomitrium lanuginosum</i> montane wet heath	32.5	0.8
WH6	<i>Schoenus nigricans</i> – <i>Molinia caerulea</i> – <i>Myrica gale</i> wet heath	10.6	0.3

5.2.2 Community diversity data for 4030 Dry heaths

NSUH code	NSUH community	Area (ha)	% of SAC
DH3	<i>Calluna vulgaris</i> – <i>Erica cinerea</i> dry heath	265.6	6.7
DH4	<i>Calluna vulgaris</i> – <i>Sphagnum capillifolium</i> dry /damp heath	83.8	2.1
DH5	<i>Calluna vulgaris</i> – <i>Antennaria dioica</i> heath	1.4	0.03
DH6	<i>Calluna vulgaris</i> – <i>Vaccinium myrtillus</i> dry heath	12.5	0.3

5.2.3 Community diversity data for 4060 Alpine and Boreal heaths

NSUH code	NSUH community	Area (ha)	% of SAC
MH1	<i>Calluna vulgaris</i> – <i>Racomitrium lanuginosum</i> montane heath	116.1	2.9
MH3	<i>Vaccinium myrtillus</i> – <i>Rhytidiadelphus loreus</i> – <i>Anthoxanthum odoratum</i> montane heath	0.9	0.02

5.2.4 Community diversity data for 7130 Blanket bogs*

Only active bog communities are shown.

NSUH code	NSUH community	Area (ha)	% of SAC
BB1	<i>Schoenus nigricans</i> – <i>Eriophorum angustifolium</i> bog	2.7	0.1
BB2	<i>Schoenus nigricans</i> – <i>Sphagnum</i> spp. bog	0.3	0.01
BB3	<i>Eriophorum vaginatum</i> – <i>Sphagnum papillosum</i> bog	20.3	0.5
BB4	<i>Trichophorum germanicum</i> – <i>Eriophorum angustifolium</i> bog	1067.7	26.9
BB5	<i>Calluna vulgaris</i> – <i>Eriophorum</i> spp. bog	985.9	24.9
HW1	<i>Sphagnum denticulatum/cuspidatum</i> hollow	19.3	0.5

5.3 Vegetation composition

Vegetation composition is assessed through a range of attributes tailored to each of the habitats. In general terms they establish minimum thresholds for the occurrence, or cover, of desirable species and maximum thresholds for undesirable species.

5.3.1 Vegetation composition: positive indicator species

An attribute for positive indicator species is common to each of the upland Annex I habitats and habitat-specific lists of the positive indicator species are presented in the NSUH manual (Perrin *et al.* 2014). A positive species criterion is set to ensure that vegetation remains representative of the habitat and is not degrading or succeeding to a different habitat. The target by which this attribute is measured varies between habitats. Descriptions of these habitats can be found in the NSUH manual (Perrin *et al.*, 2014).

For some habitats a certain number of positive indicator species are required. At least seven positive indicator species are required for 7130 Blanket bogs (* if active). For 8120 Calcareous scree and 8210 Calcareous rocky slopes at least three positive indicator species should occur at each monitoring stop and at least one fern or *Saxifraga* from the positive indicator list is required.

For some other habitats a percentage threshold is set. At least 50% cover of positive indicators is required for 4010 Wet heaths and at least 66% cover for 4060 Alpine and Boreal heaths.

4030 Dry heaths were assessed through the number of positive indicator species present and through the percentage cover of these. The positive indicator list is composed of dwarf shrub species. Only two species are required to meet the number of positive indicator species target as dry heaths are not necessarily rich in these species. However, vegetation supporting and possibly dominated by only one dwarf shrub species is not desirable. Low cover of dwarf shrubs would indicate that the habitat is transitional, usually to grassland. A maximum cover of dwarf shrubs is applied for calcareous heath, which was recorded at this site, due to the characteristically greater forb (broad-leaved herb) component.

5.3.2 Vegetation composition: other desirable species

Other elements of vegetation composition which can collectively be regarded as being desirable are also established with a range of habitat specific targets set.

Lichens and bryophytes

Minimum thresholds for cover of lichens and bryophytes are set for habitats where a plentiful lichen/moss layer is characteristic: 4010 Wet heaths and 7130 Blanket bogs (* if active), and for 4030 Dry heaths and 4060 Alpine and Boreal heaths. The latter habitats are not necessarily rich in lichen and bryophyte species, but a minimum amount should still be present. Within the habitat specific targets for these attributes the specific species, or groups of species which are required, are listed together with any exclusions (e.g. *Sphagnum fallax* can be indicative of degraded bog so is excluded from the 7130 Blanket bogs (* if active) assessment and *Campylopus* and *Polytrichum* mosses are excluded from 4030 Dry heaths as they can be indicative of disturbed conditions).

