NPWS

Doogort Machair/Lough Doo SAC (site code: 001497)

Conservation objectives supporting document- Coastal habitats

Version 1

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Contents

Please note that the opinions expressed in the site report from the Coastal Monitoring Project (CMP) are those of the authors and do not necessarily reflect the opinion or policy of NPWS.

Please note that this document should be read in conjunction with the following report: NPWS (2017) Conservation Objectives: Doogort Machair/Lough Doo SAC 001497 Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

1 Introduction

Achieving Favourable Conservation Status (FCS) is the overall objective to be reached for all Annex I habitat types and Annex II species of European Community interest listed in the Habitats Directive 92/43/EEC (European Commission, 2013). It is defined in positive terms, such that a habitat type or species must be prospering and have good prospects of continuing to do so.

Doogort Machair/Lough Doo SAC is a small coastal SAC lying on the north-east of Achill Island, approximately 3km east of Doogort, Co. Mayo. The terrestrial areas of the SAC are covered by wind-blown sand which has led to the formation of machair (i.e. coastal grassland on a sandy substrate), which fronts onto the shoreline with associated habitats including shingle beach, sandy beach, boulder beach, exposed bedrock, mobile dunes and freshwater marsh. These habitats slope back to two freshwater lakes, Lough Doo and Lough Nambrack, which are of considerable ecological interest. In places, the shore is backed by low sea-cliffs (approximately 3m high), which are formed of soft deposits of clay, and occasionally it is backed by blanket bog. Fucoids (seaweed) and green algae colonise the lower shore. Scattered on the cobble nearby are species such as common stork's-bill (*Erodium cicutarium*) and lesser stitchwort (*Stellaria graminea*) (Ryle *et al*., 2009).

Due to the exposed location of the site, mobile dunes are generally absent along the seaward edge of the machair. Mobile dunes cover 1.07ha (approximately 1.2%) of the total sand dune habitat within the SAC. There is one area of badly eroded mobile dune located in front of the machair, to the west of the river. The mobile dunes consist of the typical species marram grass (*Ammophila arenaria*) with some sand couch (*Elytrigia juncea*) scattered amongst the habitat. Other species which were present include sand sedge (*Carex arenaria*), sea holly (*Eryngium maritimum*), dandelion (*Taraxacum* spp.) and common mouse-ear (*Cerastium fontanum*) (Ryle *et al*., 2009).

The two small lakes lie at the back of the machair. Lough Doo is bordered at its western end by a freshwater marsh with fool's water-cress (*Apium nodiflorum*) and lesser spearwort (*Ranunculus flammula*). Lough Nambrack, to the south, is partially fringed by common reed (*Phragmites australis*), with occasional branched bur-reed (*Sparganium erectum*) and bulrush (*Typha latifolia*). At its western end is a small, species-rich marsh with water mint (*Mentha aquatica*), marsh marigold (*Caltha palustris*) and marsh cinquefoil (*Potentilla palustris*) (Ryle *et al*., 2009).

A small population of the liverwort petalwort (*Petalophyllum ralfsii*), which is listed on Annex II of the EU Habitats Directive, has been recorded on the machair plain (NPWS, 2013; Campbell *et al*., 2015).

The site supports several species of breeding waders including lapwing (*Vanellus vanellus*), ringed plover (*Charadrius hiaticula*) and dunlin (*Calidris alpina schinzii*). The occurrence of breeding dunlin is of national importance and the species is listed on Annex I of the Birds Directive. The site is also used for feeding grounds by other Annex I species, chough (*Pyrrhocorax pyrrhocorax*) and golden plover (*Pluvialis apricaria*). It also supports snipe (*Gallinago gallinago*), redshank (*Tringa totanus*), curlew (*Numenius arquata*) and common sandpiper (*Actitis hypoleucos*) (Ryle *et al*., 2009).

Doogort Machair/Lough Doo SAC (site code: 001497) is selected for petalwort and machair. The following is the sole coastal habitat listed as a Qualifying Interest for the SAC (* denotes a priority habitat):

21A0 Machairs (* in Ireland)

The distribution of the sand dune habitats, including machair, found in Doogort Machair/Lough Doo SAC is presented in Appendix I.

2 Conservation Objectives

A conservation objective aims to define the favourable conservation condition of a habitat or species at a particular site. Implementation of the objective will help to ensure that the habitat or species achieves favourable conservation status at a national level.

This supporting document sets out the conservation objective for machair in Doogort Machair/Lough Doo SAC, which is defined by a list of parameters, attributes and targets. The main parameters are (a) Range (b) Area and (c) Structure and Functions, the last of which is broken down into a number of attributes, including physical structure, vegetation structure and vegetation composition.

The targets set for machair habitat are based primarily on the results of the Coastal Monitoring Project (CMP) (Ryle *et al*., 2009) and this document should be read in conjunction with that report. Bassett (1983), Crawford *et al*. (1998) and Gaynor (2006, 2008) provide additional information on machair in Ireland. The CMP was a comprehensive national baseline survey of all known sand dune systems in Ireland. One sub-site associated with Doogort Machair/Lough Doo SAC was surveyed, mapped and assessed. This sub-site was Lough Doo (CMP site ID: 114).

As part of the Coastal Monitoring Project (CMP), detailed individual reports and habitat maps were produced for all sub-sites and those compiled for Lough Doo are included in Appendix II.

The conservation objective for the machair habitat in Doogort Machair/Lough Doo SAC is based on the findings of the individual report for this site from the CMP, combined with the results of Crawford *et al.* (1998) and Gaynor (2008). It is thought that the sub-site as surveyed by the CMP represents the entire area of sand dune habitat within Doogort Machair/Lough Doo SAC**.**

3 Sand dune habitats

Sand dunes are hills of wind-blown sand that have become progressively more stabilised by a cover of vegetation. In general, most sites display a progression through strandline, foredunes, mobile dunes and fixed dunes. Where the sandy substrate is decalcified, fixed dunes may give way to dune heath. Wet hollows, or dune slacks, occur where the dunes have been eroded down to the level of the water table. Transitional communities can occur between dune habitats and they may also form mosaics with each other. Dune systems are in a constant state of change and maintaining this

natural dynamism is essential to ensure that all of the habitats present at a site achieve favourable conservation condition.

