

# National Parks and Wildlife Service

---

## *Conservation Objectives Series*

---

Ben Bulbin, Gleniff and Glenade Complex SAC  
000623



An Roinn Tithíochta,  
Rialtais Áitiúil agus Oidhreachta  
Department of Housing,  
Local Government and Heritage

**National Parks and Wildlife Service,  
Department of Housing, Local Government and Heritage,  
90 King Street North, Dublin 7, D07 N7CV, Ireland.  
Web: [www.npws.ie](http://www.npws.ie)  
E-mail: [natureconservation@housing.gov.ie](mailto:natureconservation@housing.gov.ie)**

**Citation:**

**NPWS (2021) Conservation Objectives: Ben Bulbin, Gleniff and Glenade  
Complex SAC 000623. Version 1. National Parks and Wildlife Service,  
Department of Housing, Local Government and Heritage.**

**Series Editors: Rebecca Jeffrey and Christina Campbell  
ISSN 2009-4086**

## Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

### Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

## Qualifying Interests

\* indicates a priority habitat under the Habitats Directive

---

000623	Ben Bulben, Gleniff and Glenade Complex SAC
1013	Geyer's Whorl Snail <i>Vertigo geyeri</i>
1355	Otter <i>Lutra lutra</i>
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation
4010	Northern Atlantic wet heaths with <i>Erica tetralix</i>
4030	European dry heaths
4060	Alpine and Boreal heaths
5130	<i>Juniperus communis</i> formations on heaths or calcareous grasslands
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites)
6230	Species-rich <i>Nardus</i> grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)*
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels
7130	Blanket bogs (* if active bog)
7140	Transition mires and quaking bogs
7220	Petrifying springs with tufa formation (Cratoneurion)*
7230	Alkaline fens
8110	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)
8120	Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)
8210	Calcareous rocky slopes with chasmophytic vegetation

**Please note that this SAC is adjacent to Glenade Lough SAC (001919) and overlaps with Sligo/Leitrim Uplands SPA (004187). See map 2. The conservation objectives for this site should be used in conjunction with those for the adjacent and overlapping sites as appropriate.**



## Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: [www.npws.ie/Publications](http://www.npws.ie/Publications)

### NPWS Documents

<b>Year :</b>	1987
<b>Title :</b>	The vegetation of Irish rivers
<b>Author :</b>	Heuff, H.
<b>Series :</b>	Unpublished report to NPWS
<b>Year :</b>	2006
<b>Title :</b>	Otter survey of Ireland 2004/2005
<b>Author :</b>	Bailey, M.; Rochford, J.
<b>Series :</b>	Irish Wildlife Manuals, No. 23
<b>Year :</b>	2007
<b>Title :</b>	Supporting documentation for the Habitats Directive Conservation Status Assessment - backing documents. Article 17 forms and supporting maps
<b>Author :</b>	NPWS
<b>Series :</b>	Unpublished report to NPWS
<b>Year :</b>	2009
<b>Title :</b>	Ireland Red List No. 2: Non-marine molluscs
<b>Author :</b>	Byrne, A.; Moorkens, E.A.; Anderson, R.; Killeen, I.J.; Regan, E.C.
<b>Series :</b>	Ireland Red List series, NPWS
<b>Year :</b>	2009
<b>Title :</b>	Irish semi-natural grasslands survey. Annual report No. 2
<b>Author :</b>	O'Neill, F.H.; Martin, J.R.; Perrin, P.M.; Delaney, A.M.; McNutt, K.E.; Devaney, F.M.
<b>Series :</b>	Unpublished report to NPWS
<b>Year :</b>	2010
<b>Title :</b>	Ireland Red List No. 4: Butterflies
<b>Author :</b>	Regan, E.C.; Nelson, B.; Aldwell, B.; Bertrand, C.; Bond, K.; Harding, J.; Nash, D.; Nixon, D.; Wilson, C.J.
<b>Series :</b>	Ireland Red List series, NPWS
<b>Year :</b>	2011
<b>Title :</b>	Monitoring and condition assessment of populations of <i>Vertigo geyeri</i> , <i>Vertigo angustior</i> and <i>Vertigo moulinsiana</i> in Ireland
<b>Author :</b>	Moorkens, E.; Killeen, I.
<b>Series :</b>	Irish Wildlife Manuals, No. 55
<b>Year :</b>	2012
<b>Title :</b>	The conservation status of juniper formations in Ireland
<b>Author :</b>	Cooper, F.; Stone, R.E.; McEvoy, P.; Wilkins, T.; Reid, N.
<b>Series :</b>	Irish Wildlife Manuals, No. 63
<b>Year :</b>	2012
<b>Title :</b>	Ireland Red List No. 8: Bryophytes
<b>Author :</b>	Lockhart, N.; Hodgetts, N.; Holyoak, D.
<b>Series :</b>	Ireland Red List series, NPWS
<b>Year :</b>	2013
<b>Title :</b>	Conservation status assessment for petrifying springs
<b>Author :</b>	Lyons, M.D.; Kelly, D.L.
<b>Series :</b>	Unpublished report to NPWS

<b>Year :</b>	2013
<b>Title :</b>	National otter survey of Ireland 2010/12
<b>Author :</b>	Reid, N.; Hayden, B.; Lundy, M.G.; Pietravalle, S.; McDonald, R.A.; Montgomery, W.I.
<b>Series :</b>	Irish Wildlife Manuals, No. 76
<b>Year :</b>	2013
<b>Title :</b>	Irish semi-natural grasslands survey 2007-2012
<b>Author :</b>	O'Neill, F.H.; Martin, J.R.; Devaney, F.M.; Perrin, P.M.
<b>Series :</b>	Irish Wildlife Manuals, No. 78
<b>Year :</b>	2013
<b>Title :</b>	The status of EU protected habitats and species in Ireland. Volume 2. Habitats assessments
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation assessments
<b>Year :</b>	2013
<b>Title :</b>	National Survey of Upland Habitats (Phase 3, 2012-2013), Draft Site Report No. 11: Ben Bulbin, Gleniff and Glenade Complex cSAC (000623), Co. Sligo
<b>Author :</b>	Perrin, P.M.; Roche, J.R.; Barron, S.J.; Daly, O.H.; Hodd, R.L.; Muldoon, C.S.; Leyden, K.J.
<b>Series :</b>	Unpublished report to NPWS
<b>Year :</b>	2014
<b>Title :</b>	Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland, Version 2.0
<b>Author :</b>	Perrin, P.M.; Barron, S.J.; Roche, J.R.; O'Hanrahan, B.
<b>Series :</b>	Irish Wildlife Manuals, No. 79
<b>Year :</b>	2016
<b>Title :</b>	Monitoring guidelines for the assessment of petrifying springs in Ireland
<b>Author :</b>	Lyons, M.D.; Kelly, D.L.
<b>Series :</b>	Irish Wildlife Manuals, No. 94
<b>Year :</b>	2016
<b>Title :</b>	Ireland Red List No. 10: Vascular Plants
<b>Author :</b>	Wyse Jackson, M.; FitzPatrick, Ú.; Cole, E.; Jebb, M.; McFerran, D.; Sheehy Skeffington, M.; Wright, M.
<b>Series :</b>	Ireland Red Lists series, NPWS
<b>Year :</b>	2016
<b>Title :</b>	Survey of Flora Protection Order Bryophytes 2016
<b>Author :</b>	Hodd, R.L.
<b>Series :</b>	Unpublished report to NPWS
<b>Year :</b>	2018
<b>Title :</b>	The Irish Juniper Monitoring Survey 2017
<b>Author :</b>	O'Neill, F.H.; Martin, J.R.
<b>Series :</b>	Irish Wildlife Manuals, No. 101
<b>Year :</b>	2018
<b>Title :</b>	The Irish Juniper Monitoring Survey 2017 - Appendices
<b>Author :</b>	O'Neill, F.H.; Martin, J.R.
<b>Series :</b>	Irish Wildlife Manuals, No. 101
<b>Year :</b>	2018
<b>Title :</b>	The monitoring and assessment of three EU Habitats Directive Annex I grassland habitats
<b>Author :</b>	Martin, J.R.; O'Neill, F.H.; Daly, O.H.
<b>Series :</b>	Irish Wildlife Manuals, No. 102

<b>Year :</b>	2019
<b>Title :</b>	The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation assessments
<b>Year :</b>	2019
<b>Title :</b>	Monitoring of sites and habitat for three Annex II species of whorl snail ( <i>Vertigo</i> )
<b>Author :</b>	Long, M.P.; Brophy, J.T.
<b>Series :</b>	Irish Wildlife Manuals, No. 104
<b>Year :</b>	2019
<b>Title :</b>	Monitoring of sites and habitat for three Annex II species of whorl snail ( <i>Vertigo</i> ). Appendix V. <i>Vertigo geyeri</i> site reports
<b>Author :</b>	Brophy, J.T.; Long, M.P.
<b>Series :</b>	Irish Wildlife Manuals, No. 104
<b>Year :</b>	2019
<b>Title :</b>	Checklists Protected and Threatened Species in Ireland 2019
<b>Author :</b>	Nelson, B.; Cummins, S.; Fay, L.; Jeffrey, R.; Kelly, S.; Kingston, N.; Lockhart, N.; Marnell, F.; Tierney, D.; Wyse Jackson, M.
<b>Series :</b>	Irish Wildlife Manuals, No. 116
<b>Year :</b>	2021
<b>Title :</b>	Checklists Protected and Threatened Species in Ireland. Version 2.1. 3 December 2021
<b>Author :</b>	Nelson, B.; Cummins, S.; Fay, L.; Jeffrey, R.; Kelly, S.; Kingston, N.; Lockhart, N.; Marnell, F.; Tierney, D.; Wyse Jackson, M.
<b>Series :</b>	Irish Wildlife Manuals, No. 116
<b>Year :</b>	2021
<b>Title :</b>	Ben Bulbin, Gleniff and Glenade Complex SAC (site code: 623) Conservation objectives supporting document - upland habitats V1
<b>Author :</b>	NPWS
<b>Series :</b>	Conservation objectives supporting document

## Other References

<b>Year :</b>	1982
<b>Title :</b>	Otter survey of Ireland
<b>Author :</b>	Chapman, P.J.; Chapman, L.L.
<b>Series :</b>	Unpublished report to Vincent Wildlife Trust
<b>Year :</b>	1991
<b>Title :</b>	The spatial organization of otters ( <i>Lutra lutra</i> ) in Shetland
<b>Author :</b>	Kruuk, H.; Moorhouse, A.
<b>Series :</b>	Journal of Zoology, 224: 41-57
<b>Year :</b>	2003
<b>Title :</b>	Ecology of watercourses characterised by Ranunculion fluitantis and Callitriche-Batrachion vegetation
<b>Author :</b>	Hatton-Ellis, T.W.; Grieve, N.
<b>Series :</b>	Conserving Natura 2000 Rivers Ecology Series No. 11. English Nature, Peterborough
<b>Year :</b>	2004
<b>Title :</b>	The Geological Heritage of Sligo. An audit of County Geological Sites in Sligo
<b>Author :</b>	McAteer, C.; Parkes, M.
<b>Series :</b>	Geological Survey of Ireland

<b>Year :</b>	2006
<b>Title :</b>	Otters - ecology, behaviour and conservation
<b>Author :</b>	Kruuk, H.
<b>Series :</b>	Oxford University Press
<b>Year :</b>	2010
<b>Title :</b>	Otter tracking study of Roaringwater Bay
<b>Author :</b>	De Jongh, A.; O'Neill, L.
<b>Series :</b>	Unpublished draft report to NPWS
<b>Year :</b>	2011
<b>Title :</b>	The Fen Management Handbook
<b>Author :</b>	McBride, A.; Diack, I.; Droy, N.; Hamill, B.; Jones, P.; Schutten, J.; Skinner, A.; Street, M. (eds.)
<b>Series :</b>	Scottish Natural Heritage, Perth
<b>Year :</b>	2012
<b>Title :</b>	Rare and threatened bryophytes of Ireland
<b>Author :</b>	Lockhart, N.; Hodgetts, N.; Holyoak, D.
<b>Series :</b>	National Museums Northern Ireland
<b>Year :</b>	2013
<b>Title :</b>	Interpretation manual of European Union habitats- Eur 28
<b>Author :</b>	European Commission- DG Environment
<b>Series :</b>	European Commission
<b>Year :</b>	2015
<b>Title :</b>	The flora and conservation status of petrifying springs in Ireland
<b>Author :</b>	Lyons, M.D.
<b>Series :</b>	Unpublished Ph.D. thesis, Trinity College Dublin
<b>Year :</b>	2016
<b>Title :</b>	A narrative for conserving freshwater and wetland habitats in England
<b>Author :</b>	Mainstone, C.; Hall, R.; Diack, I.
<b>Series :</b>	Natural England Research Reports Number 064
<b>Year :</b>	2017
<b>Title :</b>	Irish Vegetation Classification: Technical Progress Report No. 3
<b>Author :</b>	Perrin, P.
<b>Series :</b>	Report submitted to National Biodiversity Data Centre
<b>Year :</b>	2018
<b>Title :</b>	Irish Vegetation Classification: Technical Progress Report No. 4
<b>Author :</b>	Perrin, P.
<b>Series :</b>	Report submitted to National Biodiversity Data Centre

## Spatial data sources

<b>Year :</b>	2013
<b>Title :</b>	National Survey of Upland Habitats
<b>GIS Operations :</b>	Habitat dataset for site clipped to SAC boundary. Relevant QI selected and exported to new dataset. Expert opinion used as necessary to resolve any issues arising
<b>Used For :</b>	4010, 4030, 4060, 6210, 6430, 7130, 7140, 7220, 7230, 8110, 8120, 8210 (maps 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14)
<b>Year :</b>	2013
<b>Title :</b>	Irish Semi-Natural Grassland Survey
<b>GIS Operations :</b>	Dataset clipped to the SAC boundary. Expert opinion used as necessary to resolve any issues arising
<b>Used For :</b>	6210 (map 6)
<b>Year :</b>	2016
<b>Title :</b>	Point file associated with Lyons (2015)
<b>GIS Operations :</b>	Dataset created from spatial references; clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
<b>Used For :</b>	7220 (map 10)
<b>Year :</b>	2021
<b>Title :</b>	NPWS rare and threatened species database
<b>GIS Operations :</b>	Dataset created from spatial references in database records. Expert opinion used as necessary to resolve any issues arising
<b>Used For :</b>	1013 (map 15)
<b>Year :</b>	2005
<b>Title :</b>	OSi Discovery series vector data
<b>GIS Operations :</b>	Creation of 80m buffer on aquatic side of lake data; creation of 10m buffer on terrestrial side of lake data Datasets are combined with the derived EPA WFD Waterbodies data. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising. Creation of 250m buffer on aquatic side of the lake boundary to highlight potential commuting points
<b>Used For :</b>	1355 (map 16)
<b>Year :</b>	2010
<b>Title :</b>	EPA WFD Waterbodies data
<b>GIS Operations :</b>	Creation of 10m buffer on terrestrial side of river banks data. Dataset combined with derived OSi 1:5000 vector lake buffer data. Overlapping regions investigated and resolved; resulting dataset clipped to SAC boundary. Expert opinion used as necessary to resolve any issues arising
<b>Used For :</b>	1355 (map 16)

**3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation**

**To maintain the favourable conservation condition of Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

<b>Attribute</b>	<b>Measure</b>	<b>Target</b>	<b>Notes</b>
Habitat area	Kilometres	Area stable or increasing, subject to natural processes	Conservation objectives concentrate on the high conservation value sub-types of the habitat. Selection of Ben Bulben, Gleniff and Glenade Complex SAC was based on the occurrence of a variety of rare upland stream types. Many streams rise on the plateau and form cascades as they flow over the steep slopes. Some have intermittent flow. Some disappear down swallow holes on the plateau. The SAC is an Important Bryophyte Area with many protected and threatened species, many of which are associated with intermittent streams, splash-zones and stream edges (Lockhart et al., 2012). Many headwaters are base-rich and contain a species-rich bryophyte flora accompanied by tufa deposits, i.e. have petrifying springs. Some base-poor streams have been noted, with a poorly-developed flora mainly composed of calcifuge bryophytes. Further study is required to fully document the habitat sub-types in this SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	The SAC contains the headwaters of many rivers, including the Ballaghnastrillick-Black-Duff River, Carney River, Grange River, Diffreen River, Glencar Lough and Drumcillf River. The Glencar waterfall is particularly notable for bryophytes. The Diffreen was surveyed, downstream of the SAC, by Heuff (1987). McAteer and Parkes (2004) stated that the gradual upward transition from the Benbulben Shale Formation to the Glencar Limestone Formation is well exposed in a stream section at Tievebaun and the alternating, fossil-rich shales and limestones are well exposed in other rivers. Further study of Irish rivers is needed to interpret the broad description of 3260 which covers from upland bryophyte/macroalgal dominated to lowland depositing rivers with pondweeds and starworts (European Commission, 2013)
Hydrological regime: river flow	Metres per second	Maintain appropriate hydrological regimes	As noted above, the streams in the SAC display a wide range of upland hydrological regimes from headwaters of petrifying springs and flushes, to slower flows on the plateau, swallow holes and underground stretches, cascades and waterfalls, pools, permanent and intermittent flow. Heuff (1987) described the Diffreen at Aghmore as a high-level karst stream, very few of which occur in Ireland, and a 'turlough among rivers'. Hydrology is a key driver of the high conservation value, bryophyte-rich sub-types found in the SAC. A natural flow regime is required for both plant communities and channel geomorphology to be in favourable condition, exhibiting typical dynamics for the river type (Hatton-Ellis and Grieve, 2003). For many sub-types, high flows are required to maintain the substratum necessary for the characteristic species. Flow variation can be particularly important, with high and flood flows being critical to the hydromorphology