Dwarf shrub cover

A minimum threshold cover for dwarf shrubs is set for 4060 Alpine and Boreal heaths. A relatively low threshold of at least 10% is set as loose rock and *Racomitrium lanuginosum* are characteristic elements and often abundant. A lower cover of dwarf shrubs could indicate that the habitat is transitional to grassland or other montane vegetation. Note that minimum dwarf shrub cover within 4010 Dry heaths is addressed by the positive indicator species attribute.

Cross-leaved heath

Cross-leaved heath (*Erica tetralix*) is specifically mentioned in the formal title of habitat 4010 Wet heaths and is the only characteristic species listed in European Commission (2013). Whilst it is seldom abundant in wet heath its presence at high frequencies is considered one of the few characteristics common between the varied communities of this habitat (JNCC, 2009). The target is for the presence of cross-leaved heath within a 20m radius of each monitoring stop.

Ericoid species and crowberry (*Empetrum nigrum*)

A dwarf shrub layer with ericoid species is characteristic of 4010 Wet heaths (crowberry is only rarely present). Low cover of these species would be indicative of chronic overgrazing, burning etc. The target is for at least 15% cover of these species.

5.3.3 Vegetation composition: negative indicator species

A percentage cover threshold for negative indicator species has been established for all upland habitats listed as qualifying interests for Arroo Mountain SAC except 8210 Calcareous slopes. Habitat specific negative indicator species lists have been established for each of the habitats (Perrin *et al.*, 2014). Presence of these species would likely indicate undesirable impacts of management such as overgrazing, undergrazing, nutrient enrichment, agricultural improvement or impacts on hydrology. The percentage threshold is generally set quite low such that impacts can be reversed before they become more severe.

5.3.4 Vegetation composition: non-native species

An attribute for non-native species is common to each of the upland Annex I habitats. Non-native species can be invasive and have deleterious effects on native vegetation. The target for each habitat is for the total cover of non-native species to be less than 1%. A low target is set as non-native species can spread rapidly and are most easily dealt with when still at lower abundances.

5.3.5 Vegetation composition: undesirable native species

For many habitats maximum percentage cover thresholds for undesirable native species are also set. These are detailed below.

Bracken, native trees and shrubs

The cover of bracken (*Pteridium aquilinum*) and native trees and shrubs is assessed for 4010 Wet heaths, 4030 Dry heaths and the rocky habitats, 8210 Calcareous scree and 8220 Calcareous rocky slopes. Tree and shrub cover is assessed for 7130 Blanket bogs (* if active). High cover of bracken would indicate that the habitat may be succeeding towards a dense bracken community, and high cover of native trees and shrubs would indicate that the habitat may be succeeding towards scrub or woodland due to lack of grazing or, for bog habitats, due to the habitat drying out. For 8220 Calcareous rocky slopes, high cover of these species indicate that rocky slopes are becoming more vegetated which would impact on the niches of the chasmophytic species.

Grass and dwarf shrubs

For 8120 Calcareous scree a high cover of grasses or dwarf shrubs would indicate that the scree is becoming less exposed and succeeding to another habitat. The target is for the total cover of grass species and dwarf shrubs to be less than 20%. Blue moor-grass (*Sesleria caerulea*) is excluded from the assessment.

Soft rush

High cover of soft rush (*Juncus effusus*) in 4010 Wet heaths and 4030 Dry heaths would suggest undesirable hydrological conditions. Note however, that poor flushes dominated by soft rush often naturally occur in mosaic with these habitats. Discrete areas of this separate habitat should not be considered here. The target is for the cover of soft rush to be less than 10%.

Potential dominant species

For 7130 Blanket bogs (* if active) a maximum threshold is given for bog species which could potentially dominate the habitat, reflecting a reduction in diversity. The selected species are ling (*Calluna vulgaris*), many-stalked spike-rush (*Eleocharis multicaulis*), hare's-tail cottongrass (*Eriophorum vaginatum*), purple moor-grass (*Molinia caerulea*), black bog-rush (*Schoenus nigricans*) and deergrass (*Trichoporum germanicum*). The target is for cover of each of the potential dominant species to be less than 75%.

Dwarf shrub cover

A dwarf shrub layer is characteristic of 4010 Wet heaths but the vegetation should be a mixture of dwarf shrub and graminoid species with higher cover of dwarf shrubs being potentially indicative of drainage. A maximum target of 75% is therefore set.