In Ireland, there are nine sand dune habitats (including annual vegetation of drift lines) listed under Annex I of the EU Habitats Directive (92/43/EEC) (* denotes a priority habitat):

- Annual vegetation of drift lines (1210)
- Embryonic shifting dunes (2110)
- Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) (2120)
- Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130) *
- Decalcified dunes with *Empetrum nigrum* (2140) *
- Atlantic decalcified fixed dune (Calluno-Ulicetea) (2150) *
- Dunes with *Salix repens* subsp. *argentea* (Salicion arenariae) (2170)
- Humid dune slacks (2190)
- **Machairs (21A0) ***

Two dune habitats were recorded by Ryle *et al*. (2009) from Doogort Machair/Lough Doo SAC, one of which, machairs, indicated in **bold** above, is listed as a Qualifying Interest for the SAC. Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) was also recorded, but this habitat is not a Qualifying Interest for the SAC.

Where sand accumulation is rapid, marram grass (*Ammophila arenaria*) invades, initiating the transition from embryonic dunes to mobile dunes (Shifting dunes along the shoreline with *Ammophila arenaria*). Marram growth is actively stimulated by sand accumulation. These unstable and mobile areas are sometimes referred to as 'yellow dunes' (or 'white dunes' in some European countries), owing to the areas of bare sand visible between the tussocks of marram.

Machair is a highly specialised and complex dune habitat that is confined globally to the north-west coasts of Ireland and Scotland. It comprises a flat or gently undulating sandy plain that develops in an oceanic location with a cool moist climate. Machair systems are highly calcareous, the sediments usually containing a high percentage of shell fragments and having pH values in excess of 7. The vegetation is herbaceous, with a low frequency of sand-binding species (Gaynor, 2006). Irish machair is a priority habitat under the EU Habitats Directive.

Dune habitats occur as a complex mosaic of constantly changing and evolving vegetation communities. They are inextricably linked in terms of their ecological functioning and should be regarded as single geomorphological units. As such, no dune habitat should be considered in isolation from the other dune habitats present at a site, or the adjoining semi-natural habitats with which they often form important transitional communities.

Detailed descriptions from the Coastal Monitoring Project (Ryle *et al*., 2009) of each sand dune habitat found at Doogort Machair/Lough Doo SAC are presented in Appendix II. A total of 89.27ha of sand dune habitats was mapped within Doogort Machair/Lough Doo SAC, of which 88.2ha (98.8%) represents machair, a Qualifying Interest for this particular SAC (Ryle *et al*., 2009).

3.1 Overall objective

The overall objective for 'Machairs' in Doogort Machair/Lough Doo SAC is *to 'restore the favourable conservation condition*'.

This objective is based on an assessment of the recorded condition of the machair habitat under a range of attributes and targets. The assessment is divided into three main headings: (a) Area (b) Range and (c) Structure and Functions.

3.2 Area

3.2.1 Habitat area

Habitat extent is a basic attribute to be assessed when determining the condition of a particular habitat. A baseline habitat map was produced for the sand dune habitats in the Lough Doo sub-site during the Coastal Monitoring Project (CMP) (Ryle *et al*., 2009). This map extended somewhat beyond the SAC boundary and is included with the individual site report in Appendix II at the end of this document. The total area of machair habitat within the sub-site Lough Doo (CMP site ID: 114) as estimated by Ryle *et al*. (2009) is 96.9ha, 88.2ha of which is contained within the boundary of Doogort Machair/Lough Doo SAC.

It is important to note that the CMP mapped the extent of the true machair plain and did not include the lakes at the back of the system which are ecologically intrinsic to the machair system as a whole.

The target for this attribute is that the area of machair habitat should be stable, or increasing. Bearing in mind that coastal systems are naturally dynamic and subject to change, this target is always assessed subject to natural processes, including erosion and succession.

3.3 Range

3.3.1 Habitat distribution

The distribution of sand dune habitats, including machair, within Doogort Machair/Lough Doo SAC, as mapped by Ryle *et al.* (2009), is presented in Appendix I.

The machair at Doogort Machair/Lough Doo SAC can be divided into three distinct areas. The first consists of a low area of flat machair, which is present between Lough Nambrack and Barnynagappul Strand. This area is relatively dry and supports a typical machair flora. The second area consists of wet machair and is found on slopes reaching down towards both Lough Doo and Lough Nambrack. A third area of machair, located in a wide belt at the back of Gubnahardia Strand stretching from Caraun Point to Ridge Point, is composed of a mosaic of wet and dry areas, with low hummocks throughout the habitat (Ryle *et al*., 2009).

The machair is edged by agricultural land and peatland to the east and by a caravan park and agricultural land to the west. To the front of the caravan park, the machair extends north-west and north-east, beyond the river. Also to the front of the habitat there is an unvegetated cobble beach and in the far west of the SAC a small area of mobile dune is present (Ryle *et al*., 2009).

The target is that there should be no decline or change in the distribution of the machair habitat, unless it is the result of natural processes, including erosion, accretion and succession.

3.4 Structure and Functions

The location, character and dynamic behaviour of sand dunes are governed by a combination of geographic, climatic, edaphic and anthropogenic factors. Sand dunes are highly complex, dynamic systems, where the habitats occur in a complex and constantly evolving and changing mosaic. They function as systems in terms of geomorphology and hydrology and maintaining the favourable conservation condition of the habitats present depends on allowing these processes to continue unhindered.

Maintaining the favourable conservation condition of the machair habitat in Doogort Machair/Lough Doo SAC in terms of structure and functions depends on a range of attributes for which targets have been set as outlined below.

3.4.1 Physical structure: functionality and sediment supply

Coastlines naturally undergo a constant cycle of erosion and accretion. There are two main causes of erosion: (a) those resulting from natural causes and (b) those resulting from human interference. Natural causes include the continual tendency towards a state of equilibrium between coasts and environmental forces, climatic change (particularly an increase in the frequency of storms or a shift in storm tracks), relative sea level rise and natural changes in the sediment supply. Human interference is usually associated with changes in the sediment budget, either directly, through the removal of beach or inshore sediment, or indirectly, by impeding or altering sediment movement. It is important to recognise that the process of coastal erosion is part of a natural tendency towards equilibrium. Natural shorelines attempt to absorb the energy entering the coastal zone by redistributing sediment.

Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Sediment supply is especially important in embryonic dunes and mobile dunes, as well as strandline communities where accumulation of organic matter in tidal litter is essential for trapping sand and initiating dune formation. The construction of physical barriers such as sea defences can interrupt longshore drift, leading to beach starvation and increased rates of erosion. Sediment circulation and erosion also has a role to play in the more stabilised dune habitats. Cycles of erosion and stabilisation are part of a naturally functioning dune system, where the creation of new bare areas allows pioneer species and vegetation communities to develop, thus increasing biodiversity. The construction of physical barriers can interfere with the sediment circulation by cutting the dunes off from the beach resulting in fossilisation or over-stabilisation of dunes.

At Lough Doo, there is a man-made ridge to the front of the caravan site, which was built using sand from the beach and has been planted with marram grass (*Ammophila arenaria*). Shingle and sand extraction has been carried out in the past and this has had a severe effect on the amount of sand available to the system (Ryle *et al*., 2009).

The target for this attribute is to maintain the natural circulation of sediment and organic matter throughout the entire dune system, without any physical obstructions.

3.4.2 Physical structure: hydrological and flooding regime

Typically, the true machair plain represents the area where wind erosion has eroded a dune system to a level just above the water table, where the wet consistency of the sand prevents further erosion. In general, the degree of flatness depends on the age of the system, as well as the underlying topography, geology, outcropping of local rocks and historical management. As is the case in Doogort Machair/Lough Doo SAC, machair plains can be terminated on the landward side by a lake or associated marsh/fen (Gaynor, 2006). Consequently, the condition and conservation of the machair habitat can be inextricably linked to the local hydrology.

Wet machair can essentially be compared to humid dune slacks due to the periodic fluctuations and the proximity of the groundwater table to the surface throughout the year. The frequency and duration of periods of flooding or inundation determines the vegetation composition. The water table depth has been identified as the primary determining factor in vegetation variation, followed by weak trends in calcium and sodium availability. Other contributing factors include stage of development, precipitation, distance from the sea, the grazing regime, recreational pressure, nature of the sediment, soil pH and the porosity of the sediment.

Machair is highly sensitive to human influences on hydrology, either through water abstraction, drainage works or increased nutrient inputs. Water abstraction interferes with the local hydrology, potentially having serious implications for the plant and animal communities of wet machair communities.

Two small lakes lie at the back of the machair, Lough Doo and Lough Nambrack, with associated freshwater marshes. The flushed slopes adjacent to the lakes are very calcareous and tufa encrustation is evident in places (Ryle *et al*., 2009).

Grazing and recreation are the main land uses within the SAC and in surrounding areas. A major threat to machair is agricultural improvement. Application of fertilisers to the machair can result in run-off causing pollution of associated freshwater systems (NPWS, 2013).

The target is to ensure that the hydrological regime continues to function naturally and that there are no increased nutrient inputs in the groundwater.

3.4.3 Vegetation structure: zonation

The range of vegetation zones on a dune system should be maintained. Gaynor (2008) highlights the highly transitional nature of much of the vegetation; therefore, it is important that the transitional communities are also conserved, including those to saltmarsh communities.

Doogort Machair/Lough Doo SAC is a coastal site and contains a good diversity of habitats in a small area, including shingle beach, sandy beach, boulder beach, exposed bedrock and mobile dunes. The inland machair plain grades into blanket bog and is adjoined by two small lakes with freshwater marsh habitat (NPWS, 2013).

The target is to maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession.

3.4.4 Vegetation structure: bare ground

This attribute applies to machair habitat whereas it does not apply to other Annex I coastal habitat present where high levels of bare sand are a natural component of the habitat. In the less exposed areas, some degree of instability is vital. Constant cycles of erosion and stabilisation provide the necessary conditions for the establishment of pioneer species and species that favour open conditions such as petalwort (*Petalophyllum ralfsii*) and a range of invertebrates, helping to increase biodiversity.

Bare sand can be exposed from the actions of grazing animals, however, it must be borne in mind that even with a moderate grazing regime, some localised damage is to be expected, because the impact of grazing animals is not applied at the same intensity throughout the site.

The machair in the SAC has been eroded in places, especially at the front. Sheep heavily graze the site and this is adding to the problem of erosion. The eroded front has exposed peat layers, which are present below the machair. Natural erosion occurs at the site, but it is compounded by the sheep grazing (Ryle *et al*., 2009).

There are a number of bare sandy areas in the northern part of the machair. The bare sand covers approximately 6ha and is the result of overgrazing (Ryle *et al*., 2009). The adjacent beach is popular with holidaymakers, which adds to pressure at the site as do a nearby caravan park and a car park (Ryle *et al*., 2009).

The target is not to exceed 10% bare sand. This target is assessed subject to natural processes.

3.4.5 Vegetation structure: sward height

A varied vegetation structure is important for maintaining species diversity and is particularly important for invertebrates and birds. The ecological benefits of moderate levels of grazing on dunes have been well-documented (Gaynor, 2008). Moderate grazing regimes lead to the development of a species-rich vegetation cover. The animals increase biodiversity by creating micro-habitats through their grazing, dunging and trampling activities. Grazing slows down successional processes and in some cases reverses them, helping to achieve a diverse and dynamic landscape. The effects of trampling assist the internal movement of sand through the development of small-scale blowouts, while dunging can eutrophicate those dune habitats whose nutrient-poor status is crucial for the survival of certain vegetation types. Many species, from plants to invertebrates, benefit immensely from the open and diverse system created by a sustainable grazing regime. Many dune species are small in size and have relatively low competitive ability. Consequently, the maintenance of high species diversity on a dune system is dependent on the existence of some control to limit the growth of rank coarse vegetation (Gaynor, 2008).

Machairs are extensively used in both Ireland and Scotland as commonage areas for grazing. All machair sites are grazed by cattle, or sheep, or both. Sheep are commonly the grazing animal, but the grazing density and sheep:cattle ratio is vital in determining the quality and diversity of the machair (Angus, 1994).