Hydrological regime: groundwater discharge	Metres per second	Maintain appropriate hydrological regime	Groundwater makes significant contributions to the streams in the SAC, with petrifying springs and tufaceous deposits occurring, and some streams disappearing into swallow holes and flowing underground for part of their length. It is essential that the appropriate groundwater contributions necessary for the natural functioning of the habitat be maintained and that there is no significant disturbance of the catchments' groundwater regimes
Substratum composition: particle size range	Millimetres	Maintain appropriate substratum particle size range, quantity and quality, subject to natural processes	Substratum type is variable within the streams in the SAC; however, bedrock is frequent and calcareous groundwater springs and seepages exert a significant influence on many streams through the precipitation of tufa. Boulders and rock dominated the upland stretch of the Diffreen surveyed by Heuff (1987). Although many high conservation value sub-types are dominated by coarse substrata and bedrock, certain sub-types, notably those associated with lake inflows/outflows and peatlands, are dominated by fine substrata. The size and distribution of particles is largely determined by the river flow and geology. The chemical composition (particularly minerals and nutrients) of the substratum is also important. The quality of finer sediment particles is a notable driver of rooted plant communities
Water quality	Various	Maintain appropriate water quality to support the natural structure and functioning of the habitat	The rivers within the SAC are naturally very nutrient-poor and, therefore, require Water Framework Directive (WFD) high status or reference condition. However, some of the methods, e.g. EQRs (Ecological Quality Ratios) for macroinvertebrates and phytobenthos, may not be appropriate to the upland streams such as those found in the SAC, and there are no WFD river monitoring stations within the SAC. A station on the Grange River immediately downstream of the SAC boundary has had consistently high status (Q4-5 or Q5) 1990-2018. See also The European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2019
Typical species	Occurrence	Typical species of the relevant habitat sub-type should be present and in good condition	Typical species have not been fully defined, but may include higher plants, bryophytes, algae and invertebrates. The habitat in the SAC is dominated by bryophytes. Some bryophytes are fully aquatic; however, many are associated with intermittent streams, splash-zones and stream edges: <i>Marchantia polymorpha</i> subsp. <i>montivagans</i> (FPO) is an Endangered species found on a small, tufaceous rock in the river below Glencar waterfall; <i>Campylostelium saxicola</i> (FPO) is Endangered and occurs on rocks at edge of Glencar river (Lockhart et al., 2012). Other species that may be associated with waterfalls and/or temporary streams/cascades include the Near Threatened species <i>Didymodon maximus</i> (FPO), <i>Dumortiera hirsuta</i> and <i>Hymenostylium recurvirostrum</i> (Lockhart et al., 2012). Species with FPO are protected under the Flora (Protection) Order, 2015. <i>Saxifraga aizoides</i> , a spring and stream-side species, is frequent in the SAC

Floodplain connectivity: area	Hectares	Maintain the area of active floodplain at and upstream of the habitat	As the SAC has upland streams, natural floodplains are unlikely to occur. River connectivity with natural floodplains is important for habitat functioning. Channels with a naturally functioning floodplain are better able to maintain habitat and water quality (Hatton-Ellis and Grieve, 2003). Floodplain connectivity is particularly important in terms of sediment sorting and nutrient deposition. High conservation value rivers are intimately connected to floodplain habitats and function as important wildlife corridors, connecting otherwise isolated or fragmented habitats in the wider countryside (Hatton-Ellis and Grieve, 2003; Mainstone et al., 2016)
Riparian habitat: area and condition	Hectares	Maintain the area and condition of fringing habitats necessary to support the habitat and its sub-types	Riparian habitats (e.g. woodlands and wetlands) are integral to the structure and functioning of rivers, even where not part of a floodplain. Fringing habitats can contribute to the aquatic food web (e.g. allochthonous matter such as leaf fall), provide habitat for certain life-stages of fish, birds and aquatic invertebrates, assist in the settlement of fine suspended material, protect banks from erosion and contribute to nutrient cycling. Shade may be important in suppressing algal growth and moderating temperatures. Equally, fringing habitats are dependent on rivers, particularly their water levels, and support wetland communities and species of conservation concern. See Mainstone et al. (2016). A variety of upland and woodland habitats fringe the streams in the SAC. Trees and rock outcrops are important for many typical species as they provide shade and maintain high moisture levels



## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 4010 Northern Atlantic wet heaths with *Erica tetralix*

**To restore the favourable conservation condition of Northern Atlantic wet heaths with *Erica tetralix* in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Northern Atlantic wet heaths with <i>Erica tetralix</i> was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 44.4ha, covering 0.7% of the SAC. Perrin et al. (2013) report no significant losses of area of the habitat since 1995. Further information can be found in Perrin et al. (2013). Further details on this and the following attributes can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats where a summary of the mapping methodology and a brief discussion of restoration potential are also presented
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 3	Wet heath was recorded with a fragmented distribution and in intimate mosaic with blanket bog within Ben Bulben, Gleniff and Glenade Complex SAC by Perrin et al. (2013). See Perrin et al. (2013) for further information. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	See the uplands supporting document for further details
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Perrin et al. (2013) recorded five different wet heath communities within this SAC. Data on the abundance of these communities is reproduced in the uplands supporting document. Further information on the vegetation communities associated with this habitat is presented in Perrin et al. (2014). See also the Irish Vegetation Classification (Perrin, 2017; <a href="http://www.biodiversityireland.ie/projects/ivc-classification-explorer">www.biodiversityireland.ie/projects/ivc-classification-explorer</a> )
Vegetation composition: cross-leaved heath	Occurrence within 20m of a representative number of 2m x 2m monitoring stops	Cross-leaved heath ( <i>Erica tetralix</i> ) present within a 20m radius of each monitoring stop	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of positive indicator species at least 50%	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is presented. Further details can be found in the uplands supporting document
Vegetation composition: lichens and bryophytes	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of <i>Cladonia</i> and <i>Sphagnum</i> species, <i>Racomitrium lanuginosum</i> and pleurocarpous mosses at least 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: ericoid species and crowberry	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of ericoid species and crowberry ( <i>Empetrum nigrum</i> ) at least 15%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: dwarf shrub species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of dwarf shrubs less than 75%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details

Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is presented. See the uplands supporting document for further details
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 20%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: bracken	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of bracken ( <i>Pteridium aquilinum</i> ) less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: soft rush	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of soft rush ( <i>Juncus effusus</i> ) less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: <i>Sphagnum</i> condition	Condition at a representative number of 2m x 2m monitoring stops	Less than 10% of the <i>Sphagnum</i> cover is crushed, broken and/or pulled up	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Less than 33% collectively of the last complete growing season's shoots of ericoids, crowberry ( <i>Empetrum nigrum</i> ) and bog-myrtle ( <i>Myrica gale</i> ) showing signs of browsing	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning in sensitive areas, into the moss, liverwort or lichen layer or exposure of peat surface due to burning	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas for this habitat is presented. See the uplands supporting document for further details
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: drainage	Percentage cover in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat and no decline in status of hepatic mats associated with this habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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. Any new records should be considered within this attribute. See the uplands supporting document for further details

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 4030 European dry heaths

**To restore the favourable conservation condition of European dry heaths in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). European dry heaths was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 648.9ha, covering 10.8% of the SAC. Perrin et al. (2013) report obvious losses of habitat since 1995 of approximately 0.02ha. Further information can be found in Perrin et al. (2013). Further details on this and the following attributes can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats where a summary of the mapping methodology and a brief discussion of restoration potential are also presented
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 4	Dry heath was recorded by Perrin et al. (2013) throughout Ben Bulben, Gleniff and Glenade Complex SAC, particularly on the summit of Ben Bulben, on and around the summit and King's Mountain, the upper slopes of Truskmore, east of the summit of Tievebaun Mountain, in the Gortnagarn and Largy townlands and around the bluffs of the Dooneens. See Perrin et al. (2013) for further information. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	See the uplands supporting document for further details
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Perrin et al. (2013) recorded four different dry heath communities within this SAC. Data on the abundance of these communities is reproduced in the uplands supporting document. Further information on the vegetation communities associated with this habitat is presented in Perrin et al. (2014). See also the Irish Vegetation Classification (Perrin, 2017; <a href="http://www.biodiversityireland.ie/projects/ivc-classification-explorer">www.biodiversityireland.ie/projects/ivc-classification-explorer</a> )
Vegetation composition: lichens and bryophytes	Number of species at a representative number of 2m x 2m monitoring stops	Number of bryophyte or non-crustose lichen species present at each monitoring stop at least three, excluding <i>Campylopus</i> and <i>Polytrichum</i> mosses	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: number of positive indicator species	Number of species at a representative number of 2m x 2m monitoring stops	Number of positive indicator species present at each monitoring stop at least two	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat, which is composed of dwarf shrubs, is presented. See the uplands supporting document for further details
Vegetation composition: cover of positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of positive indicator species at least 50% for siliceous dry heath and 50-75% for calcareous dry heath	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat, which is composed of dwarf shrubs, is presented. See the uplands supporting document for further details

Vegetation composition: dwarf shrub composition	Percentage cover at a representative number of 2m x 2m monitoring stops	Proportion of dwarf shrub cover composed collectively of bog-myrtle ( <i>Myrica gale</i> ), creeping willow ( <i>Salix repens</i> ) and western gorse ( <i>Ulex gallii</i> ) is less than 50%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species is presented. See the uplands supporting document for further details
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details. The non-native moss <i>Campylopus introflexus</i> was recorded by Perrin et al. (2013) within this habitat in the SAC
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 20%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: bracken	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of bracken ( <i>Pteridium aquilinum</i> ) less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: soft rush	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of soft rush ( <i>Juncus effusus</i> ) less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: senescent ling	Percentage cover at a representative number of 2m x 2m monitoring stops	Senescent proportion of ling ( <i>Calluna vulgaris</i> ) cover less than 50%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Less than 33% collectively of the last complete growing season's shoots of ericoids showing signs of browsing	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning in sensitive areas	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas is presented. See the uplands supporting document for further details
Vegetation structure: growth phases of ling	Percentage cover in local vicinity of a representative number of monitoring stops	Outside sensitive areas, all growth phases of ling ( <i>Calluna vulgaris</i> ) should occur throughout, with at least 10% of cover in the mature phase	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas is also presented. See the uplands supporting document for further details
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat and no decline in status of hepatic mats associated with this habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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. Hepatic mats of the <i>Calluna vulgaris</i> - <i>Herbertus aduncus</i> community were recorded within this habitat during the NSUH (Perrin et al., 2013). Any new records should also be considered within this attribute. See the uplands supporting document for further details

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 4060 Alpine and Boreal heaths

**To restore the favourable conservation condition of Alpine and Boreal heaths in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Alpine and Boreal heath was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 202.6ha, covering 3.4% of the SAC. Perrin et al. (2013) report no significant losses of area since 1995. Further information can be found in Perrin et al. (2013). Further details on this and the following attributes can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats where a summary of the mapping methodology is also presented
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5	Alpine and Boreal heath was recorded by Perrin et al. (2013) throughout the SAC, particularly around the summit areas of Ben Bulben and Truskmore and the summit and surrounding slopes of Tievebaun with patches of the habitat occurring around the summit of King's Mountain. See Perrin et al. (2013) for further information. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	See the uplands supporting document for further details
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Perrin et al. (2013) recorded two Alpine and Boreal heath communities within this SAC. Data on the abundance of these communities is reproduced in the uplands supporting document. Further information on the vegetation communities associated with this habitat is presented in Perrin et al. (2014). See also the Irish Vegetation Classification (Perrin, 2017; <a href="http://www.biodiversityireland.ie/projects/ivc-classification-explorer">www.biodiversityireland.ie/projects/ivc-classification-explorer</a> )
Vegetation composition: lichens and bryophytes	Number of species at a representative number of 2m x 2m monitoring stops	Number of bryophyte or non-crustose lichen species present at each monitoring stop at least three	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of positive indicator species at least 66%	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is presented. See the uplands supporting document for further details
Vegetation composition: dwarf shrub species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of dwarf shrub species at least 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 10%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species is presented. See the uplands supporting document for further details
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details. No non-native species were recorded within this habitat by Perrin et al. (2013)

Vegetation structure: signs of grazing	Percentage of leaves grazed at a representative number of 2m x 2m monitoring stops	Less than 10% collectively of the live leaves of specific graminoids showing signs of grazing	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details, including the list of specific graminoids
Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Less than 33% collectively of the last complete growing season's shoots of ericoids and crowberry ( <i>Empetrum nigrum</i> ) showing signs of browsing	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning within the habitat	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat and no decline in status of hepatic mats associated with this habitat	This includes species on the Flora (Protection Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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. Hepatic mats of the <i>Calluna vulgaris</i> - <i>Herbertus aduncus</i> community were recorded within this habitat during the NSUH (Perrin et al., 2013). Any new records should also be considered within this attribute. See the uplands supporting document for further details

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 5130 Juniperus communis formations on heaths or calcareous grasslands

To maintain the favourable conservation condition of *Juniperus communis* formations on heaths or calcareous grasslands in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	The total area of <i>Juniperus communis</i> formations on heath or calcareous grasslands in Ben Bulben, Gleniff and Glenade Complex SAC is unknown. The habitat was not recorded in the SAC during the National Survey of Upland Habitats (NSUH) by Perrin et al. (2013); although specimens of juniper ( <i>Juniperus communis</i> ) were recorded in the SAC, they were not abundant enough to create a formation
Habitat distribution	Occurrence	No decline, subject to natural processes	See the notes for Habitat area above
Juniper formation size	Number and proximity of juniper plants	At least 50 juniper plants present with each plant separated by no more than 20m	Attribute and target based on O'Neill and Martin (2018). A juniper formation is defined by O'Neill and Martin (2018) as any cluster of $\geq 50$ juniper plants where no plant is more than 20m from another. In practice, this means that juniper plants should achieve a minimum density of 25 plants per hectare to qualify as a formation
Vegetation structure: female fruiting plants	Percentage in a representative number of 5m x 5m monitoring stops or in an <i>ad hoc</i> count of 50 plants	Fruiting females comprise at least 10% of juniper plants rooted in plot in at least 50% of stops or in an <i>ad hoc</i> count of 50 plants	Attribute and target based on Cooper et al. (2012) and O'Neill and Martin (2018)
Vegetation structure: seedling recruitment	Presence in a representative number of 5m x 5m monitoring stops	At least one seedling recorded in at least one monitoring stop	Attribute and target based on O'Neill and Martin (2018). Juniper seedlings are defined as plants less than 15cm high that are still flexible and single-stemmed, or with only two branches at most
Vegetation structure: live juniper	Percentage in a representative number of 5m x 5m monitoring stops or across the site as a whole	At least 90% of juniper plants rooted in plot alive in at least 75% of stops or across the site as a whole	Attribute and target based on Cooper et al. (2012) and O'Neill and Martin (2018)
Vegetation composition: negative indicator species	Percentage in a representative number of 5m x 5m monitoring stops	Total cover of negative indicator species to be less than 10% in at least 50% of stops	Attribute and target based on O'Neill and Martin (2018) where the list of negative indicator species is also presented
Physical structure: germination niches	Percentage in a representative number of 5m x 5m monitoring stops	At least 5% bare soil and/or at least 5% bare rock in at least 25% of stops	Attribute and target based on O'Neill and Martin (2018). Bare soil is important as a germination micro-site and bare rock can also contribute, particularly at the soil-rock interface and in limestone pavement grikes
Formation structure: browning/die-back of plants	Percentage of juniper cover in a representative number of 5m x 5m monitoring stops	Browning or dead juniper branches (excluding fully dead plants) comprise no more than 20% of total juniper cover in plot in at least 75% of stops	Attribute and target based on O'Neill and Martin (2018)
Formation structure: evidence of browsing and bark stripping	Occurrence across a representative number of 5m x 5m monitoring stops	Recent browsing of juniper plants and bark stripping and trampling due to browsers evident in no more than 75% of stops	Attribute and target based on O'Neill and Martin (2018). This attribute concerns bark stripping by animals. Bark stripping or damage from abrasion by rock is not included here. It should be noted, however, that distinguishing between the two may be difficult
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021)



## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (\* important orchid sites)

To restore the favourable conservation condition of Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (\* important orchid sites) in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	The National Survey of Upland Habitats (NSUH; Perrin et al., 2013) surveyed Ben Bulben, Gleniff and Glenade Complex SAC in 2012, mapping large areas which contain this habitat. The Irish Semi-natural Grassland Survey (ISGS; O'Neill et al., 2013) surveyed seven sites in the SAC in 2009 and 2010. Combining the results from both of these surveys gives an area of 96.56ha of 6210 within this SAC (see map 6). It is important to note that further unsurveyed areas of the habitat may be present within the SAC. It should also be noted that the habitat occurs in intimate association with other habitats, including other Annex I habitats, and therefore, these habitats sometimes cannot easily be mapped or considered separately. Conservation objectives for all co-occurring habitats should be used in conjunction with each other as appropriate
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 6	The distribution is based on the mapping of the NSUH (Perrin et al., 2013) and the ISGS (O'Neill et al., 2013). The habitat is widespread across the SAC, but is most common on the grassy slopes. In places its occurrence is patchy. Note that further unsurveyed areas of the habitat may be present within the SAC
Vegetation composition: positive indicator species	Number at a representative number of 2m x 2m monitoring stops; within 20m surrounding area of monitoring stops	At least 7 positive indicator species present in monitoring stop or, if 5–6 present in stop, additional species within 20m of stop; this includes at least two 'high quality' positive indicator species present in stop or within 20m of stop	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the lists of positive indicator species, including high quality indicators, are also presented. A small number of additional positive indicators for upland examples of this habitat are also provided (Martin et al., 2018). These documents should be consulted for further details
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Negative indicator species collectively not more than 20% cover, with cover of an individual species not more than 10%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018), where the list of negative indicator species is presented
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation composition: woody species and bracken	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of woody species (except certain listed species) and bracken ( <i>Pteridium aquilinum</i> ) not more than 5%	Woody species that can occur above 5% cover are juniper ( <i>Juniperus communis</i> ), burnet rose ( <i>Rosa spinosissima</i> ), mountain avens ( <i>Dryas octopetala</i> ) and hoary rock-rose ( <i>Helianthemum oelandicum</i> ). However, cover of these species above 25% may indicate transition to another Annex I habitat such as Alpine and Boreal heaths (4060) or <i>Juniperus communis</i> formations (5130). Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). Scrub and bracken encroachment has been noted as an issue for this habitat in some areas in this SAC (O'Neill et al., 2013)
Vegetation structure: broadleaf herb:grass ratio	Percentage at a representative number of 2m x 2m monitoring stops	Broadleaf herb component of vegetation between 40% and 90%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). Broadleaf herb component of vegetation between 30% and 40% may be allowed to pass on expert judgement (Martin et al., 2018)