Similarly the calcareous version of 4030 Dry heaths, which was recorded at this site, characteristically has a greater component of broad-leaved herbs than siliceous dry heath. A maximum target of 75% is therefore set.

Dwarf shrub composition

The dwarf shrub layer within 4030 Dry heaths should not be composed primarily of bog-myrtle (*Myrica gale*), creeping willow (*Salix repens*) and western gorse (*Ulex gallii*). Bog-myrtle is indicative of flushed conditions and is more characteristic of wet heaths and blanket bogs. Creeping willow is more characteristic of dune heaths. Western gorse is a component of dry heath, but high proportions of it may indicate a history of undesirable levels of grazing. The target for 4030 Dry heaths is for the proportion of dwarf shrub composed of these species to be collectively less than 50%.

5.4 Vegetation structure

Vegetation structure is assessed through a number of attributes tailored to each of the habitats. These measures assess levels of grazing and browsing, burning, *Sphagnum* condition and, for 4030 Dry heaths, growth phases of ling (*Calluna vulgaris*).

5.4.1 Browsing and grazing

Browsing is generally measured through viewing the last complete season's shoots of particular species and assessing the proportion which shows signs of having been browsed. The species which are assessed for browsing are generally the dwarf shrub species: ericoids, crowberry (*Empetrum nigrum*) and bog-myrtle (*Myrica gale*). The target for the heath habitats (4010, 4030 and 4060) and 7130 Blanket bogs (* if active) is for less than 33% of shoots to show signs of grazing. On the rocky habitats (8120 and 8210) live leaves of forbs and shoots of dwarf shrubs showing signs of grazing or browsing collectively should be less than 50%. An additional assessment of grazing of live leaves of specific graminoids is made for 4060 Alpine and Boreal heaths. The specific graminoids are stiff sedge (*Carex bigelowii*), wavy hair-grass (*Deschampsia flexuosa*), sheep's-fescue (*Festuca ovina*) and viviparous sheep's-fescue (*Festuca vivipara*). High levels of grazing of these species in 4060 Alpine and Boreal heaths would be undesirable as grazing is not required to maintain this habitat.

5.4.2 Burning

Fires can be part of the natural cycle of heath and peatlands and may also be used as a valuable management tool to promote a diversity of growth phases in ling. However, currently most hill fires in Ireland are intentionally started to encourage grass growth for livestock. Fires which are too intense, too frequent, too extensive or which occur in sensitive areas are damaging to habitats. An assessment of burning is made for the heath habitats (4010, 4030 and 4060) and 7130 Blanket bogs (* if active). Habitat specific lists of sensitive areas where burning should not occur are presented in Perrin *et al.* (2014). Examples of sensitive areas are: 'areas where soils are thin and less than 5cm deep' and 'pools, wet hollows, hags and erosion gullies, and within 5-10m of the edge of watercourses'.

4010 Wet heaths and 7130 Blanket bogs (* if active) have the same targets relating to there being no signs of burning into the moss, liverwort or lichen layer or exposure of peat surface due to burning and no signs of burning in sensitive areas. The target for 4030 Dry heaths is no sign of burning in sensitive areas. The target for 4060 Alpine and Boreal heaths, which does not require burning for the maintenance of the habitat, is for there to be no signs of burning within the habitat.

5.4.3 Sphagnum condition

Disturbance to *Sphagnum* is assessed for habitats 4010 Wet heaths and 7130 Blanket bogs (* if active). High levels of disturbed *Sphagnum* would indicate undesirable levels of grazers. For both of the habitats the target is for less than 10% of the *Sphagnum* cover to be crushed, broken and/or pulled up.

5.4.4 Growth phases of ling

The growth phases of ling (*Calluna vulgaris*) are assessed for 4030 Dry heaths. The growth phases are pioneer (<10cm high), building (10-30cm high) and mature (>30cm high). The target is that all growth phases of ling should occur throughout the habitat, outside sensitive areas, with at least 10% of cover in the mature phase. As burning is undesirable within sensitive areas, it is not reasonable to require the stated diversity of growth phases within these areas. The list of sensitive areas is presented in the NSUH manual (Perrin *et al.*, 2014).

5.4.5 Senescent ling

The cover of senescent ling (*Calluna vulgaris*) in 4030 Dry heaths is also assessed. Senescence is part of the natural cycle of ling but a dominance of ling in the senescent phase would indicate a lack of management (appropriate grazing or burning) to promote ling regeneration. The target is that the cover of senescent ling should be less than 50%.