The machair at Doogort Machair/Lough Doo SAC is one of the few remaining largely unenclosed coastal commonages which is used for grazing sheep and cattle. The machair is generally close-

cropped and having the correct level of grazing, evenly spread over the site, is a critical factor in maintaining species diversity and habitat quality of machair (NPWS, 2013). The main threats to the machair at Doogort Machair/Lough Doo SAC include overgrazing and amenity use. Sheep have overgrazed the machair and some supplementary feed (< 1% of machair habitat) was noted on the machair (Ryle *et al*., 2009).

The target for this attribute is to maintain structural variation within the sward.

3.4.6 Vegetation composition: typical species and sub-communities

Species diversity and plant distribution in dunes is strongly controlled by a range of factors, including mobility of the substrate, grazing intensities, moisture gradients, nutrient gradients and human disturbance. In the younger, more mobile dunes, marram (*Ammophila arenaria*) is common, while groundsel (*Senecio vulgaris*), sea rocket (*Cakile maritima*) and dandelion (*Taraxacum* spp.) are also present. The fixed, more stable dune vegetation includes lady's bedstraw (*Galium verum*), common bird's-foot-trefoil (*Lotus corniculatus*), wild thyme (*Thymus polytrichus*), kidney vetch (*Anthyllis vulneraria*), wild pansy (*Viola tricolor*) and biting stonecrop (*Sedum acre*).

The vegetation of machair is often composed of both wet and dry communities and although there is generally an obvious distinction between the dry and wet types, transitional communities are common (Gaynor, 2006). No suite of species is unique to machair and the vegetation can best be described as a mosaic of calcareous fixed dune, mesotrophic grassland and dune slack communities (Gaynor, 2006).

The following table lists the dominant species listed in dry and wet Irish machair from Gaynor (2006). Differences in the dominant species between the two types of machair plain are indicated by *.

Dry machair	**Wet machair**
Festuca rubra	*Trifolium repens*
Plantago lanceolata	*Agrostis stolonifera*
Trifolium repens	*Calliergonella cuspidata*
Lotus corniculatus	*Festuca rubra*
Bellis perennis	*Bellis perennis*
*Galium verum**	*Plantago lanceolata*
Carex arenaria	*Carex arenaria*
*Rhytidiadelphus squarrosus**	*Potentilla anserina*
*Leontodon taraxacoides**	*Hydrocotyle vulgaris*
Poa pratensis (*subcaerulea*)*	*Lotus corniculatus*
*Homalothecium lutescens**	*Prunella vulgaris*

Other species typically recorded on Irish machair include common yarrow (*Achillea millefolium*), early hair-grass (*Aira praecox*), common mouse-ear (*Cerastium fontanum*), smooth hawksbeard (*Crepis capillaris*), common stork's-bill (*Erodium cicutarium*), eyebright (*Euphrasia officinalis*), common flax (*Linum catharticum*), red bartsia (*Odontites verna*), yellow rattle (*Rhinanthus minor*),

biting stonecrop (*Sedum acre*), wild thyme (*Thymus polytrichus*) and violets (*Viola* spp.) (Ryle *et al*., 2009). The calcareous nature of the substrate can be reflected by the presence of thyme-leaved sandwort (*Arenaria serpyllifolia*), crested hair-grass (*Koeleria macrantha*), ox-eye daisy (*Leucanthemum vulgare*) and squinancywort (*Asperula cynanchica*).

The machair sward at Doogort Machair/Lough Doo SAC includes species such as common bird's-foot-trefoil (*Lotus corniculatus*), lady's bedstraw (*Galium verum*), ribwort plantain (*Plantago lanceolata*), sand sedge (*Carex arenaria*), white clover (*Trifolium repens*), selfheal (*Prunella vulgaris*), glaucous sedge (*Carex flacca*), daisy (*Bellis perennis*), marsh pennywort (*Hydrocotyle vulgaris*), common sedge (*Carex nigra*), carnation sedge (*Carex panicea*), yarrow (*Achillea millefolium*), creeping bent (*Agrostis stolonifera*), smooth hawk's-beard (*Crepis capillaris*), silverweed (*Potentilla anserina*) and marsh orchid spp. (*Dactylorhiza* spp.) (Ryle *et al*., 2009).

Other species of the machair include red fescue (*Festuca rubra*), field wood-rush (*Luzula* campestris), cat's-ear (*Hypochaeris radicata*), annual meadow grass (*Poa annua*), dandelion (*Taraxacum* agg.), buck's-horn plantain (*Plantago coronopus*), lesser hawkbit (*Leontodon saxatilis*), creeping buttercup (*Ranunculus repens*), watercress (*Nasturtium officinale*), dog lichen (*Peltigera* spp.), common scurvygrass (*Cochlearia officinalis*), sweet vernal-grass (*Anthoxanthum odoratum*), common bent (*Agrostis capillaris*), red clover (*Trifolium pratense*), many-stalked spike-rush (*Eleocharis multicaulis*) and rushes (*Juncus* spp.) (Ryle *et al*., 2009).

The Annex II liverwort species petalwort (*Petalophyllum ralfsii*) has also been recorded on the machair (Campbell *et al*., 2015).

The target for this attribute is to maintain a typical flora for the machair habitat.

3.4.7 Vegetation composition: negative indicator species

Negative indicators include non-native species (e.g. *Hippophae rhamnoides*), species indicative of changes in nutrient status (e.g. *Urtica dioica*) and species not considered characteristic of the habitat. Sea buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled.

A major threat to machair at Doogort Machair/Lough Doo SAC is agricultural improvement. Application of fertilisers can result in the loss of semi-natural vegetation and a reduction in species-richness. Negative indicators recorded were cock's-foot (*Dactylis glomerata*), which was rare, common nettle (*Urtica dioica*) and common ragwort (*Senecio jacobaea*) (Ryle *et al*., 2009).

The target is that negative indicators (including non-native species) should represent less than 5% of the vegetation cover.

3.4.8 Vegetation composition: scrub/trees

Scrub encroachment leads to reduction in dune biodiversity and needs to be controlled. The presence of scrub and trees which have deep roots can also lower the groundwater table which can have significant impacts on the slack communities.

The target for this attribute therefore is that the cover of scrub and tree species should be under control, or make up less than 5% of the vegetation cover.