Vegetation structure: sward height	Percentage at a representative number of 2m x 2m monitoring stops	At least 30% of sward between 5cm and 40cm tall	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Vegetation structure: litter	Percentage cover at a representative number of 2m x 2m monitoring stops	Litter cover not more than 25%	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018). The sward becoming rank, with high litter cover, has been mentioned as an issue for this habitat in some areas in the SAC (O'Neill et al., 2013)
Physical structure: bare soil	Percentage cover at a representative number of 2m x 2m monitoring stops	Not more than 10% bare soil	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)
Physical structure: grazing or disturbance	Area in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or disturbance less than 20m <sup>2</sup>	Attribute and target based on O'Neill et al. (2013) and Martin et al. (2018)

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

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

To restore the favourable conservation condition of Species-rich *Nardus* grassland, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe)\* in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Areas of habitat referable to Species-rich <i>Nardus</i> grassland* have been mapped at both the Sligo and Leitrim sides of this large SAC (NPWS internal files; O'Neill et al., 2009), but further data are needed in both cases to confirm the nature and extent of the habitat area. The total area of the habitat is thus not currently known for Ben Bulben, Gleniff and Glenade Complex SAC
Habitat distribution	Occurrence	No decline, subject to natural processes	See the notes for habitat area above
Vegetation composition: positive indicator species	Number of species at a representative number of 2m x 2m monitoring stops	At least 7 positive indicator species present in monitoring stop	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014), both of which present the list of positive indicator species for this habitat. A range of positive indicator species are known to occur in the habitat in the SAC
Vegetation composition: high quality indicator species	Number of species at a representative number of 2m x 2m monitoring stops	The list of positive indicators for a monitoring stop to include at least 2 'high quality' indicator species for base-rich examples of the habitat, and at least 1 for base-poor examples	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014), both of which present the list of positive indicator species for this habitat
Vegetation composition: species richness	Number of species at a representative number of 2m x 2m monitoring stops	Species richness at each monitoring stop at least 25 species, with bryophytes and lichens included	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). Species richness is a key characteristic of 6230 <i>Nardus</i> grasslands* which distinguishes it from species-poor <i>Nardus</i> swards that are very common in the uplands of Ireland and the UK. All vascular plants, bryophytes and terricolous macrolichens are counted
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of non-native species not more than 1%	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). Non-native species can be invasive and have deleterious effects on native vegetation. A low target is set as non-native species can spread rapidly and are most easily dealt with when still at lower abundances
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Negative indicator species collectively not more than 20% cover, with cover of an individual species not more than 10%	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014), both of which present the list of negative indicator species for this habitat
Vegetation composition: <i>Sphagnum</i> cover	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of <i>Sphagnum</i> species not more than 10%	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). High cover of <i>Sphagnum</i> mosses is not characteristic of 6230 <i>Nardus</i> grasslands* and may indicate changes in hydrology or soil nutrients within the habitat, but is more likely to indicate that the community is inherently a marginal example of the habitat
Vegetation composition: <i>Polytrichum</i> cover	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of <i>Polytrichum</i> species not more than 25%	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). High cover of <i>Polytrichum</i> mosses is not characteristic of 6230 <i>Nardus</i> grasslands*. Such levels may indicate changes in hydrology or soil nutrients within the habitat, but are more likely to indicate that the community is inherently a marginal example of the habitat

Vegetation composition: shrubs, bracken and heath cover	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of woody species (shrubs, heathers) and bracken ( <i>Pteridium aquilinum</i> ) collectively not more than 5%	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). High cover of bracken indicates that the habitat may be undergoing succession towards a dense bracken community, and high cover of native trees and shrubs may indicate that the habitat is moving towards scrub or woodland due to lack of grazing. High cover of heather species (above 25%) may indicate transition to a heathland habitat
Vegetation structure: forb to graminoid ratio	Percentage at a representative number of 2m x 2m monitoring stops	Forb component of forb:graminoid ratio is 20-90%	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). Forb richness is characteristic of conservation value swards
Vegetation structure: sward height	Percentage at a representative number of 2m x 2m monitoring stops	At least 25% of sward between 5cm and 50cm tall	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). The lower and upper height limits aim to record overgrazing and undergrazing respectively
Vegetation structure: litter cover	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of litter not more than 20%	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). High levels of leaf litter can be indicative of undergrazing, with a resulting impact on species richness
Physical structure: bare ground	Percentage cover at a representative number of 2m x 2m monitoring stops	Not more than 10% bare ground	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). Notable areas of bare ground can result from overgrazing, use of machinery, human trampling, etc. If excessive, this can result in loss of characteristic species and habitat damage
Physical structure: grazing or disturbance	Area in local vicinity of a representative number of monitoring stops	Area of the habitat showing signs of serious grazing or disturbance less than 20m <sup>2</sup>	Attribute and target based on O'Neill et al. (2013) and Perrin et al. (2014). Serious overgrazing or disturbance can impact on species richness, nutrient status, soil stability and habitat integrity
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	Relevant nutrients and their natural ranges are yet to be defined. However, nitrogen deposition is noted as being relevant to this habitat (NPWS, 2013)

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

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

**To maintain the favourable conservation condition of Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 1.9ha. The upland cliff ledge variant of the habitat was recorded on many of the limestone cliffs in the SAC by Perrin et al. (2013). Further information can be found in Perrin et al. (2013). A summary of the mapping methodology can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats. An additional area of 0.21ha of this habitat was mapped by the Irish Semi-natural Grasslands Survey (O'Neill et al., 2013) on the south side of Glencar Lough. This brings the total area of the habitat known from the SAC to c.2.1ha
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 7	The distribution is based on the mapping of the NSUH (Perrin et al., 2013) and the ISGS (O'Neill et al., 2013)
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	Relevant nutrients and their natural ranges are yet to be defined. However, nitrogen deposition is noted as being relevant to this habitat (NPWS, 2013)
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Perrin et al. (2013) recorded two tall herb communities of the upland ledge variant of the habitat within this SAC, namely TH2 - <i>Cochlearia pyrenaica</i> tall herb vegetation and TH3 - <i>Sedum rosea-Angelica sylvestris</i> tall herb vegetation. Further information on these communities is presented in Perrin et al. (2014)
Vegetation composition: number of positive indicator species	Number of species at a representative number of monitoring stops	At least one positive indicator species at each monitoring stop	The list of positive indicator species for the upland variant of this habitat can be found in the Article 17 habitat assessment for 6430 (NPWS, 2019). See Perrin et al. (2013, 2014) for further details
Vegetation composition: cover of positive indicator species	Percentage cover at a representative number of monitoring stops	Cover of positive indicator species at least 25%	The list of positive indicator species for the upland variant of this habitat can be found in the Article 17 habitat assessment for 6430 (NPWS, 2019). See Perrin et al. (2013, 2014) for further details
Vegetation composition: non-native species	Percentage cover at a representative number of monitoring stops	Cover of non-native species less than 1%	See NPWS (2019) and Perrin et al. (2013, 2014) for further details
Vegetation structure: height/flowering	Percentage/occurrence at a representative number of monitoring stops	At least 50% of tall herb stems should be greater than 20cm tall or signs of flowering/ability to flower should be present	See NPWS (2019) and Perrin et al. (2013, 2014) for further details
Vegetation structure: grazing	Percentage of flowering tall herb shoots grazed at a representative number of monitoring stops	Live shoots of flowering tall herb shoots showing signs of grazing less than 50%	See NPWS (2019) and Perrin et al. (2013, 2014) for further details

Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of disturbed bare ground in monitoring stop less than 25% and less than 10% in local vicinity of monitoring stop	See NPWS (2019) and Perrin et al. (2013, 2014) for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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. Any new records should be considered within this attribute

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 7130 Blanket bogs (\* if active bog)

**To restore the favourable conservation condition of Blanket bogs (\* if active bog) in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Perrin et al. (2013) state that the total area of blanket bog in the SAC is 2,134.5ha (35.6% of the SAC). This comprises 2,083.5ha of active blanket bog and 51.0ha of inactive blanket bog. Perrin et al. (2013) report obvious losses of habitat since 1995 of approximately 0.86ha. However, this is almost certainly an underestimate, as chronic losses due to erosion since 1995 cannot be quantified (106.5ha were mapped as eroding blanket bog by Perrin et al., 2013). It should be noted also that further restoration of blanket bog would be required in order to fulfil the targets for peat formation and hydrology presented below. See the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 8	Blanket bog was recorded by Perrin et al. (2013) throughout Ben Bulben, Gleniff and Glenade Complex SAC. See Perrin et al. (2013) for further information. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	See the uplands supporting document for further details
Ecosystem function: peat formation	Active blanket bog as a proportion of the total area of Annex I blanket bog habitat	At least 99% of the total Annex I blanket bog area is active	From the areas given by Perrin et al. (2013) above, 97.6% of the Annex I blanket bog habitat is currently active. See the uplands supporting document for further details
Ecosystem function: hydrology	Flow direction, water levels, occurrence of drains and erosion gullies	Natural hydrology unaffected by drains and erosion	Further details and a brief discussion of restoration potential is presented in the uplands supporting document
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Perrin et al. (2013) recorded five different active blanket bog communities within this SAC. Data on the abundance of these communities is reproduced in the uplands supporting document. Further information on the vegetation communities associated with this habitat is presented in Perrin et al. (2014). See also the Irish Vegetation Classification (Perrin, 2017; <a href="http://www.biodiversityireland.ie/projects/ivc-classification-explorer">www.biodiversityireland.ie/projects/ivc-classification-explorer</a> )
Vegetation composition: positive indicator species	Number of species at a representative number of 2m x 2m monitoring stops	Number of positive indicator species at each monitoring stop at least seven	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is presented. See the uplands supporting document for further details
Vegetation composition: lichens and bryophytes	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of bryophytes or lichens, excluding <i>Sphagnum fallax</i> , at least 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: potential dominant species	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of each of the potential dominant species less than 75%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details, including the list of potentially dominant species

Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species is presented. See the uplands supporting document for further details
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details. Rhododendron ( <i>Rhododendron ponticum</i> ) and the non-native moss <i>Campylopus introflexus</i> were recorded within this habitat in the SAC by Perrin et al. (2013)
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: <i>Sphagnum</i> condition	Condition at a representative number of 2m x 2m monitoring stops	Less than 10% of the <i>Sphagnum</i> cover is crushed, broken and/or pulled up	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: signs of browsing	Percentage of shoots browsed at a representative number of 2m x 2m monitoring stops	Last complete growing season's shoots of ericoids, crowberry ( <i>Empetrum nigrum</i> ) and bog-myrtle ( <i>Myrica gale</i> ) showing signs of browsing collectively less than 33%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: burning	Occurrence in local vicinity of a representative number of monitoring stops	No signs of burning in sensitive areas, into the moss, liverwort or lichen layer or exposure of peat surface due to burning	Attribute and target based on Perrin et al. (2014), where the list of sensitive areas is presented. See the uplands supporting document for further details
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: drainage	Percentage area in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: erosion	Percentage area in local vicinity of a representative number of monitoring stops	Less than 5% of the greater bog mosaic comprises erosion gullies and eroded areas	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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. Any new records should be considered within this attribute. See the uplands supporting document for further details

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 7140 Transition mires and quaking bogs

**To maintain the favourable conservation condition of Transition mires and quaking bogs in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Transition mire was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 4.1ha, covering only c.0.1% of the SAC. Perrin et al. (2013) report no significant losses of area since 1995. Further details on this and the following attributes can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats where a summary of the mapping methodology is also presented
Habitat distribution	Occurrence	No decline from current distribution, subject to natural processes. See map 9	Transition mire was recorded by Perrin et al. (2013) scattered throughout the SAC. See Perrin et al. (2013) for further information. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	See the uplands supporting document for further details
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Perrin et al. (2013) recorded three different transition mire communities within this SAC. Data on the abundance of these communities is reproduced in the uplands supporting document. Further information on vegetation communities associated with this habitat is presented in Perrin et al. (2014). See also the Irish Vegetation Classification (Perrin, 2018; <a href="http://www.biodiversityireland.ie/projects/ivc-classification-explorer">www.biodiversityireland.ie/projects/ivc-classification-explorer</a> )
Vegetation composition: number of positive indicator species	Number at a representative number of 2m x 2m monitoring stops	Number of positive indicator species at least three for in-filling pools and flushes and at least six for fens	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: number of core positive indicator species	Number of species at a representative number of 2m x 2m monitoring stops	At least one core positive indicator species present	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: cover of positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of positive indicator species is at least 25%	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: height	Percentage at a representative number of 2m x 2m monitoring stops	Proportion of live leaves and/or flowering shoots of vascular plants that are more than 15cm above the ground surface should be at least 50%	Attribute and target based on Perrin et al. (2014). This attribute is only applicable to fen and flush examples of the habitat, not to in-filling pool examples. See the uplands supporting document for further details



Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: drainage	Percentage area in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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. Any new records should be considered within this attribute. See the uplands supporting document for further details

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 7220 Petrifying springs with tufa formation (Cratoneurion)\*

**To maintain the favourable conservation condition of Petrifying springs with tufa formation (Cratoneurion)\* in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Square metres	Area stable or increasing, subject to natural processes	Within Ben Bulben, Gleniff and Glenade Complex SAC, 71 polygons were recorded as containing petrifying springs during the National Survey of Upland Habitats (NSUH; Perrin et al., 2013), with an area of 2.6ha (c.26,000m <sup>2</sup> ). The approach to mapping conducted during the NSUH is detailed in Perrin et al. (2014). Note that the NSUH did not undertake a conservation status assessment of the habitat in the SAC; thus, it is not included in the 000623 uplands supporting document. Lyons (2015) mapped 17 springs in total: at Glencar (sub-sites PS038a and PS038b), Glenade, below Eagle's Rock (PS040a-e), Gleniff, Annacoona (PS058a-e), Cormac Reagh's Hole (PS106), Benbulbin Corrie (PS107), Benwiskin (PS108), Eagle's Rock, Glenade (PS113) and Larganavaddoge (PS115), totalling c.10,840m <sup>2</sup> . See Perrin et al. (2013) and Lyons (2015) for further details. See Lyons and Kelly (2016) for further details on this and all attributes. It is important to note that further unmapped springs may be present in the SAC
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 10	See map 10 for the point locations mapped by Lyons (2015) and the point locations of the centroids of the polygons containing the habitat recorded by Perrin et al. (2013)
Hydrological regime: height of water table; water flow	Metres; metres per second	Maintain appropriate hydrological regimes	Petrifying springs rely on permanent irrigation, usually from upwelling groundwater sources or seepage sources (Lyons and Kelly, 2013). In karst areas, water tends to flow away rapidly over bare rock surfaces, even on fairly flat ground (Lyons and Kelly, 2013). Water flow should not be altered anthropogenically. See Lyons and Kelly (2016) for further details. Conifer plantations adjoin the sub-sites PS058e and PS106; harvesting of trees poses a potential risk to the wetland habitats due to disturbance and run-off associated with felling and removing trees (Lyons, 2015)
Physical structure: tufa formations	Seepage rate to the spring and groundwater quality (saturated calcium carbonate, pH, temperature and alkalinity conditions)	Maintain appropriate levels of tufa formation	Petrifying springs are springs that typically form small calcareous or 'tufa' deposits. On contact with the atmosphere at the spring head, carbon dioxide is lost from calcium saturated water to the atmosphere or is depleted by the photosynthetic activities of plants. This results in the precipitation of a calcium carbonate marl or tufa. Seepage flow rates are crucial for the development of tufa. See Lyons (2015) for the main tufa types at the sub-sites surveyed in the SAC
Ecosystem function: water quality - nitrate level	mg/l	Maintain nitrate level at less than 10mg/l	Attribute and target based on Lyons and Kelly (2016). Lyons (2015) recorded baseline nitrate levels of: 2.58mg/l at PS038b; 1.87mg/l at PS040d; <0.07mg/l at PS058b; 1.34mg/l at PS058d; 0.20mg/l at PS058e; 0.39mg/l at PS106; 0.81mg/l at PS107; 0.94mg/l at PS108; 0.32mg/l at PS113 and <0.07mg/l at PS115
Ecosystem function: water quality - phosphate level	µg/l	Maintain phosphate level to less than 15µg/l	Attribute and target based on Lyons and Kelly (2016). Lyons (2015) recorded baseline phosphate levels of: 9µg/l at PS038b; 12µg/l at PS040d; 6µg/l at PS058b; 9µg/l at PS058d; 5µg/l at PS058e; 6µg/l at PS106; 5µg/l at PS107; 5µg/l at PS108; 8µg/l at PS113 and 11µg/l at PS115