5.5 Physical structure

The physical structure of upland habitats can be damaged by drainage, walking trails, unsuitable levels of grazing and erosion. Physical structure is assessed through a number of attributes tailored to each of the habitats. Elements which are assessed for the various habitats comprise disturbed bare ground, drainage and erosion; these are detailed below.

5.5.1 Disturbed bare ground

This attribute is common to all the upland habitats listed as qualifying interests for Arroo Mountains SAC, except 8210 Calcareous rocky slopes. Disturbance can include hoof marks, wallows, human foot prints, vehicle and machinery tracks and, for 8120 Calcareous screes, scree running. Excessive disturbance can result in loss of characteristic species and presage erosion for heaths and peatlands. Scree is subject to naturally recurrent disturbance, but high levels of disturbance may impact on vegetation cover and diversity. The target for each habitat is set at there being less than 10% disturbed ground.

5.5.2 Drainage

Drainage can result in loss of characteristic species and transition to drier habitats. This attribute is applied to 4010 Wet heaths and 7130 Blanket bogs (* if active). For each habitat the target is the area showing signs of drainage from heavy trampling, tracking or ditches to be less than 10%.

5.5.3 Erosion

Erosion is assessed for 7130 Blanket bogs (* if active). Erosion leads to loss of peat from the blanket bog system, increases in peat sediment in nearby water courses, loss of blanket bog habitat and drainage. The target for both habitats is less than 5% of the greater bog mosaic comprises erosion gullies and eroded areas. The greater bog mosaic incorporates the blanket bog itself and associated vegetation types and non-vegetation cover types that appear to have been derived from former blanket bog, including, but not limited to bare peat, loose rock, gravel and running water.

5.6 Indicators of local distinctiveness

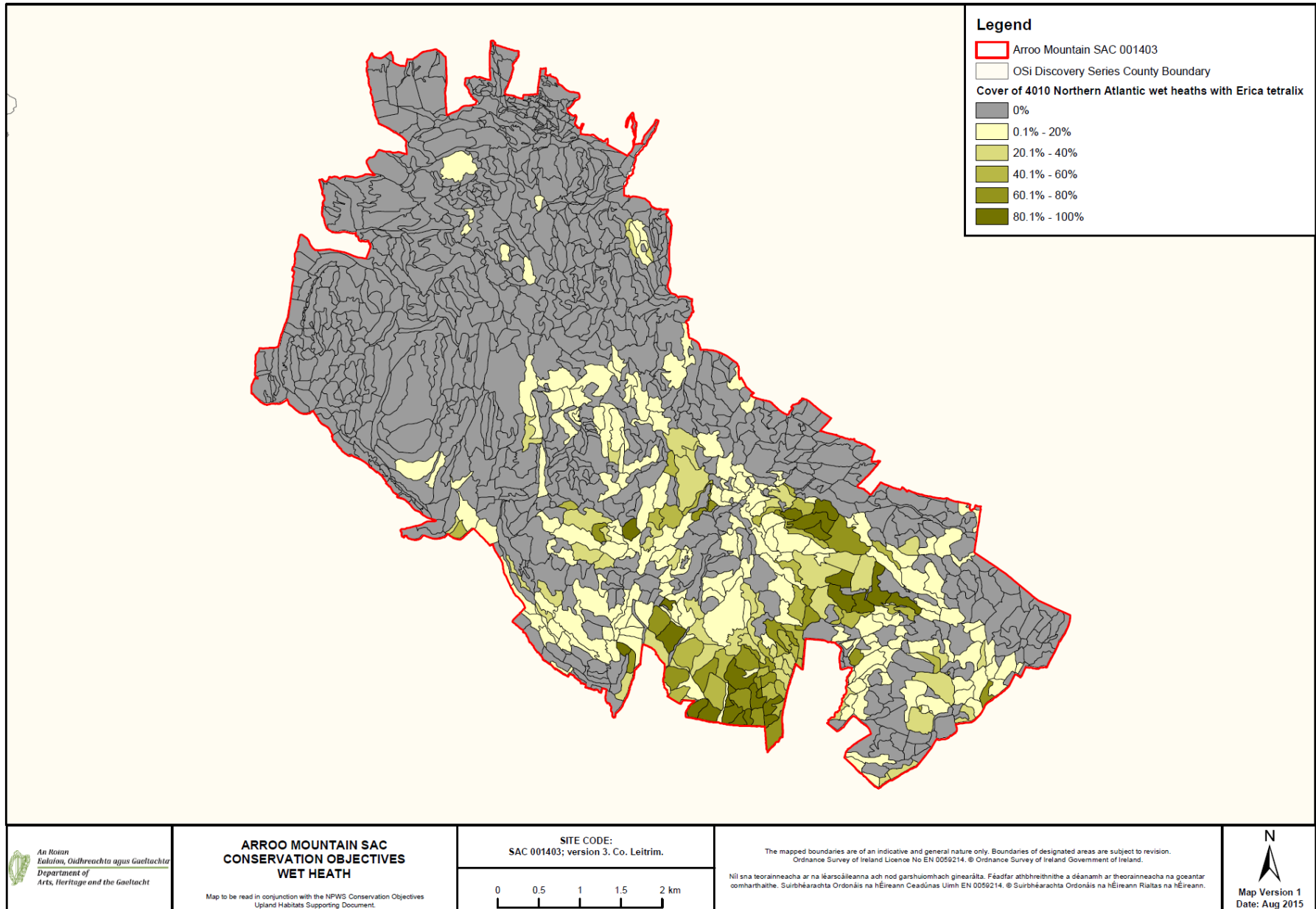
Perrin *et al.* (2013) compiled and mapped existing rare and notable plant records for the SAC and added any new records collected during the NSUH survey. Rare species (those considered at least Near Threatened on the appropriate Red Data List) which could be assigned to a particular habitat, either through waypoint data collected during the NSUH or expert judgement, were considered indicators of local distinctiveness for habitats. The target is for no decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat.