3.4.9 Vegetation composition: bryophytes

Bryophytes are an important element of the machair flora. Frequently occurring species include *Campylium stellatum, Scorpidium revolvens, Ctenidium molluscum* and *Philontis fontana*, most of which are indicative of wet, base-rich conditions.

Doogort Machair/Lough Doo SAC is relatively species-rich and bryophytes (mosses and liverworts) are abundant and frequently carpet the machair surface. Particularly rare and scarce species, which have been found at the site, include several that are listed as threatened and/or red-listed (Lockhart *et al*., 2012): *Bryum calophyllum* (Endangered), *Bryum dyrffrynense* (Near Threatened), *Catoscopium nigritum* (Near Threatened), *Leiocolea gillmanii* (Vulnerable) and *Scapania cuspiduligera* (Vulnerable). *Catoscopium nigritum* and *Leiocolea gillmanii* are afforded protection under the Flora (Protection) Order, 2015 (FPO; Statutory Instrument No. 356 of 2015). *Leiocolea gillmanii* has its main stronghold in Ireland within this SAC, there being only one other known population (in Donegal).

Other mosses recorded on the machair include *Amblyodon dealbatus*, *Brachythecium velutinum*, *Calliergonella cuspidata*, *Fossombronia incurva*, *Haplomitrium hookeri*, *Nardia geoscyphus*, *Pohlia camptotrachel*, *P. filum*, *P. wahlenbergii*, *Pseudoscleropodium purum*, *Rhizomnium pseudopunctatum*, *Rhytidiadelphus squarrosus* and *Syntrichia ruralis* subsp. *ruraliformis* (Ryle *et al*., 2009).

A small population of the liverwort petalwort (*Petalophyllum ralfsii*), a rare species listed on Annex II of the EU Habitats Directive and protected though listing on the FPO, has also been recorded on the machair plain within this SAC (Ryle *et al*., 2009; Campbell *et al*., 2015). This species was recorded on the machair plain. However, if the current level of sheep grazing continues this will lead to severe erosion of the machair plain and a possible loss of this species (Ryle *et al*., 2009).

The target for this attribute is that the cover of bryophytes should always be at least an occasional component of the vegetation (Ryle *et al*., 2009).

4 References

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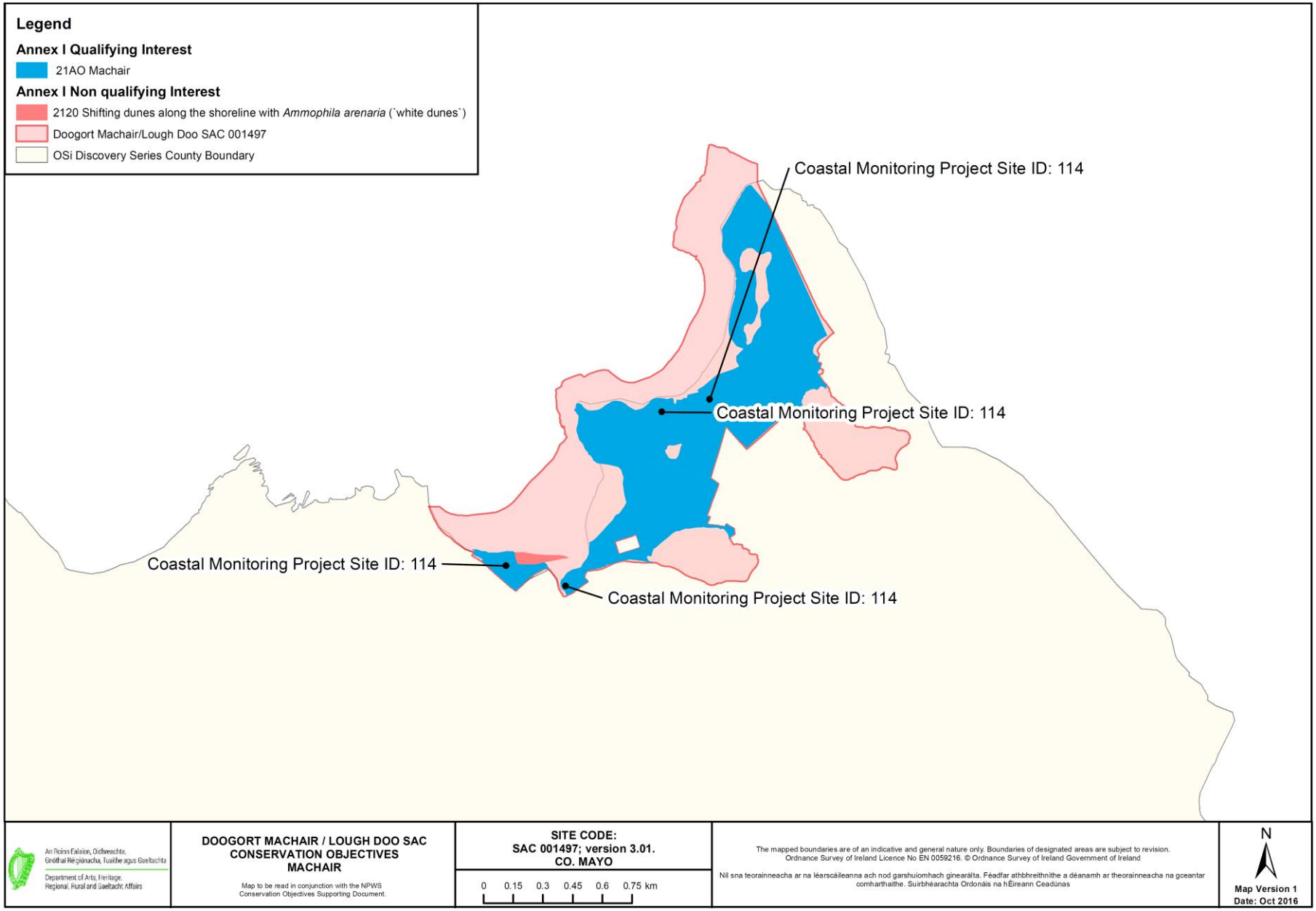
Appendix I – Distribution map of sand dune habitats within Doogort Machair/Lough Doo SAC



Appendix II – Lough Doo site report and habitat map from the Coastal Monitoring Project (Ryle *et al.*, 2009)

LOUGH DOO

SITE DETAILS

CMP06 site name: Lough Doo **CMP06 site code:** 114 **CMP Map No.:** 112

County: Mayo **Discovery map:** 30 **Grid Reference:** F705 093

6 inch Map No.: Ma 43

Aerial photographs (2000 series): O-1505 D; O 1573 A, B, C, D; O 1574 A, C.