Vegetation composition: community diversity	Variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Lyons and Kelly (2016) describe eight plant communities of petrifying springs in Ireland based on relevé data. At PS038a and PS038b, the main community type recorded by Lyons (2015) was <i>Palustriella commutata-Geranium robertianum</i> springheads; that at PS040d and PS040e was <i>Palustriella falcata-Carex panicea</i> springs; that at PS058e was <i>Eucladium verticillatum-Pellia endiviifolia</i> tufa cascades; <i>Saxifraga aizoides-Seligeria oelandica</i> springs were recorded at PS058b, PS058c, PS058d, PS107, PS108, PS113 and PS115; and, at PS106, <i>Palustriella commutata-Agrostis stolonifera</i> springheads, with <i>Schoenus nigricans</i> springs were recorded. Further information on the vegetation communities associated with the habitat is presented in Lyons and Kelly (2016)
Vegetation composition: positive indicator species	Number per spring	At least three positive/high quality indicator species as listed in Lyons and Kelly (2016) and no loss from baseline number	Attribute and target based on Lyons and Kelly (2016), where the lists of positive and high quality indicator species are presented. See Lyons (2015) for baseline numbers and lists of species recorded in the surveyed springs in the SAC
Vegetation composition: negative indicator species	Cover (DAFOR scale)	Potentially negative indicator species should not be Dominant or Abundant; potentially negative woody species should be absent in unwooded springs; invasive species should be absent	Based on Lyons and Kelly (2016), where the lists of potentially negative herbaceous, bryophyte, algal and woody species are presented. See Lyons and Kelly (2016) for further details on potentially negative and potentially invasive species. The potentially negative woody species ash ( <i>Fraxinus excelsior</i> ) was recorded at PS040d, and hawthorn ( <i>Crataegus monogyna</i> ) at PS040d and PS040e, both unwooded springs, but were very rare overall. Lyons (2015) recorded the potentially negative bryophytes <i>Brachythecium rivulare</i> at PS058a and PS106, <i>Cratoneuron filicinum</i> at PS058b, PS058d and PS058e and <i>Platyhypnidium riparioides</i> at PS038a and the potentially negative herbaceous species soft rush ( <i>Juncus effusus</i> ) at PS058b and PS107 and the non-native New Zealand willowherb ( <i>Epilobium brunnescens</i> ) at PS038b, PS058b, PS058e, PS107 and PS113, but none were Dominant or Abundant alone or in combination and the attribute was passed by Lyons (2015)
Vegetation composition: algal cover	Percentage cover at, and in local vicinity of, a representative number of monitoring stops	Cover of algae less than 2%	Algal cover is indicative of nutrient enrichment from multiple sources (McBride et al., 2011)
Vegetation structure: sward height	Centimetres	Field layer height between 10cm and 50cm (except for bryophyte-dominated ground <10cm)	Attribute and target based on Lyons and Kelly (2016)
Physical structure: trampling/dung	Cover (DAFOR scale)	Cover should not be Dominant or Abundant	Attribute and target based on Lyons and Kelly (2016)
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat; maintain features of local distinctiveness, subject to natural processes	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). Of particular note, the Near Threatened liverwort <i>Leiocolea bantriensis</i> (Lockhart et al., 2012) was recorded at PS058b. The Near Threatened mosses <i>Hymenostylium recurvirostrum</i> var. <i>insigne</i> , <i>Orthothecium rufescens</i> and <i>Seligeria patula</i> and the Vulnerable moss <i>Seligeria oelandica</i> (Lockhart et al., 2012) were recorded at various sub-sites in the SAC by Lyons (2015). See also the conservation objective for Geyer's whorl snail ( <i>Vertigo geyeri</i> ; Annex II species code 1013) in this volume

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 7230 Alkaline fens

**To restore the favourable conservation condition of Alkaline fens in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Alkaline fen was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 22.7ha, covering only 0.4% of the SAC. Perrin et al. (2013) report obvious losses of habitat of <0.01ha since 1995. Further details on this and the following attributes can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats where a summary of the mapping methodology is also presented
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 11	Perrin et al. (2013) recorded alkaline fen across the SAC on lower slopes, most frequently below the cliffs at Annacoona. See Perrin et al. (2013) for further details. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	See the uplands supporting document for further details
Ecosystem function: peat formation	Percentage cover of peat-forming vegetation and water table levels	Maintain active peat formation, where appropriate	In order for peat to form, water levels need to be slightly below or above the soil surface for c.90% of the time
Ecosystem function: hydrology	Metres	Maintain, or where necessary restore, appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Maintenance of groundwater, surface water flows and water table levels within natural ranges is essential for this wetland habitat
Ecosystem function: water quality	Water chemistry measures	Maintain appropriate water quality, particularly pH and nutrient levels, to support the natural structure and functioning of the habitat	Fens receive natural levels of nutrients (e.g. iron, magnesium and calcium) from water sources. However, they are generally poor in nitrogen and phosphorus, with the latter tending to be the limiting nutrient under natural conditions. Water supply should be also relatively calcium-rich
Community diversity	Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Perrin et al. (2013) recorded four different alkaline fen vegetation communities within this SAC. Data on the abundance of these communities is reproduced in the uplands supporting document. Further information on vegetation communities associated with this habitat is presented in Perrin et al. (2014). See also the Irish Vegetation Classification (Perrin, 2018; <a href="http://www.biodiversityireland.ie/projects/ivc-classification-explorer">www.biodiversityireland.ie/projects/ivc-classification-explorer</a> )
Vegetation composition: number of positive indicator species (brown mosses)	Number of species at a representative number of 2m x 2m monitoring stops	Number of brown moss species present at each monitoring stop at least one	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details

Vegetation composition: number of positive indicator species (vascular plants)	Number of species at a representative number of 2m x 2m monitoring stops	Number of positive vascular plant indicator species present at each monitoring stop is at least two for small-sedge flushes and at least three for black bog-rush ( <i>Schoenus nigricans</i> ) flush and bottle sedge ( <i>Carex rostrata</i> ) fen	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: cover of positive indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of brown moss species and positive vascular plant indicator species at least 20% for small-sedge flushes and at least 75% cover for black bog-rush ( <i>Schoenus nigricans</i> ) flush and bottle sedge ( <i>Carex rostrata</i> ) fen	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: non-native species	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details. No non-native species were recorded within this habitat during the NSUH (Perrin et al., 2013)
Vegetation composition: native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: soft rush and common reed cover	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of soft rush ( <i>Juncus effusus</i> ) and common reed ( <i>Phragmites australis</i> ) less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: height	Percentage of leaves/shoots at a representative number of 2m x 2m monitoring stops	Proportion of live leaves and/or flowering shoots of vascular plants that are more than 5cm above the ground surface should be at least 50%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: disturbed bare ground	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: drainage	Percentage area in local vicinity of a representative number of monitoring stops	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: tufa formations	Percentage cover in local vicinity of a representative number of 2m x 2m monitoring stops	Disturbed proportion of vegetation cover where tufa is present is less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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. Any new records should be considered within this attribute. See the uplands supporting document for further details

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 8110 Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*)

To maintain the favourable conservation condition of Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Siliceous scree of the montane to snow levels ( <i>Androsacetalia alpinae</i> and <i>Galeopsietalia ladani</i> ) was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 37.6ha. This covers 0.6% of the SAC. Perrin et al. (2013) report no significant losses of area of the habitat in the SAC since 1995. Further information can be found in Perrin et al. (2013). Further details on this and the following attributes can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats where a summary of the mapping methodology is also presented
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 12	In Ben Bulben, Gleniff and Glenade Complex SAC, siliceous scree was recorded by Perrin et al. (2013) most notably on the slopes of Tievebaun Mountain and Truskmore. See Perrin et al. (2013) for further information. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	See the uplands supporting document for further details
Vegetation composition: lichens and bryophytes	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of bryophytes and non-crustose lichen species at least 5%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Proportion of vegetation composed of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is presented. See the uplands supporting document for further details
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Proportion of vegetation composed of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details. No non-native species were recorded within this habitat by Perrin et al. (2014)
Vegetation composition: positive indicator species	Number of species in local vicinity of a representative number of monitoring stops	At least one positive indicator species present in vicinity of each monitoring stop in block scree	Attribute and target based on Perrin et al. (2014). The list of positive indicator species for this habitat is also presented in Perrin et al. (2014) and is the same as for 8220 Siliceous rocky slopes. Further details can be found in the uplands supporting document
Vegetation composition: grass species and dwarf shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of grass species and dwarf shrubs less than 20%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: bracken, native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of bracken ( <i>Pteridium aquilinum</i> ), native trees and shrubs less than 25%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: grazing and browsing	Percentage of leaves/shoots grazed/browsed at a representative number of 2m x 2m monitoring stops	Live leaves of forbs and shoots of dwarf shrubs showing signs of grazing or browsing collectively less than 50%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details

Physical structure: disturbance	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Ground disturbed by human and animal paths, scree running or vehicles less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat and no decline in status of hepatic mats associated with this habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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, including a number of rare and threatened bryophyte species. Hepatic mats of the <i>Calluna vulgaris-Herbertus aduncus</i> community were recorded within this habitat during the NSUH (Perrin et al., 2013). See Perrin et al. (2013) for further details. Any new records should also be considered within this attribute. See the uplands supporting document for further information

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 8120 Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)

**To restore the favourable conservation condition of Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii) in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii) was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 40.7ha. This covers 0.7% of the SAC. Perrin et al. (2013) report obvious losses of habitat of <0.01ha since 1995. Further information can be found in Perrin et al. (2013). Further details on this and the following attributes can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats where a summary of the mapping methodology is also presented
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 13	Calcareous scree was recorded by Perrin et al. (2013) throughout Ben Bulben, Gleniff and Glenade Complex SAC, notably on the steep upper slopes of Ben Bulben, the summit area and slopes of Kings Mountain, the slopes of Benwiskin, below the corrie of Annacoona, at Glencarbury, south of Slievemore, the lower slopes of Tievebaun and at Cloontypruglish and Craumpaun and Glencar. See Perrin et al. (2013) for further information. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil pH and nutrient status within natural ranges	See the uplands supporting document for further details
Vegetation composition: positive indicator fern and <i>Saxifraga</i> species	Number of species in local vicinity of a representative number of monitoring stops	Number of ferns and <i>Saxifraga</i> indicators in vicinity of each monitoring stop at least one	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: positive indicator species	Number of species in local vicinity of a representative number of monitoring stops	Number of positive indicator species in vicinity of each monitoring stop at least three	Attribute and target based on Perrin et al. (2014), where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: grass species and dwarf shrubs	Percentage cover at a representative number of 2m x 2m monitoring stops	Cover of dwarf shrubs and grasses, excluding blue moor-grass ( <i>Sesleria caerulea</i> ), collectively less than 20%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation composition: negative indicator species	Percentage cover at a representative number of 2m x 2m monitoring stops	Proportion of vegetation composed of negative indicator species less than 1%	Attribute and target based on Perrin et al. (2014), where the list of negative indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: non-native species	Percentage cover at a representative number of 2m x 2m monitoring stops	Proportion of vegetation composed of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). Excessive cover of the non-native New Zealand willowherb ( <i>Epilobium brunnescens</i> ) was recorded in the habitat in the SAC by Perrin et al. (2013). See the uplands supporting document for further details
Vegetation composition: bracken, native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of bracken ( <i>Pteridium aquilinum</i> ), native trees and shrubs less than 25%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details



Vegetation structure: grazing and browsing	Percentage of leaves/shoots grazed/browsed at a representative number of 2m x 2m monitoring stops	Live leaves of forbs and shoots of dwarf shrubs showing signs of grazing or browsing collectively less than 50%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Physical structure: disturbance	Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Ground disturbed by human and animal paths, scree running, vehicles less than 10%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species on the Flora (Protection) Order, 2015 and/or Red Lists (Byrne et al., 2009; Regan et al., 2010; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.; see Nelson et al., 2019, 2021). 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, including a number of rare and threatened bryophyte species, the Vulnerable holly fern ( <i>Polystichum lonchitis</i> ) and the Near Threatened species Irish saxifrage ( <i>Saxifraga rosacea</i> subsp. <i>rosacea</i> ) and moonwort ( <i>Botrychium lunaria</i> ) which were recorded in the habitat in the SAC. See Perrin et al. (2013) for further information. Any new records should be considered within this attribute. See the uplands supporting document for further details

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 8210 Calcareous rocky slopes with chasmophytic vegetation

**To restore the favourable conservation condition of Calcareous rocky slopes with chasmophytic vegetation in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area increasing, subject to natural processes	Ben Bulben, Gleniff and Glenade Complex SAC was surveyed as part of the National Survey of Upland Habitats (NSUH; Perrin et al., 2013, 2014). Calcareous rocky slopes with chasmophytic vegetation was mapped in detail for the SAC and the total area of the qualifying habitat stated by Perrin et al. (2013) is 58.3ha. This covers 1.0% of the SAC. Perrin et al. (2013) report obvious losses of habitat since 1995 of approximately 0.04ha. Further information can be found in Perrin et al. (2013). Further details on this and the following attributes can be found in the Ben Bulben, Gleniff and Glenade Complex SAC conservation objectives supporting document for upland habitats where a summary of the mapping methodology is also presented
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 14	Calcareous rocky slopes was recorded throughout Ben Bulben, Gleniff and Glenade Complex SAC by Perrin et al. (2013), most notably at Benwiskin, Annacoona and the cliffs at and eastward of Cloontyprughlish and Crumpaun. See Perrin et al. (2013) for further information. A summary of the mapping methodology is presented in the uplands supporting document
Ecosystem function: soil nutrients	Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain pH and soil nutrient status within natural ranges	See the uplands supporting document for further details
Vegetation composition: positive indicator fern and <i>Saxifraga</i> species	Number of species in local vicinity of a representative number of monitoring stops	Number of ferns and <i>Saxifraga</i> indicators in vicinity of each monitoring stop at least one	Attribute and target based on Perrin et al. (2014) where the list of positive indicator species for this habitat is also presented. See the uplands supporting document for further details
Vegetation composition: positive indicator species	Number of species in local vicinity of a representative number of monitoring stops	Number of positive indicator species in vicinity of each monitoring stop at least three	Attribute and target based on Perrin et al. (2014) where the list of positive indicator species for this habitat is presented. Further details can be found in the uplands supporting document
Vegetation composition: non-native species	Percentage cover in local vicinity of a representative number of monitoring stops	Proportion of vegetation composed of non-native species less than 1%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details. Perrin et al. (2013) recorded excessive cover of the non-native New Zealand willowherb ( <i>Epilobium brunnescens</i> ) in the habitat in the SAC
Vegetation composition: bracken, native trees and shrubs	Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of bracken ( <i>Pteridium aquilinum</i> ), native trees and shrubs less than 25%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details
Vegetation structure: grazing and browsing	Percentage of leaves/shoots grazed/browsed in local vicinity of a representative number of monitoring stops	Live leaves of forbs and shoots of dwarf shrubs showing signs of grazing or browsing collectively less than 50%	Attribute and target based on Perrin et al. (2014). See the uplands supporting document for further details

Indicators of local distinctiveness	Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat	This includes species on the Flora (Protection) Order, 2015 (FPO) and/or Red Lists (Byrne et al., 2009; Lockhart et al., 2012; Wyse Jackson et al., 2016, etc.). Perrin et al. (2013) compiled and mapped existing rare and notable plant records for the SAC, e.g. the FPO listed and Critically Endangered moss <i>Encalypta rhaptocarpa</i> (Lockhart et al., 2012) which was subsequently recorded in association with the habitat by Hodd (2016), and added any new records collected during the NSUH in the habitat, including a number of other rare and threatened bryophyte species and the Endangered tea-leaved willow ( <i>Salix phylicifolia</i> ) and the Vulnerable species northern rock-cress ( <i>Cardaminopsis petraea</i> ; also FPO listed) and fringed sandwort ( <i>Arenaria ciliata</i> ) (Wyse Jackson et al., 2016). See Perrin et al. (2013) for further information. Any additional records should be considered within this attribute. See the uplands supporting document for further details
-------------------------------------	--------------------------------	--	---

---

## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]

### 1013 Geyer's Whorl Snail *Vertigo geyeri*

**To maintain the favourable conservation condition of Geyer's Whorl Snail (*Vertigo geyeri*) in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:**

Attribute	Measure	Target	Notes
Distribution	Number of occupied 1km squares	No decline except through natural processes. There are two known sites for this species in the SAC within the 1km grid squares G7748, G7749, G7849, G7850 and G7542	Geyer's whorl snail ( <i>Vertigo geyeri</i> ) has been recorded from eight 1km grid squares that overlap this SAC. The location data from five of the 1km grid squares are good quality and precise. This is taken as the baseline figure. These five 1km squares are: G7748, G7749, G7849, G7850 and G7542 and only these are mapped on map 15. See details for the sites Meenaphuil (site code VgCAM01) and Tievebaun (site code VgCAM02) in Moorkens and Killeen (2011), Long and Brophy (2019) and Brophy and Long (2019). The records from the remaining three 1km squares are vague and the status of the species and/or precise location of the occupied habitat in each has not been confirmed. These squares are G7644, G7548 and G7848
Occurrence in suitable habitat	Percentage positive records in a representative number of samples	No decline, subject to natural processes. Baseline figures of at least 67% positive samples in optimal habitat and 33% in suboptimal habitat are set	The species should be present in at least 67% of sample points within areas of optimal habitat and in 33% of sample points in suboptimal habitat. See Moorkens and Killeen (2011), Brophy and Long (2019) and Long and Brophy (2019) for description of sampling and assessment methods and for definitions of optimal and suboptimal habitat
Habitat area	Hectares	Area of suitable habitat stable or increasing, subject to natural processes; no less than 12.4ha of at least suboptimal habitat	The baseline survey by Moorkens and Killeen (2011) determined that there should be at least 12.4ha of habitat in at least suboptimal condition within all occupied sites in the SAC. See Moorkens and Killeen (2011), Brophy and Long (2019) and Long and Brophy (2019) for description of sampling and assessment methods and for definitions of optimal and suboptimal habitat
Habitat quality: soil wetness	Assessment in a representative number of samples	No decline, subject to natural processes	Within occupied Geyer's whorl snail ( <i>Vertigo geyeri</i> ) habitat, soil wetness should be suitable for the species in 50% of sample points within optimal habitat and in 25% of sample points in suboptimal habitat. This should be assessed following the methodology and definitions in Moorkens and Killeen (2011), Brophy and Long (2019) and Long and Brophy (2019)