Where hepatic mats of the *Calluna vulgaris-Herbertus aduncus* community were recorded within a particular habitat by Perrin *et al.* (2013) these are also listed as indicators of local distinctiveness. No assessment of the conservation status of this community has been conducted but proposals for such an assessment are presented in Barron & Perrin (2014). The target for these hepatic mats is for no decline in status of hepatic mats associated with this habitat.

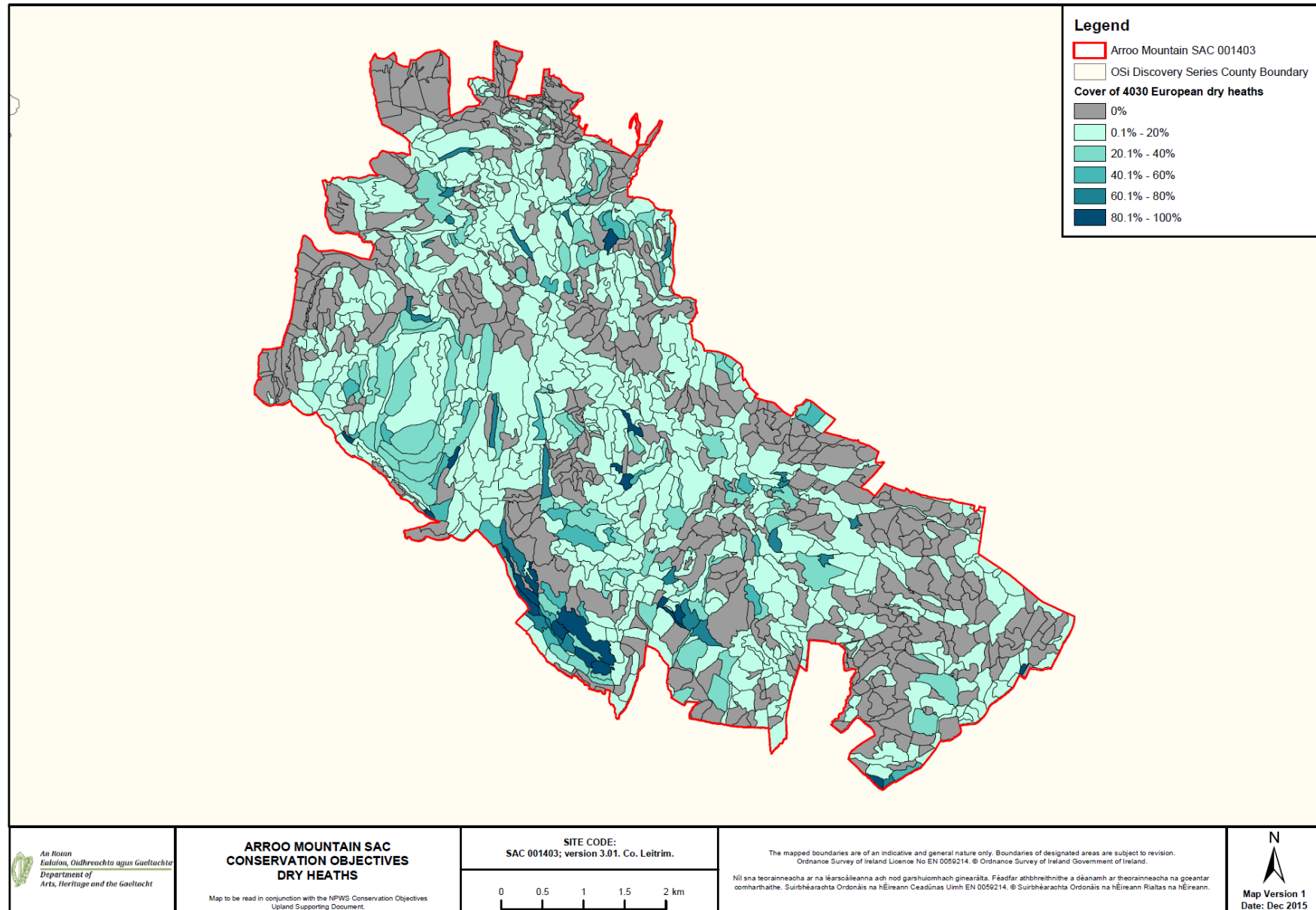
6 References

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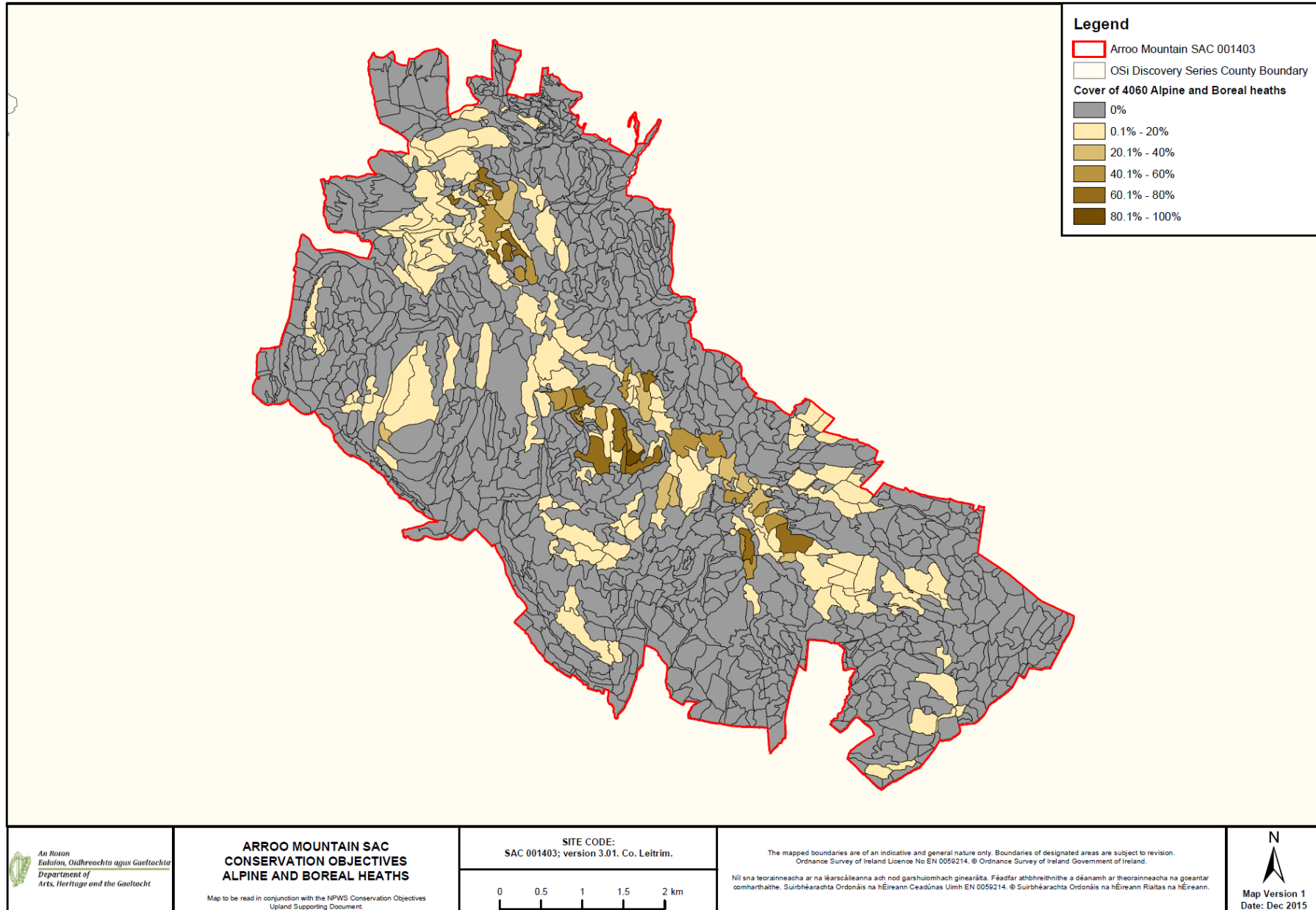
Map 1 Arroo Mountain SAC Conservation Objectives – 4010 Wet Heaths