NPWS Site Name: Slieve Doogort Machair/Lough Doo

NPWS designation: pNHA: 001497 **cSAC:** 001497

Other Designation: Blue Flag: Doogort

Ranger Area: West

MPSU Plan: Draft 2: Consultation

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SITE DESCRIPTION

Doogort Machair/Lough Doo cSAC is a small coastal site lying in the northeast corner of Achill Island in County Mayo. It is adjacent to the village of Valley and approximately 3 km east of Doogort. Sand dune habitats associated with the site include machair, mobile dunes, a shingle or storm beach and an extensive sandy beach. Other habitats present at the site include blanket bog, sea cliffs and lakes. The site is part of the cSAC 001497 which is designated for the presence of the Annex I habitat – 'Machair'

Two small lakes lie at the back of the machair, Lough Doo and Lough Nambrack. Lough Doo is bordered at its western end by a freshwater marsh with *Apium nodiflorum* (fool's water-cress) and *Ranunculus flammula* (lesser spearwort). Lough Nambrack, to the south, is partially fringed by *Phragmites australis* (common reed) with occasional *Sparganium erectum* (branched bur-reed) and *Typha latifolia* (bulrush). At its western end is a small, species-rich marsh with *Mentha aquatica* (water mint), *Caltha palustris* (marsh marigold) and *Potentilla palustris* (marsh cinquefoil). Around these lakes, as on the machair, there is a good moss and liverwort flora, which includes some scarce and rare species, (MPSU, 2000). Particularly noteworthy species, which have been previously found at the site, include *Amblyodon dealbatus, Brachythecium velutinum, Campylopus subulatus, Catoscopium nigritum, Fossombronia incurva, Geocalyx graveolens, Haplomitrium hookeri, Mastigophora woodsii, Nardia geoscyphus, Pohlia camptotrachel, Pohlia filum, Pohlia wahlenbergii* and *Rhizomnium pseudopunctatum*. The site also holds the only Irish record for the liverwort *Leiocolea gillmanii*. (information taken from Stewart, 1993). Achill Island is internationally important for bryophyte and liverwort species.

Furthermore, the site is designated as a result of the presence of the Annex II species, liverwort – *Petalophyllum ralfsii* (petalwort). Lockhart (1998) recorded the species on the machair plain in two

areas consisting of two populations of two plants. Although the species was not found in the last survey by Holyoak, 1999, this was because the site was covered with wind-blown sand and conditions were not optimal to make a detailed search.

The machair provides good feeding grounds for the Annex I bird species *Pyrrhocorax pyrrhocorax* (chough), which occurs in flocks of up to 40 individuals (Birdwatch Ireland, pers. comm., 2007) as well as for *Pluvialis apricaria* (golden plover) (Annex I). Also present are a number of breeding waders including *Vanellus vanellus* (lapwing) (11 pairs), *Calidris alpina* (dunlin) (2 pairs) and *Charadrius hiaticula* (ringed plover) (1 pair) recorded in 1996. The site is of National Importance for breeding dunlin, which is an Irish Red Data Book species, although numbers have declined since 1985 (MPSU 2000). The site also supports other species such as *Gallinago gallinago* (snipe), *Tringa totanus* (redshank), *Numenius arquata* (curlew) and *Actitis hypoleucos* (common sandpiper).

The beach is very popular with holidaymakers and has Blue Flag status (2006), which adds to the recreational pressure at the site. The caravan park attracts high volumes of people in the summer months.

The current survey concentrates on Annex I sand dune habitats and includes machair and mobile dunes. The areas of Annex I sand dune habitats recorded at Lough Doo are shown in Table 114A.

Table 114A Areas of EU Annex I habitats mapped at Lough Doo

EU Code	EU Habitat	Area (ha)
H21AO	Machair	96.9*
H2120	Shifting dunes along the shoreline with *Ammophila arenaria*	1.07
	Total Sand dune	98.7**
	Total Sandy substrate area including developments/modifications* **	100.7

* Including areas of bare sand which total 6ha
** Total includes a floodlit football pitch on machair within cSAC
*** Developments in this case is a caravan park outside cSAC

Machair (H21A0)

The machair habitat comprises 96.9ha (approximately 98.2% of the total sand dune habitat) at Lough Doo (Table 114A). Of the 96.9ha of machair, bare sand, as a result of overgrazing accounts for 6 ha (see explanation below). The machair habitat at Lough Doo is quite extensive and is a typical example of this type of habitat supporting *Festuca rubra-Galium verum* grassland. It is edged by agricultural land and peatland to the east of the site and by a caravan park and agricultural land to the west. The caravan park is situated behind a man-made ridge, which has been planted with *Ammophila arenaria* (marram grass). To the front of this ridge, the machair extends northwest and northeast, beyond the river. The machair is interesting at Doogort as it can be divided into three distinct areas. The first consists of a low area of flat machair, which is present between Lough Nambrack and Barnynagappul Strand. This area is relatively dry and supports a typical machair flora. The second area consists of wet machair and is found on slopes reaching down towards both Lough Doo and Lough Nambrack. These flushed slopes are very calcareous and tufa encrustation is evident in places (Neil Lockhart, pers. comm., cited in MPSU, 2000). A third area of machair, located in a wide belt at the back of Gubnahardia Strand stretching from Caraun Point to Ridge Point, is composed of a mosaic of wet and dry areas, with low hummocks throughout the habitat.