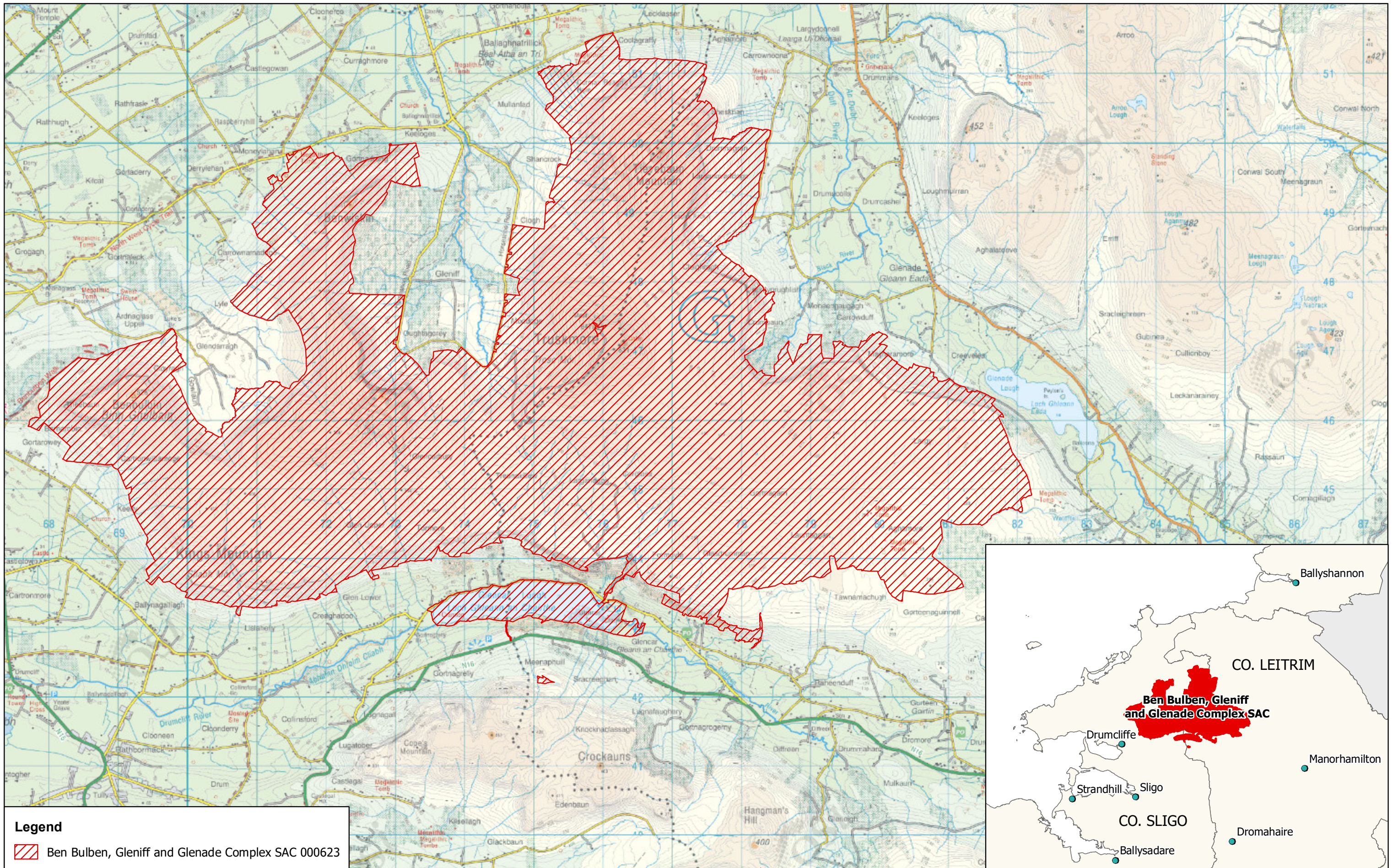
## Conservation Objectives for : Ben Bulben, Gleniff and Glenade Complex SAC [000623]


### 1355 Otter *Lutra lutra*

To maintain the favourable conservation condition of Otter (*Lutra lutra*) in Ben Bulben, Gleniff and Glenade Complex SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Distribution	Percentage positive survey sites	No significant decline	Measure based on standard otter survey technique. Favourable Conservation Status (FCS) target, based on 1980/81 survey findings, is 88% in SACs. Current range is estimated at 93.6% (Reid et al., 2013)
Extent of terrestrial habitat	Hectares	No significant decline. Area mapped and calculated as 167.31ha along river banks/lake shoreline/ around ponds	No field survey. Areas mapped to include 10m terrestrial buffer, identified as critical for otters (NPWS, 2007), along rivers and around water bodies
Extent of freshwater (river) habitat	Kilometres	No significant decline. Length mapped and calculated as 85.13km	No field survey. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982)
Extent of freshwater (lake) habitat	Hectares	No significant decline. Area mapped and calculated as 47.45ha	No field survey. Area mapped based on evidence that otters tend to forage within 80m of the shoreline (NPWS, 2007)
Couching sites and holts	Number	No significant decline	Otters need lying up areas throughout their territory where they are secure from disturbance (Kruuk and Moorhouse, 1991; Kruuk, 2006)
Fish biomass available	Kilograms	No significant decline	Broad diet that varies locally and seasonally, but dominated by fish, in particular salmonids, eels and sticklebacks in freshwater (Bailey and Rochford, 2006; Reid et al., 2013)
Barriers to connectivity	Number	No significant increase. For guidance, see map 16	Otters will regularly commute across stretches of open water up to 500m. e.g. between the mainland and an island; between two islands; across an estuary (De Jongh and O'Neill, 2010). It is important that such commuting routes are not obstructed





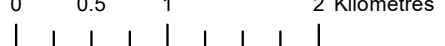
**Legend**  
 Ben Bulbin, Gleniff and Glenade Complex SAC 000623

 **An Roinn Tithíochta, Rialtais Áitiúil agus Oidhreacht**  
 Department of Housing, Local Government and Heritage

**MAP 1:  
 BEN BULBIN, GLENIFF  
 AND GLENADE COMPLEX SAC 000623  
 CONSERVATION OBJECTIVES  
 SAC DESIGNATION**  
 Map to be read in conjunction with the NPWS Conservation Objectives Document


**SITE CODE:  
 SAC 000623; version 3.02  
 CO. SLIGO/LEITRIM**

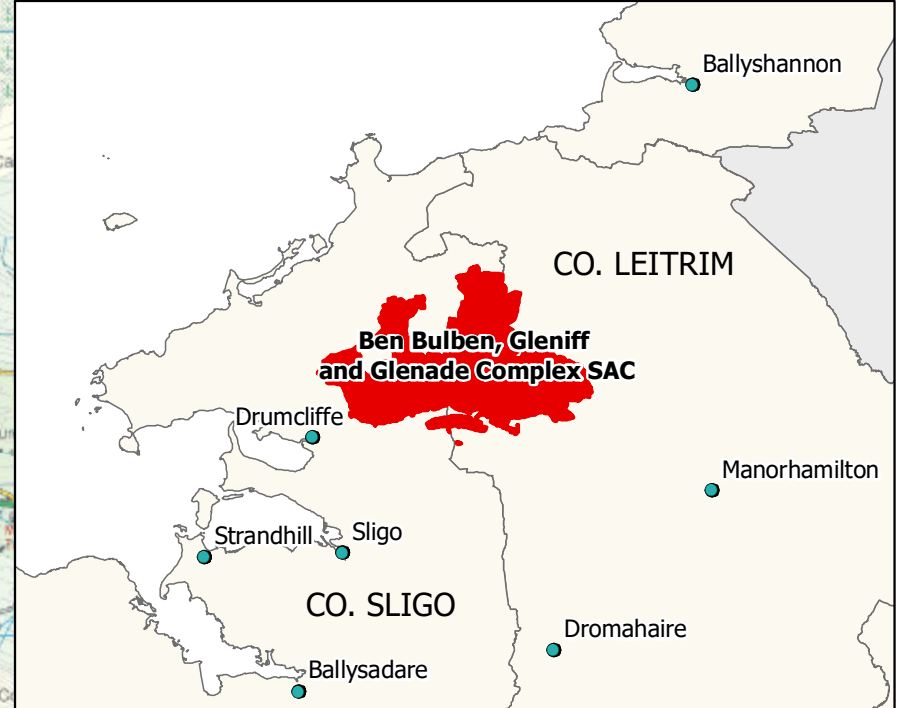
0 0.5 1 2 Kilometres



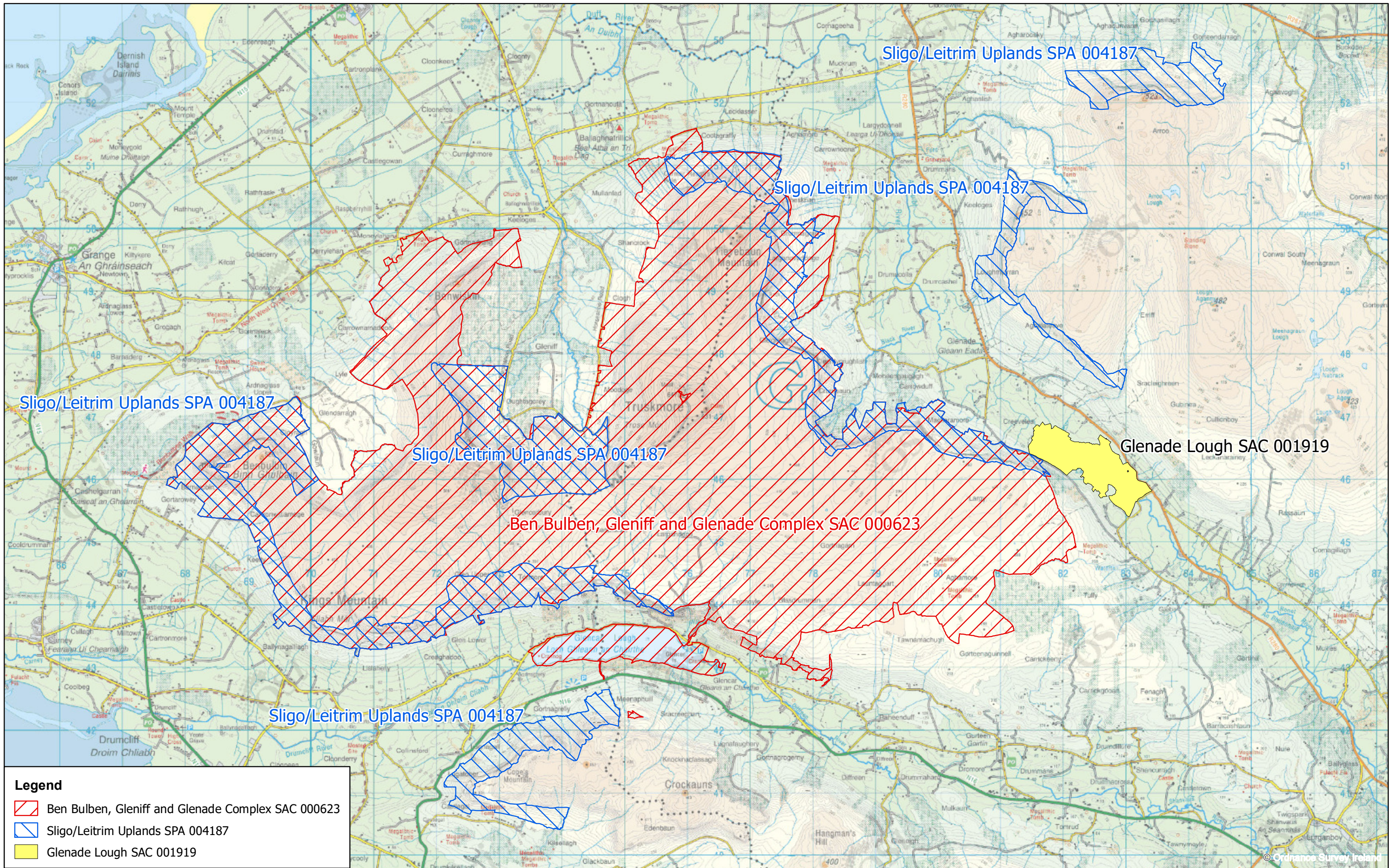
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Ordnance Survey of Ireland Licence No OSI-NMA-014. © Ordnance Survey of Ireland Government of Ireland

Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbheithnithe a déanamh ar theorainneacha na gceantar comharthaite. Suirbhéarachtá Ordonáis na hÉireann Ceadúnas Uimh OSI-NMA-014. © Suirbhéarachtá Ordonáis na hÉireann Rialtas na hÉireann



  
**Date: November 2021**



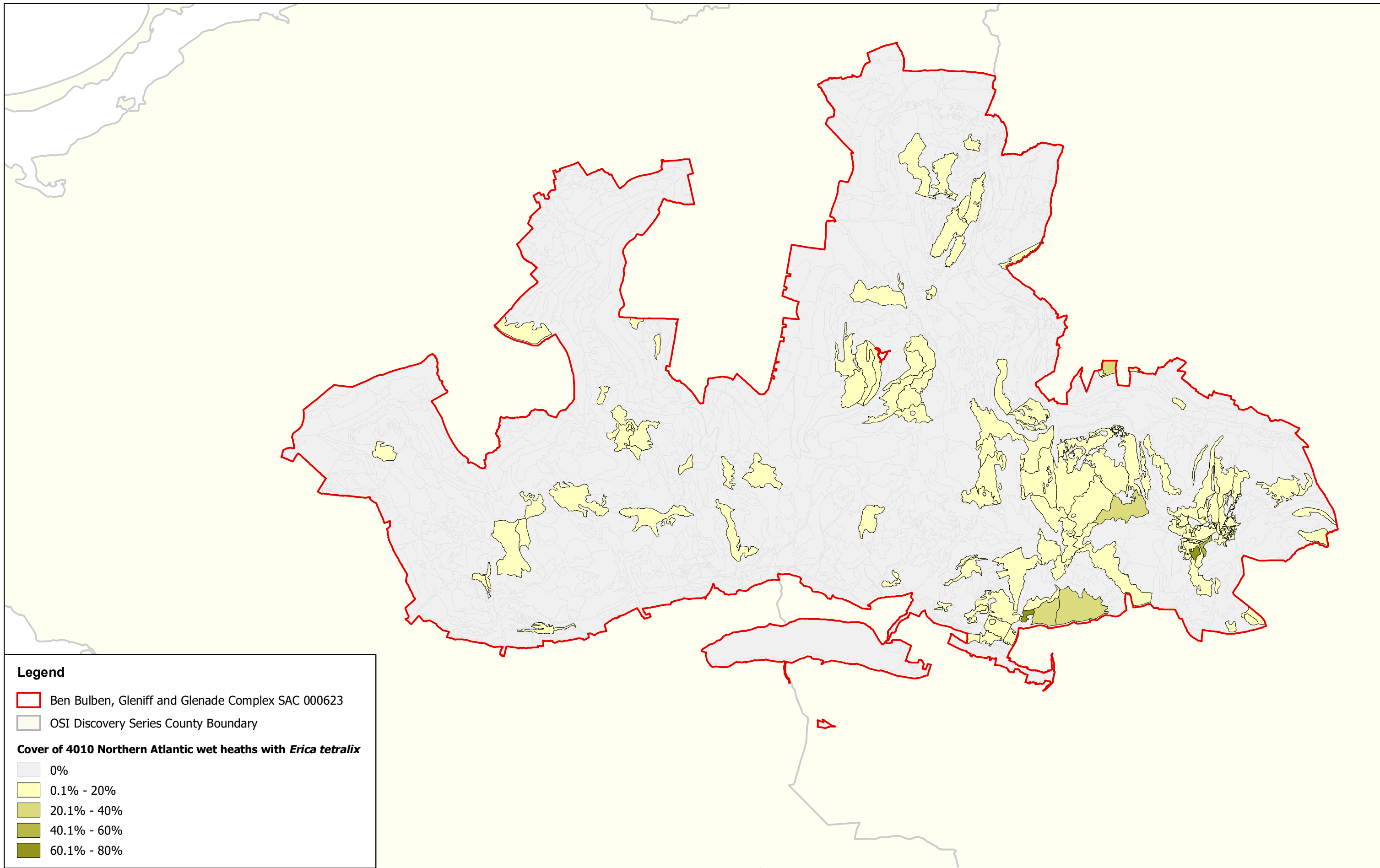




**Legend**

-  Ben Bulbin, Gleniff and Glenade Complex SAC 000623
-  Sligo/Leitrim Uplands SPA 004187
-  Glenade Lough SAC 001919





**Legend**

- Ben Bulbin, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary

**Cover of 4010 Northern Atlantic wet heaths with *Erica tetralix***

- 0%
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%



An Roinn Tithíochta,  
Rialtais Áitiúil agus Oidhreachta  
Department of Housing,  
Local Government and Heritage