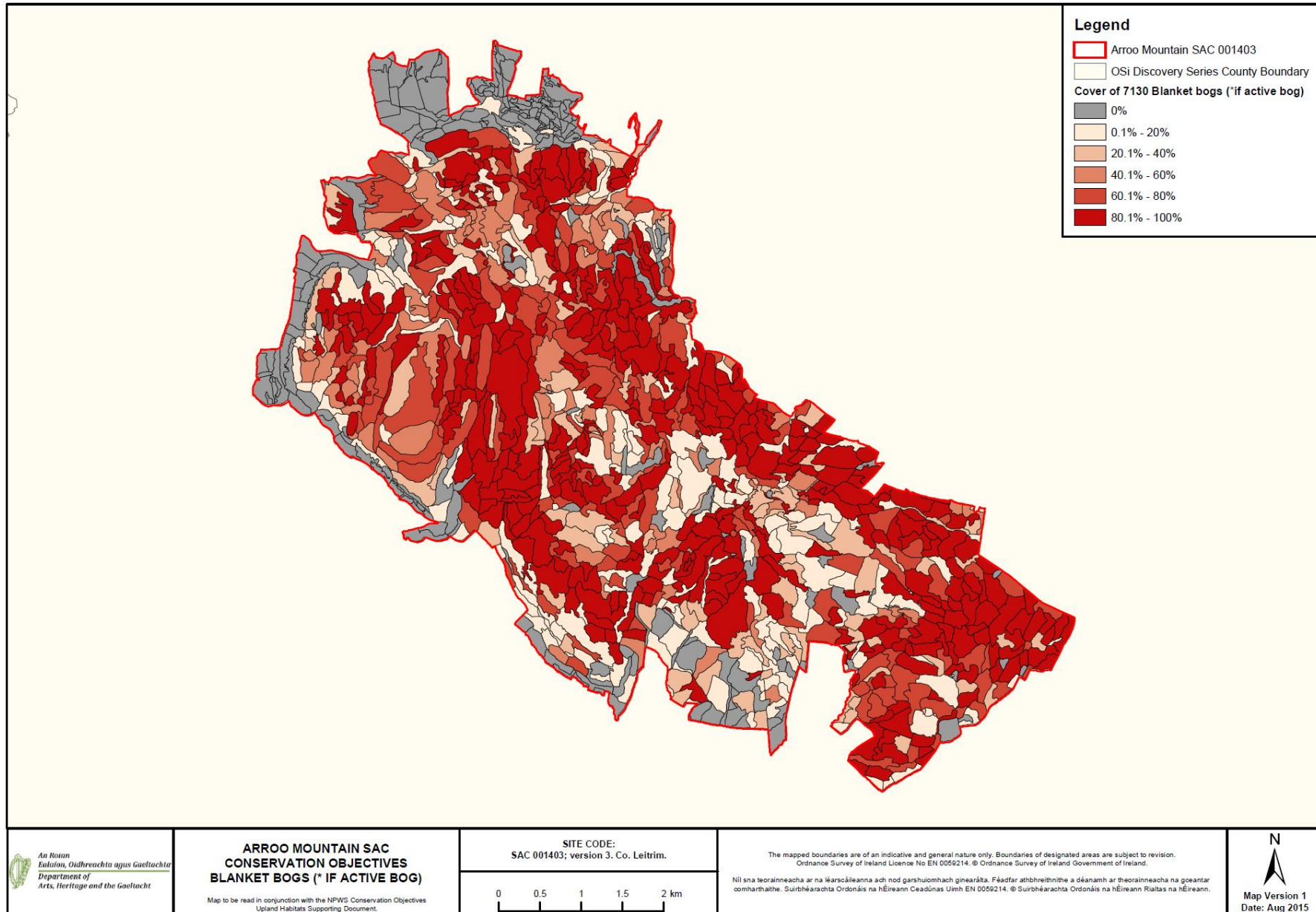
Map 2 Arroo Mountain SAC Conservation Objectives – 4030 Dry Heaths