The machair has been eroded in places especially at the front. Sheep heavily graze the site and this is adding to the problem of erosion. The eroded front has exposed peat layers, which are present below the machair. There are also a number of bare sandy areas in the northern part of the machair, however it must be noted that these were mapped from aerial photographs, as bad weather on the survey day prevented full - on the ground mapping. Therefore the machair area may be underestimated as a result of this. Also to the front of the habitat there is an un-vegetated cobble beach and in the far west of the site a small area of mobile dune is present.
The machair is an unfenced commonage, however, there is a fenced sports pitch and a small, temporary structure is located about 40 metres north of this pitch. This acts as a clubhouse for the Achill Rovers Football Club and there is also a septic tank next to this building. Some fertilisation has taken place in some areas in the past (MPSU, 2000) however this was not evident in the current survey, the main improved areas are fenced off and they are outside the boundary of the cSAC. The sports pitch is however fertilised. A small area of supplementary feed (<1% of machair habitat) was noted on the machair and there were some tracks from motorised vehicles present. An appeal is to be lodged in the future to have the Keel Golf course re-located to Doogort and therefore this should be monitored closely.

Overall the machair is relatively species rich and bryophytes are abundant. However if the current level of sheep grazing continues this will lead to severe erosion of the machair plain and a possible loss of the Annex II liverwort species (*Petalophyllum ralfsii*) altogether. There is also an area north of Lough Nambrack which is used as a dumping area for old cars and the ground is very broken-up by tyre tracks.

The typical species found in the machair at Lough Doo include *Lotus corniculatus* (common bird's-foot trefoil), *Galium verum* (lady's bedstraw), *Plantago lanceolata* (ribwort plantain), *Carex arenaria* (sand sedge), *Trifolium repens* (white clover), *Prunella vulgaris* (selfheal), *Carex flacca* (glaucous sedge), *Bellis perennis* (daisy), *Hydrocotyle vulgaris* (marsh pennywort), *Carex nigra* (common sedge), *Achillea millefolium* (yarrow), *Agrostis stolonifera* (creeping bent), *Crepis capillaris* (smooth hawk's-beard), *Potentilla anserina* (silverweed) and *Dactylorhiza* spp. (marsh orchid spp.).

Other species of the machair include *Festuca rubra* (red fescue), *Luzula campestris* (field wood-rush), *Hypochaeris radicata* (cat's-ear), *Poa annua* (annual meadow grass), *Taraxacum* agg. (dandelion), *Plantago coronopus* (buck's-horn plantain), *Leontodon saxatilis* (lesser hawkbit), *Ranunculus repens* (creeping buttercup), *Ranunculus* spp. (buttercup spp.), *Nasturtium officinale* (watercress), *Peltigera* spp. (dog lichen), *Cochlearia officinalis* (common scurvygrass), *Anthoxanthum odoratum* (sweet vernal-grass), *Agrostis capillaris* (common bent), *Trifolium pratense* (red clover), *Carex panicea* (carnation sedge), *Eleocharis multicaulis* (many-stalked spike-rush) and *Juncus* spp. (rush spp.).

Mosses recorded on the machair include *Rhytidiadelphus squarrosus, Tortula ruraliformis, Brachythecium* spp., *Scleropodium purum* and *Calliergonella cuspidata.*

Negative indicators recorded were *Dactylis glomerata* (cock's-foot), which was rare, *Urtica dioica* (common nettle) and *Senecio jacobaea* (common ragwort).
Petalophyllum ralfsii (petalwort) was searched for on the day of survey but was not found.

Mobile Dunes (H2120)

The mobile dune habitat comprises 1.07ha (approximately 1.8%) of the total sand dune habitat at Lough Doo (Table 114A). Due to the exposed location of the site, fore-dunes are generally absent along the seaward edge of the machair plain. The Machair Survey (1996) described relict and badly damaged fore-dunes behind a wide, low beach. It also described both beaches, as being severely eroded due both to sea level rise and depletion in sediment supply and that there was insufficient sand to build fore-dunes. Furthermore, it described the site as a former system that had all but blown out (Machair Survey, 1996). There is one area of mobile dune located in front of the machair, west of the river. According to the ASI survey 1993, this was the only area of fore-dune present that was partially stabilised by *Ammophila arenaria* (marram grass). There is also a man-made ridge to the front of the caravan site, which was built using sand from the beach (Machair Survey, 1996) but has been disregarded for the conservation assessment. The monitoring of the naturally formed habitat showed that at present some areas are functioning well while other parts are in decline. Shingle and sand extraction has been carried out in the past (MPSU, 2000) and this has had a severe effect on the amount of sand available to the system. If this is still being carried out it should be discontinued.

The mobile dunes consist of the typical species *Ammophila arenaria* (marram grass) with some *Elytrigia juncea* (sand couch) scattered amongst the habitat. Other species, which were present include *Carex arenaria* (sand sedge), *Eryngium maritimum* (sea holly) *Taraxacum* agg., (dandelion) and *Cerastium fontanum* (common mouse-ear). There were no negative indicators recorded in the habitat.

Scattered on the cobble nearby are species such as *Erodium cicutarium* (common stork's-bill), and *Stellaria graminea* (lesser stitchwort).

IMPACTS

The main threats to the site include overgrazing and amenity use. In the past there has also been other damaging threats recorded such as shingle extraction from a location near Ridge Point, periwinkle collection at Ridge Point, gravel deposition for a car park and fertilisation (MPSU, 2000). It is not known whether the gravel extraction and periwinkle collection still continues. The main current impacts on the sand dune habitat at Lough Doo are given in Table 114B. The machair habitat is affected by the presence of a caravan park (Code 608) located adjacent to the cSAC. This attracts high number of visitors. There is a car park (Code 400) to the front of this, which was built on the machair. Walking (Code 622) across the habitat, therefore takes place in order to access the beach. The presence of the sports pitch (Code 607), which is floodlit means that cars are driven (Code 623) onto the machair during matches. The pitch is fertilised (Code 120) and mown (Code 102) and the presence of the clubhouse (Code 600) and septic tank poses a significant threat to the ecology of the habitat. There is a fence surrounding the pitch (Code 150). Sheep have overgrazed the machair (Code 142) and some supplementary feed (Code 171) is provided. Cars are dumped on the machair (Code 423) and there is some domestic litter (Code 421) near to the football pitch. Finally natural erosion (Code 900) occurs at the site, which is compounded by the sheep grazing.

The mobile dune is also affected by natural erosion (Code 900) and by trampling and overuse (Code 720) by visitors to the beach.