**MAP 3:  
BEN BULBIN, GLENIFF  
AND GLENADE COMPLEX SAC 000623  
CONSERVATION OBJECTIVES  
WET HEATH**

Map to be read in conjunction with the NPWS Conservation Objectives Document

**SITE CODE:  
SAC 000623; version 3.02  
CO. SLIGO/LEITRIM**

0 0.5 1 2 Kilometres

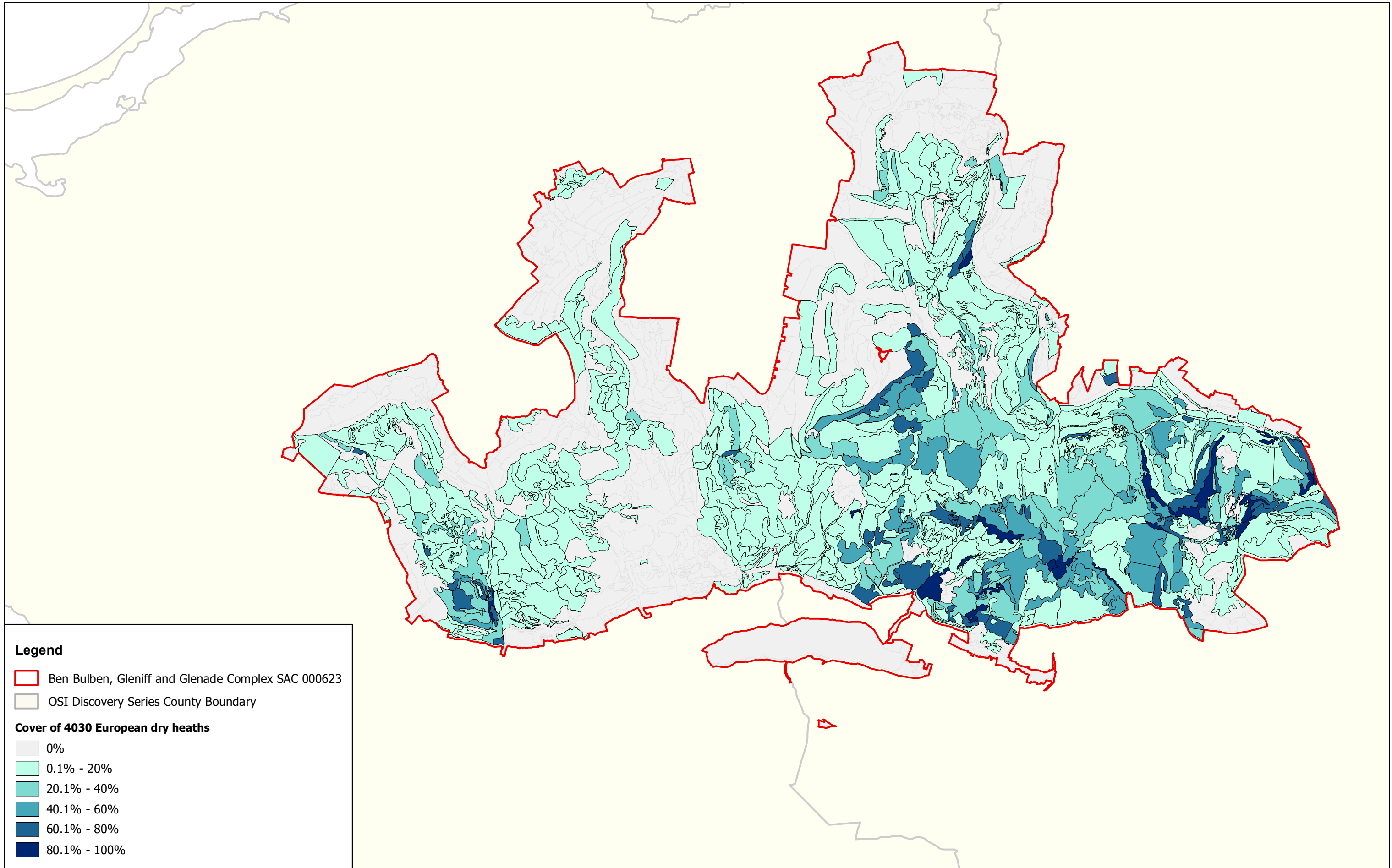
The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.  
Ordnance Survey of Ireland Licence No OSI-NMA-014. © Ordnance Survey of Ireland Government of Ireland

Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaíthe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas Uimh OSI-NMA-014. © Suirbhéarachta Ordonáis na hÉireann Rialtas na hÉireann



Date: December 2021





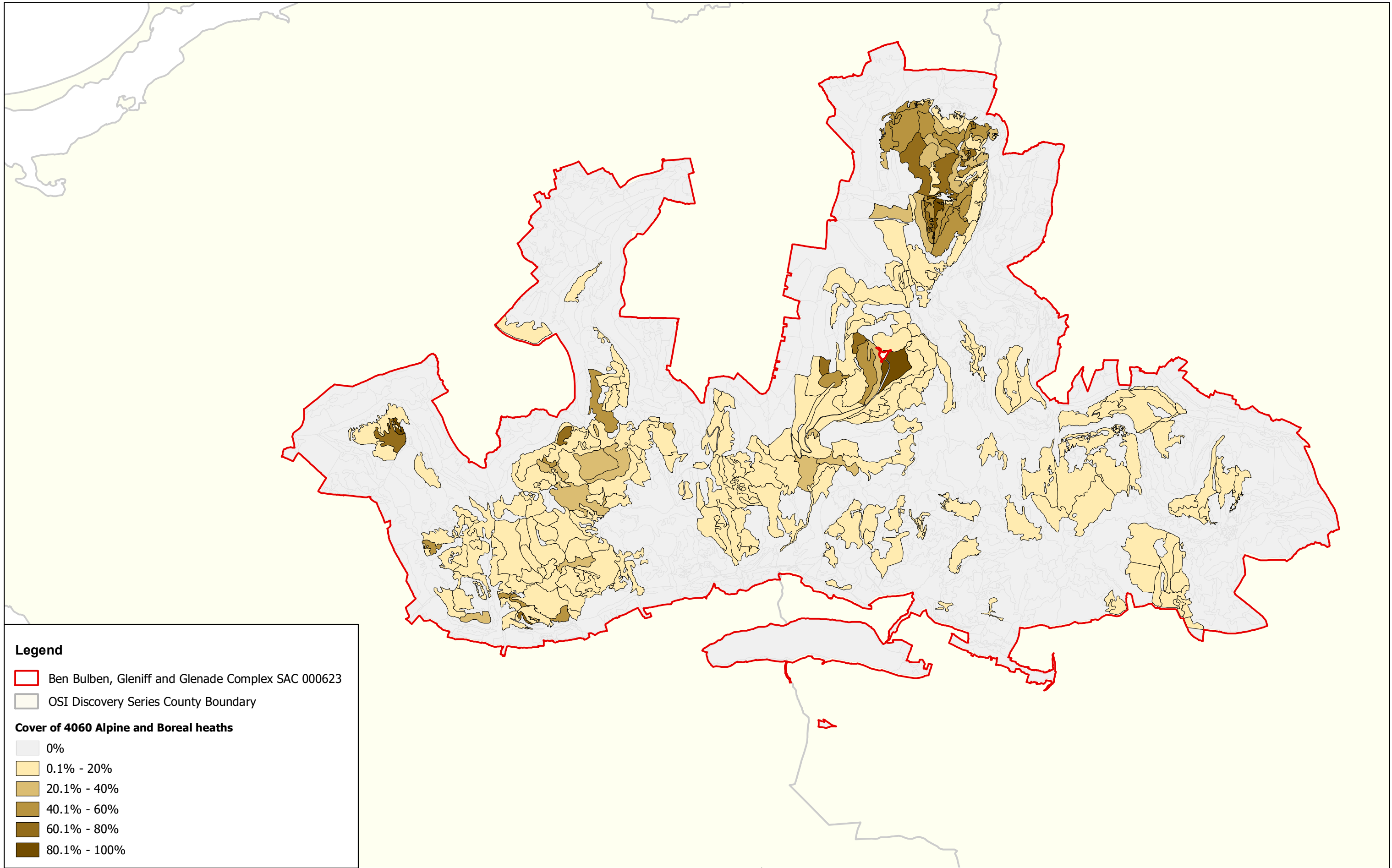
**Legend**

- Ben Bulbin, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary

**Cover of 4030 European dry heaths**

- 0%
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%
- 80.1% - 100%



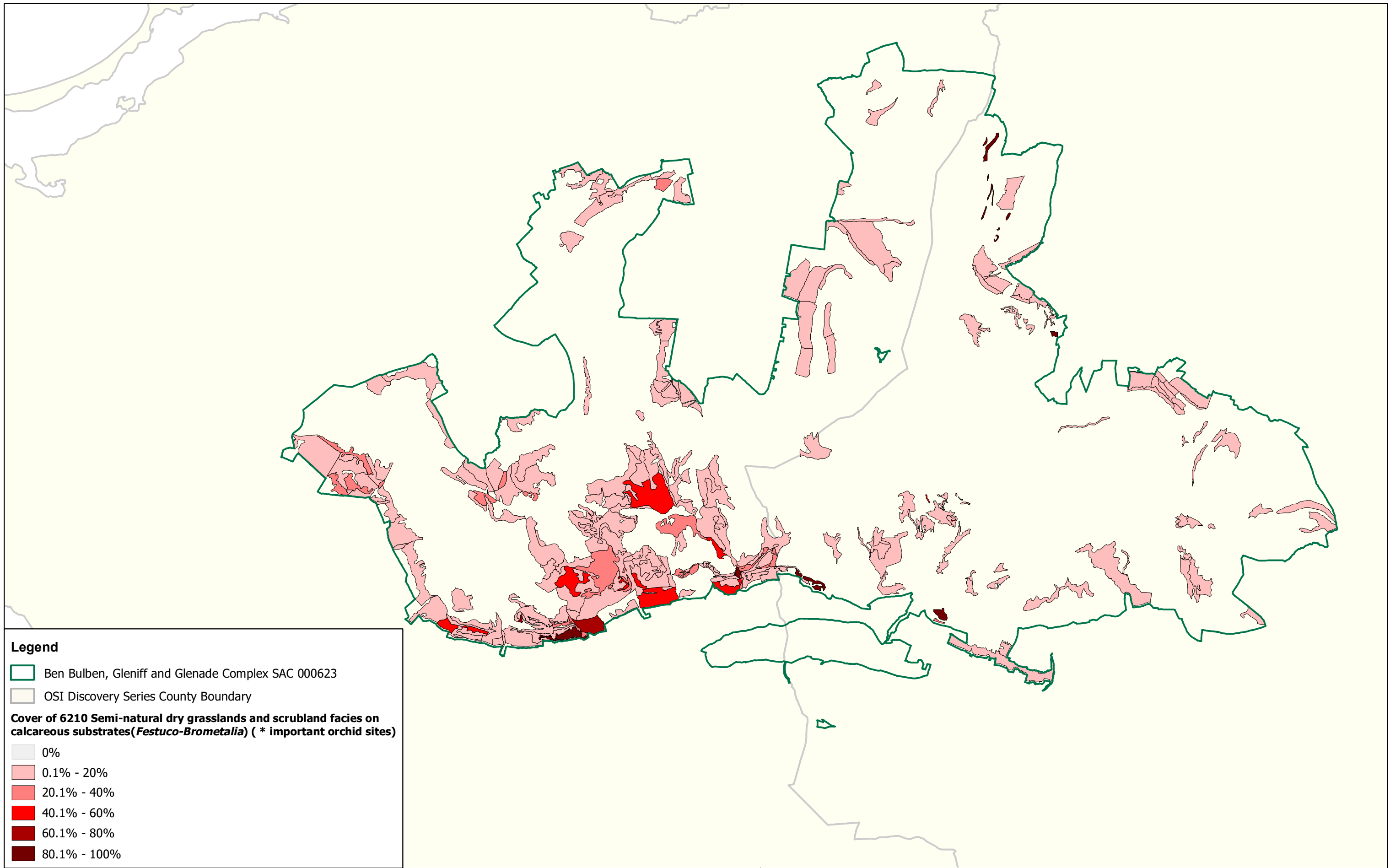


**Legend**

- Ben Bulbin, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary

**Cover of 4060 Alpine and Boreal heaths**

- 0%
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%
- 80.1% - 100%



**Legend**

Ben Bulbin, Gleniff and Glenade Complex SAC 000623

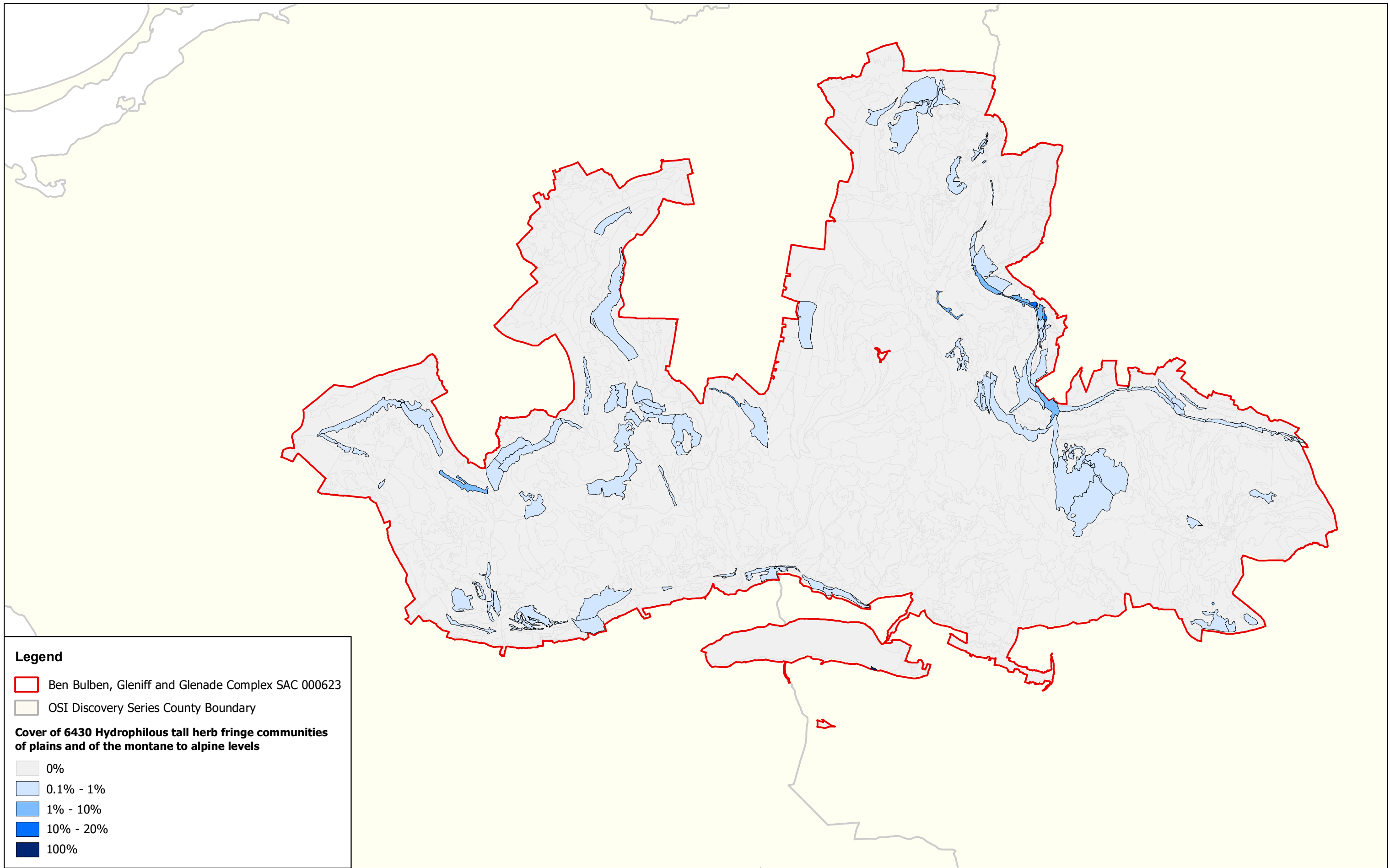
OSI Discovery Series County Boundary

**Cover of 6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (\* important orchid sites)**


- 0%
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%
- 80.1% - 100%












**Legend**

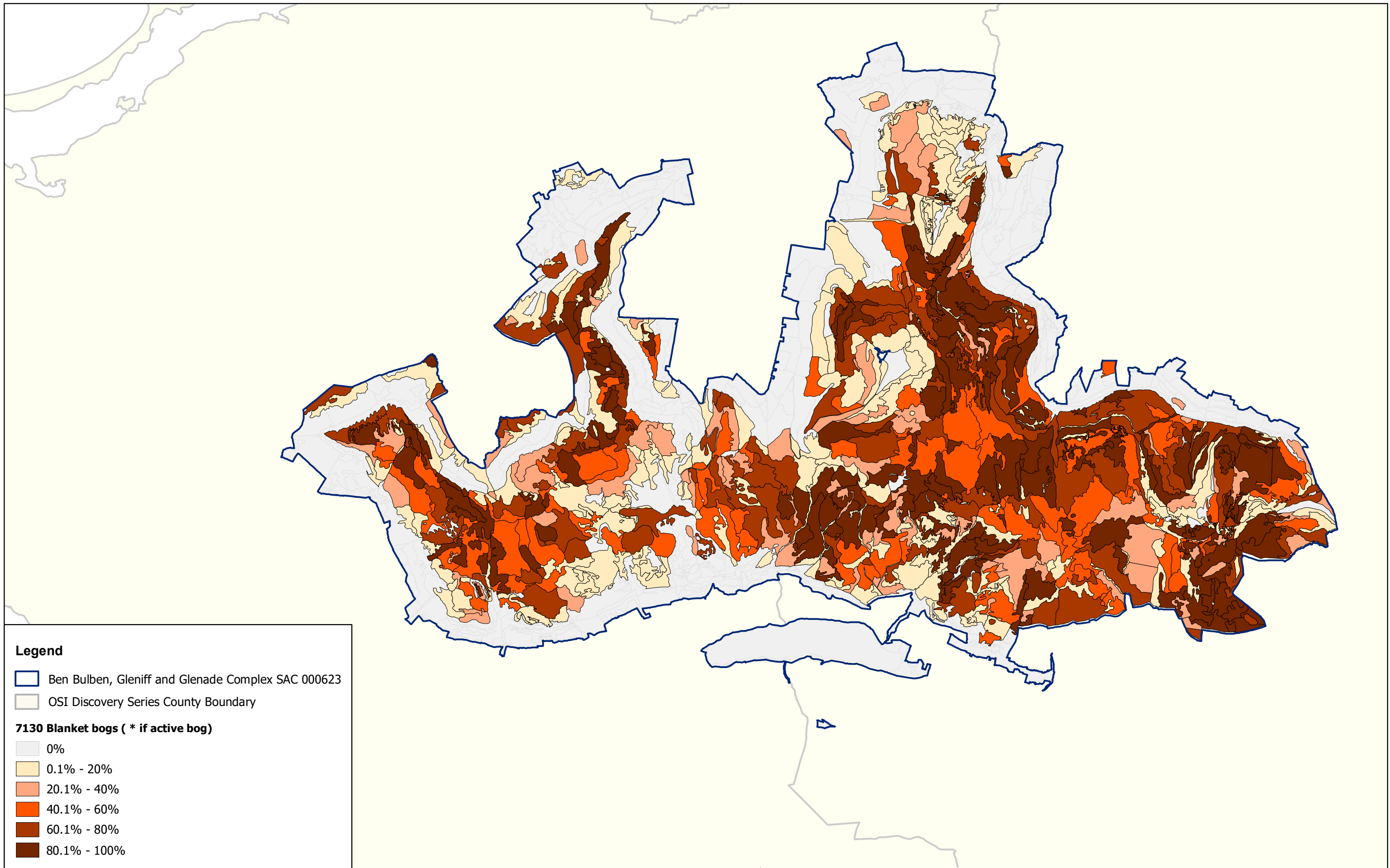
 Ben Bulbin, Gleniff and Glenade Complex SAC 000623