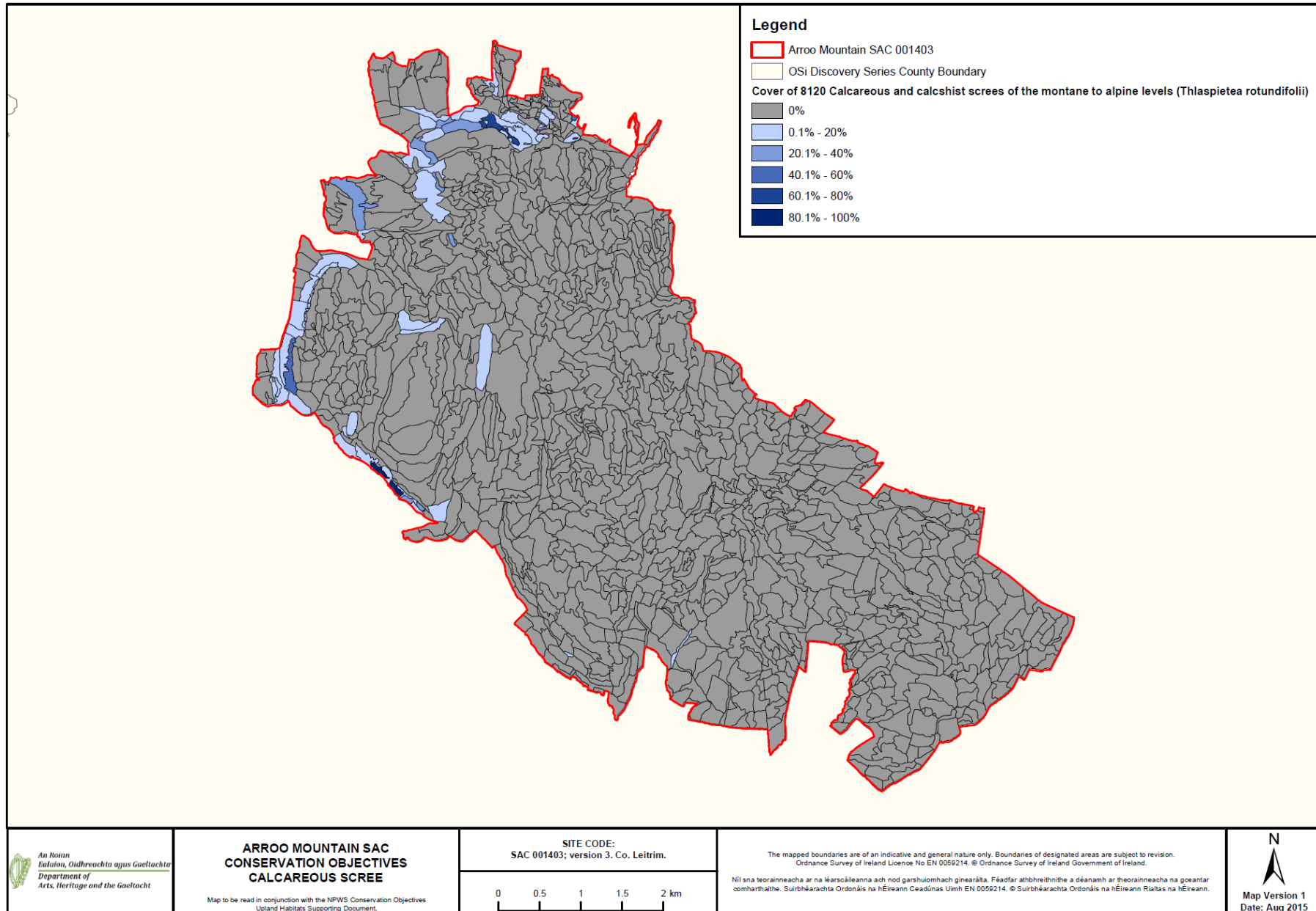
Map 3 Arroo Mountain SAC Conservation Objectives – 4060 Alpine and Boreal Heaths



Map 4 Arroo Mountain SAC Conservation Objectives – 7130 Blanket Bogs (* if active)



Map 5 Arroo Mountain SAC Conservation Objectives – 8120 Calcareous Screes



Map 6 Arroo Mountain SAC Conservation Objectives – 8210 Calcareous Rocky Slopes