 OSI Discovery Series County Boundary

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

-  0%
-  0.1% - 1%
-  1% - 10%
-  10% - 20%
-  100%





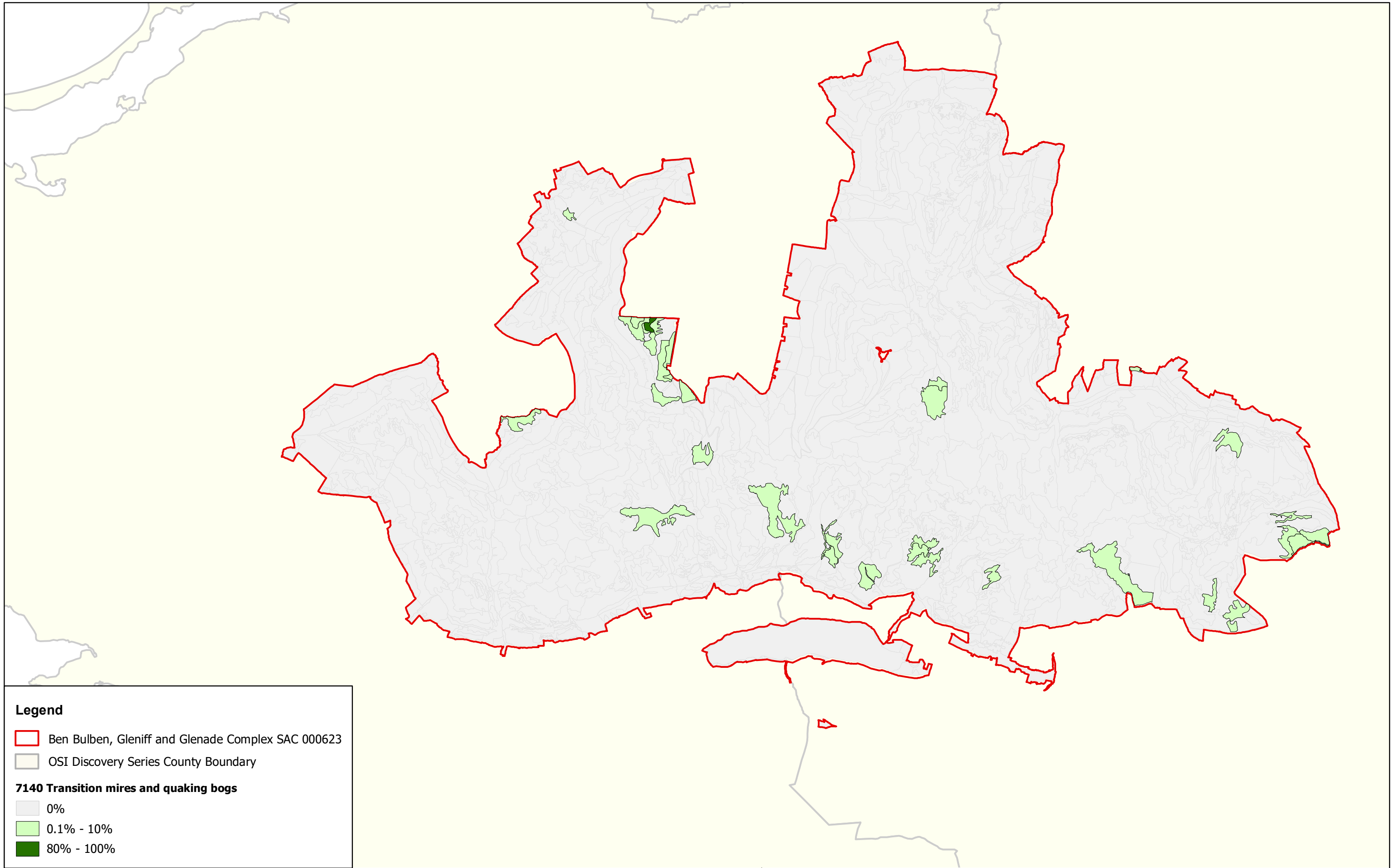
**Legend**

- Ben Bulbin, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary

**7130 Blanket bogs ( \* if active bog)**

- 0%
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%
- 80.1% - 100%





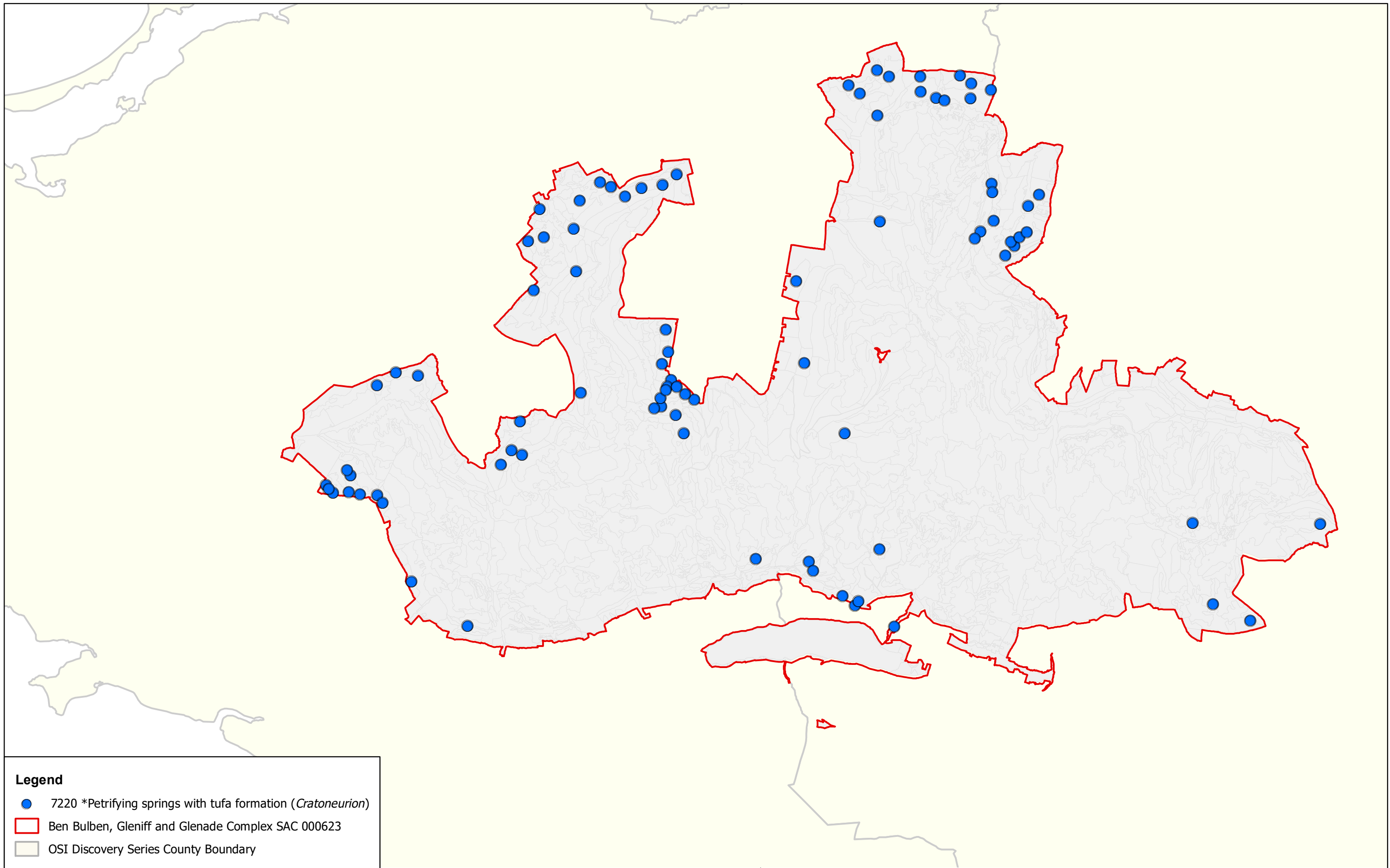
**Legend**

- Ben Bulben, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary

**7140 Transition mires and quaking bogs**

- 0%
- 0.1% - 10%
- 80% - 100%

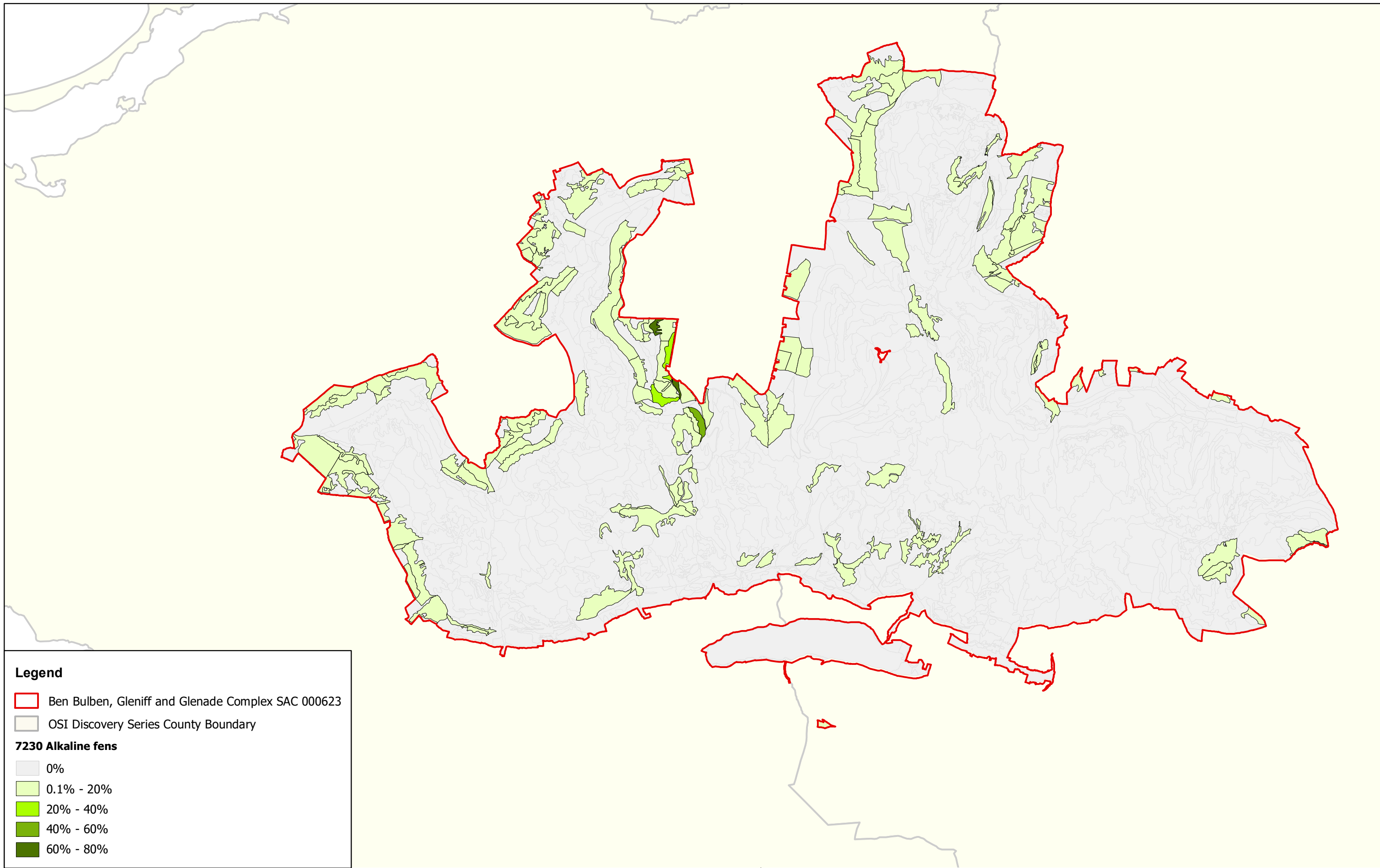




**Legend**

- 7220 \*Petrifying springs with tufa formation (*Cratoneurion*)
- Ben Bulben, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary





**Legend**

Ben Bulben, Gleniff and Glenade Complex SAC 000623

OSI Discovery Series County Boundary

**7230 Alkaline fens**

0%

0.1% - 20%

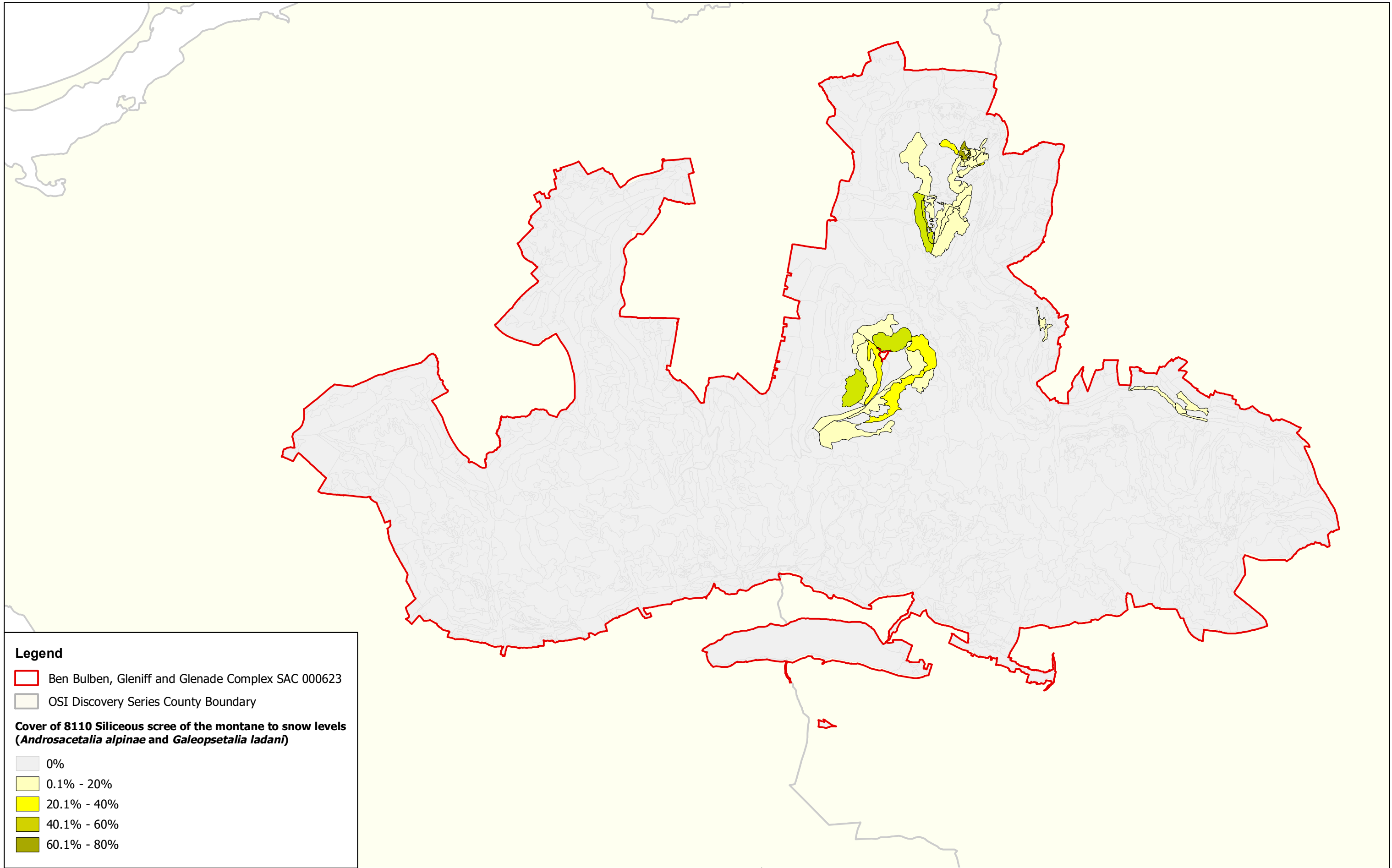
20% - 40%

40% - 60%

60% - 80%







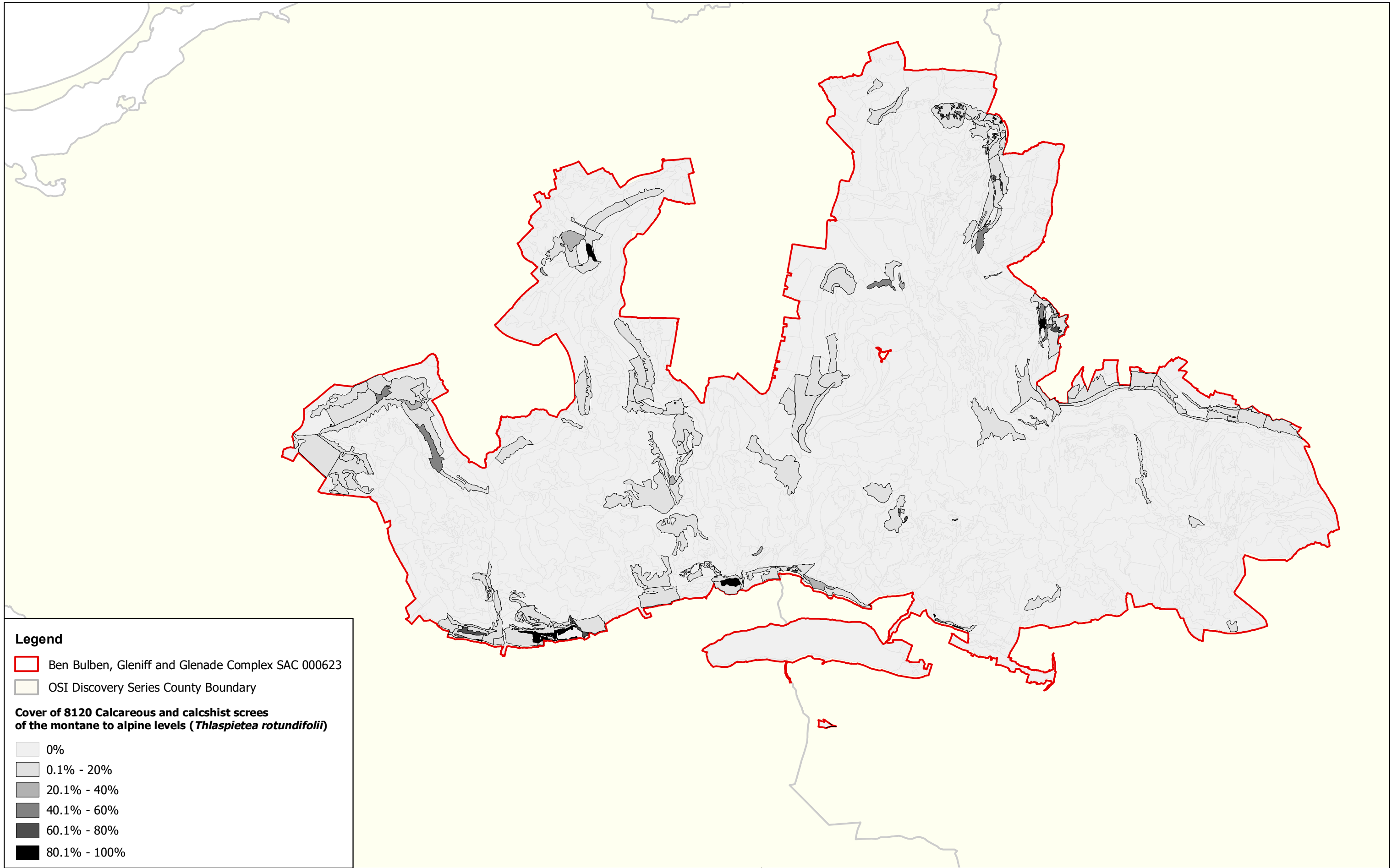
**Legend**

- Ben Bulbin, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary

**Cover of 8110 Siliceous scree of the montane to snow levels  
(*Androsacetalia alpinae* and *Galeopsetalia ladani*)**

- 0%
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%





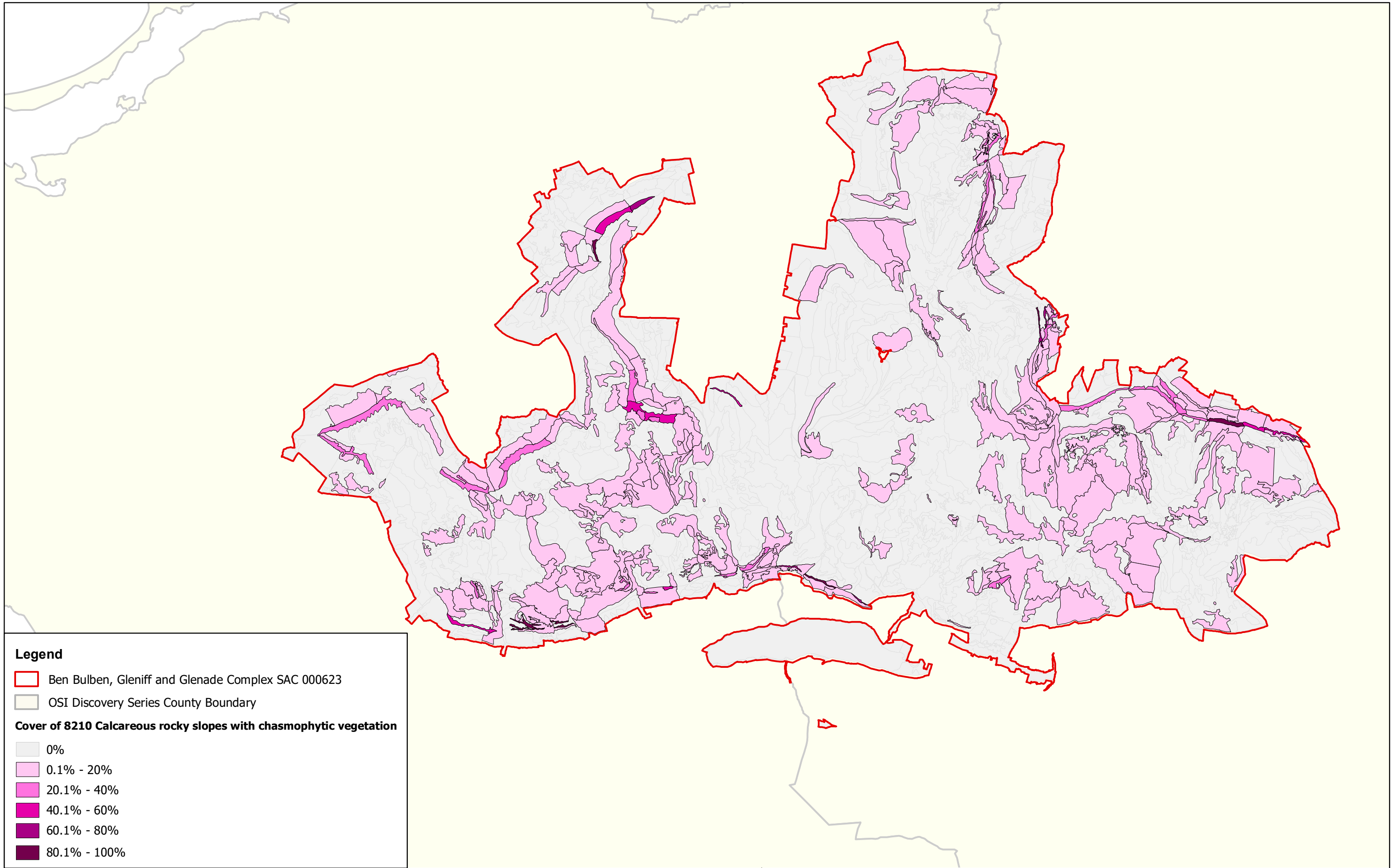
**Legend**

- Ben Bulbin, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary

**Cover of 8120 Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii*)**

- 0%
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%
- 80.1% - 100%





**Legend**

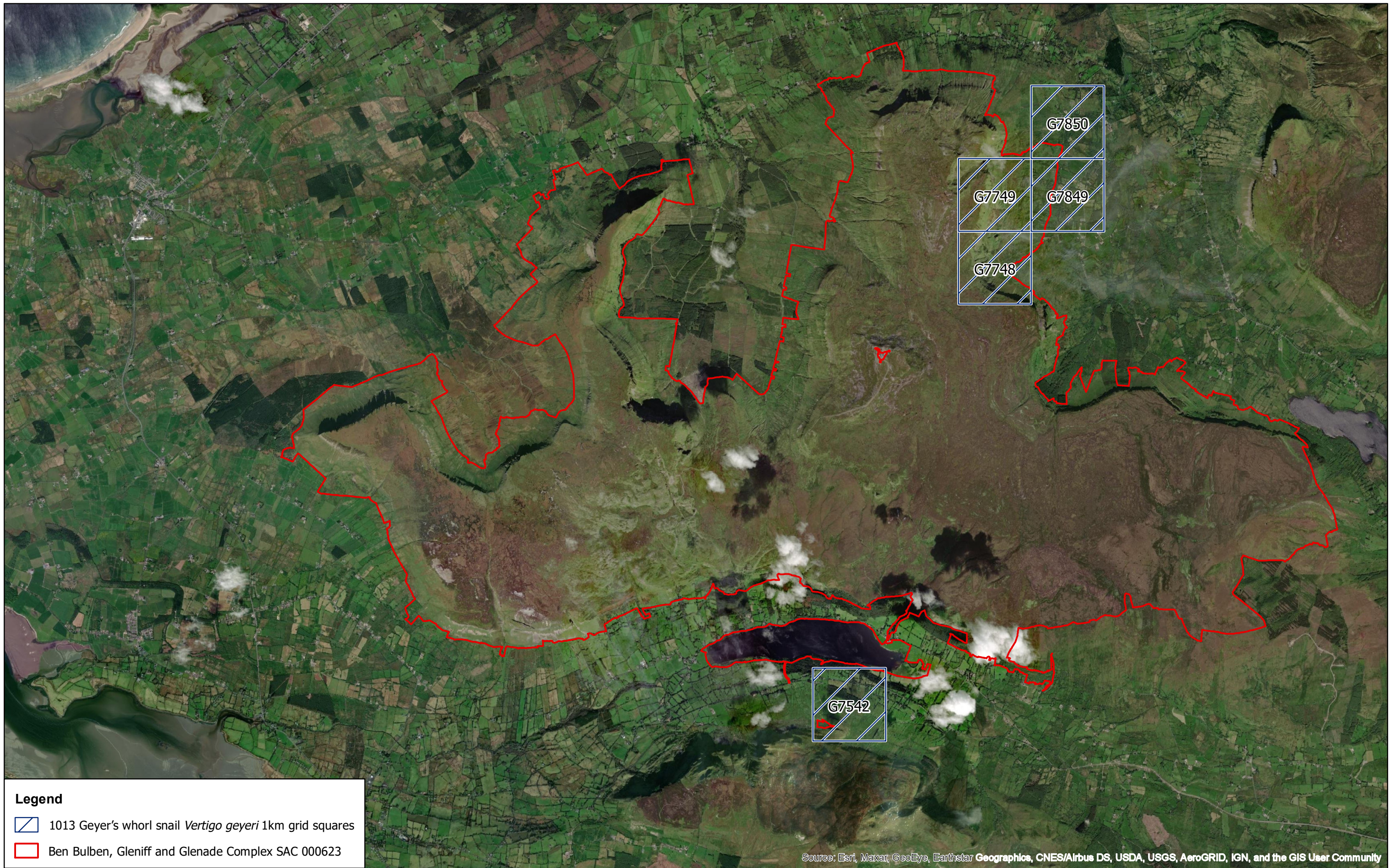
- Ben Bulbin, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary

**Cover of 8210 Calcareous rocky slopes with chasmophytic vegetation**

- 0%
- 0.1% - 20%
- 20.1% - 40%
- 40.1% - 60%
- 60.1% - 80%
- 80.1% - 100%





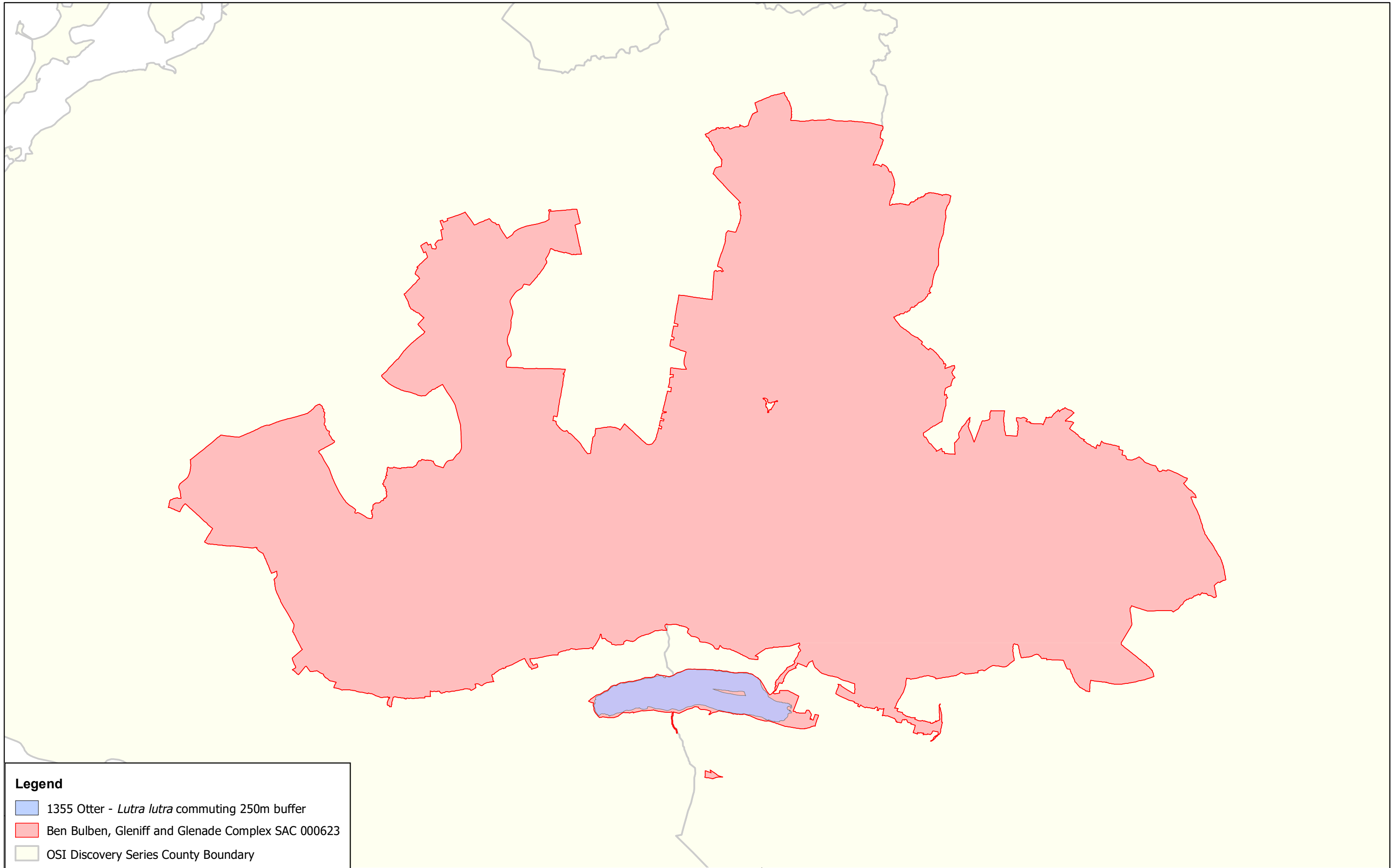


**Legend**

- 1013 Geyer's whorl snail *Vertigo geyeri* 1km grid squares
- Ben Bulben, Gleniff and Glenade Complex SAC 000623

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community





**Legend**

- 1355 Otter - *Lutra lutra* commuting 250m buffer
- Ben Bulben, Gleniff and Glenade Complex SAC 000623
- OSI Discovery Series County Boundary



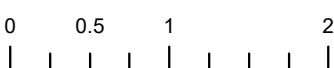
**An Roinn Tithíochta,  
Rialtais Áitiúil agus Oidhreacht**  
Department of Housing,  
Local Government and Heritage

**MAP 16:  
BEN BULBEN, GLENIFF  
AND GLENADE COMPLEX SAC 000623  
CONSERVATION OBJECTIVES  
OTTER COMMUTING**

Map to be read in conjunction with the NPWS Conservation Objectives Document


**SITE CODE:  
SAC 000623; version 3.02  
CO. SLIGO/LEITRIM**

0    0.5    1    2 Kilometres



The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision.  
Ordnance Survey of Ireland Licence No OSI-NMA-014. © Ordnance Survey of Ireland Government of Ireland

Níl sna teorainneacha ar na léarscáileanna ach nod garshuíomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaíthe. Suirbhéarachta Ordonáis na hÉireann Ceadúnas Uimh OSI-NMA-014. © Suirbhéarachta Ordonáis na hÉireann Rialtas na hÉireann



**Date: December 2021**