Table 114B Intensity and impact of various activities on sand dune habitats at Lough Doo

EU Habitat Code[1]	Activity Code[2]	Intensity[3]	Impact[4]	Area affected/ha	Location of Activity[5]
H21A0	102	A	-1	0.742	Inside
H21A0	120	A	-1	0.742	Inside
H21A0	142	A	-1	6	Inside
H21A0	150	C	-1	0.742	Inside
H21A0	171	C	-1	Unknown	Inside
H21A0	400	A	-1	0.1	Outside
H21A0	421	C	-1	0.01	Inside
H21A0	423	C	-1	0.1	Inside
H21A0	600	A	-2	0.2	Inside
H21A0	607	A	-2	0.742	Inside
H21A0	608	A	-1	2.027	Outside
H21A0	622	B	-1	10	Inside
H21A0	623	A	-1	0.5	Inside
H21A0	900	A	0	8	Inside
H2120	720	B	-1	0.5	Inside
H2120	900	B	0	Unknown	Inside

[1] EU Codes as per Interpretation Manual. Code 21BB is an additional code used to signify the entire dune habitat.
[2] Description of activity codes are found in Appendix 3
[3] Intensity of the influence of an activity is rated as: A= high, B = medium, C = low influence and D = unknown.
[4] Impact is rated as: -2 = irreparable negative influence, -1 = repairable negative influence, 0 = neutral, +1 = natural positive influence and +2 = strongly managed positive influence
[5] Location of activity: Inside = activities recorded within the cSAC and directly impacting the sand dune habitat. Outside = activities recorded outside the cSAC but adjacent to sand dune habitat that may impact the sand dune habitat

CONSERVATION STATUS

The conservation status of a site is assessed on the condition of the site with regards to extent, structure & functions and future prospects. The main source of baseline information for this site was from the ASI Survey (1993), the NATURA 2000 report (1999), the Biomar Survey (1996) and the MPSU management plan (2000).

Table 114C Conservation status of Annex I sand dune habitats at Lough Doo

Habitat[1]	EU Conservation Status Assessment				
	Favourable	**Unfavourable – Inadequate**	**Unfavourable – Bad**	**Overall EU conservation status assessment**	**Proposed Irish conservation status system[2]**
Machair (H21AO)		Extent, Structure & functions Future Prospects		**Unfavourable - Inadequate**	**Unfavourable - Declining**
Mobile Dunes (H2120)		Extent Future Prospects	Structure & functions	**Unfavourable - Bad**	**Unfavourable - Declining**

[1] EU Codes as per Interpretation Manual
[2] Ratings are Favourable (Enhanced, Maintained, Recovered, Declining), Unfavourable (Recovering, Unchanged, Declining) and Destroyed (Partially destroyed, Completely destroyed and Unknown)

Details of the numbers and pass/failure rates of monitoring stops used to assess habitat structure & functions at Lough Doo are shown in Table 114D.

Machair (H21A0)

The machair habitat is well represented at this site. However there has been some loss of extent as a result of the presence of the football pitch and clubhouse. There is also a substantial area of bare sand on the machair, which is due to natural erosion but is compounded by overgrazing by sheep. This area of bare sand accounts for approximately 6.8% (this is most probably an overestimation) of the overall habitat and therefore significantly reduces the area of machair. The extent of the machair is therefore considered to be *unfavourable-inadequate* at present. The NATURA 2000 assessment is *good representativity*, meaning the machair is well represented.

The structure and functions parameter is rated as *unfavourable-inadequate*. Eight monitoring stops were placed in the machair within the cSAC. Six passed their targets and two failed (Table 114D). Overall species diversity is relatively good throughout the machair. Heavy grazing by sheep however is having an effect on the structure of the habitat and is exacerbating natural erosion of the plain. Species diversity has decreased in places as two of the monitoring stops failed as a result of this, as well as a decrease in flowering and fruiting of the sward. Further erosion and a decline in ecological viability of the habitat will occur if the grazing continues at this level. This needs to be addressed immediately. The NATURA 2000 assessment is *structure well conserved*. The machair has therefore declined in condition since this assessment was made.

Quadrats taken from the Biomar machair survey have also been used to compare past and present condition of the site. The closest quadrats to the 2006 monitoring stops are used for comparison and this provides a good indicator of any change in species composition as well as sward height. The criteria used during the current survey (2006) are applied to quadrats in the machair survey (1996). Two monitoring stops were compared to two quadrats taken in 1996, the rest of the stops were too far away from one another to make a comparison. Of these two, neither was directly comparable. One monitoring stop, which passed in the current survey, failed in the 1996 survey, as a result of low species diversity and bare ground >10%. The other two stops/quadrats passed in both surveys. A number of other quadrats that were placed in the 1996 survey were also analysed using current criteria and it was noted that five of these passed and one failed (none of these were near the 2006 monitoring stops). Therefore, a total of eight quadrats were looked at and six passed and two failed. This would be assessed as *unfavourable-inadequate* in 1996. Therefore no significant change in conditions has occurred between surveys simply different areas are affected.

Table 114D Pass/fail results of Annex I sand dune habitats at Lough Doo

	Monitoring stops		
Habitat	**Pass**	**Fail**	**Conservation status**
Machair (H21A0)	6	2	**Unfavourable - Inadequate**
Mobile dunes (H2120)	1	1	**Unfavourable - Bad**

The future prospects of the machair at Lough Doo are rated as *unfavourable-inadequate*. This assessment is based on the presence of high numbers of sheep, which if not reduced will further add to the already eroding surface. The NATURA 2000 survey assessed the site as of *good conservation* value in 1993, while Bassett (1983) described the machair in the past as of limited conservation value. The MPSU Management Plan (2000) aims to maintain, and if possible, enhance the ecological value of the priority habitat - Machair. Some of the strategies set out in the plan, in order to achieve these

objectives include the completion of a commonage framework plan to introduce a sustainable grazing regime on the Machair. Fence the fore-dune area to allow the establishment of dune vegetation and thereby reduce erosion and to liase with various organisations and groups on the management of the site. This plan should therefore be implemented if the habitat is to be maintained into the future. The sand/shingle extraction should also be ceased.

An overall EU conservation status of *unfavourable-inadequate* is assigned to the machair (Table 114C).

The overall Irish conservation status is *unfavourable-declining*.

Mobile Dunes (H2120)

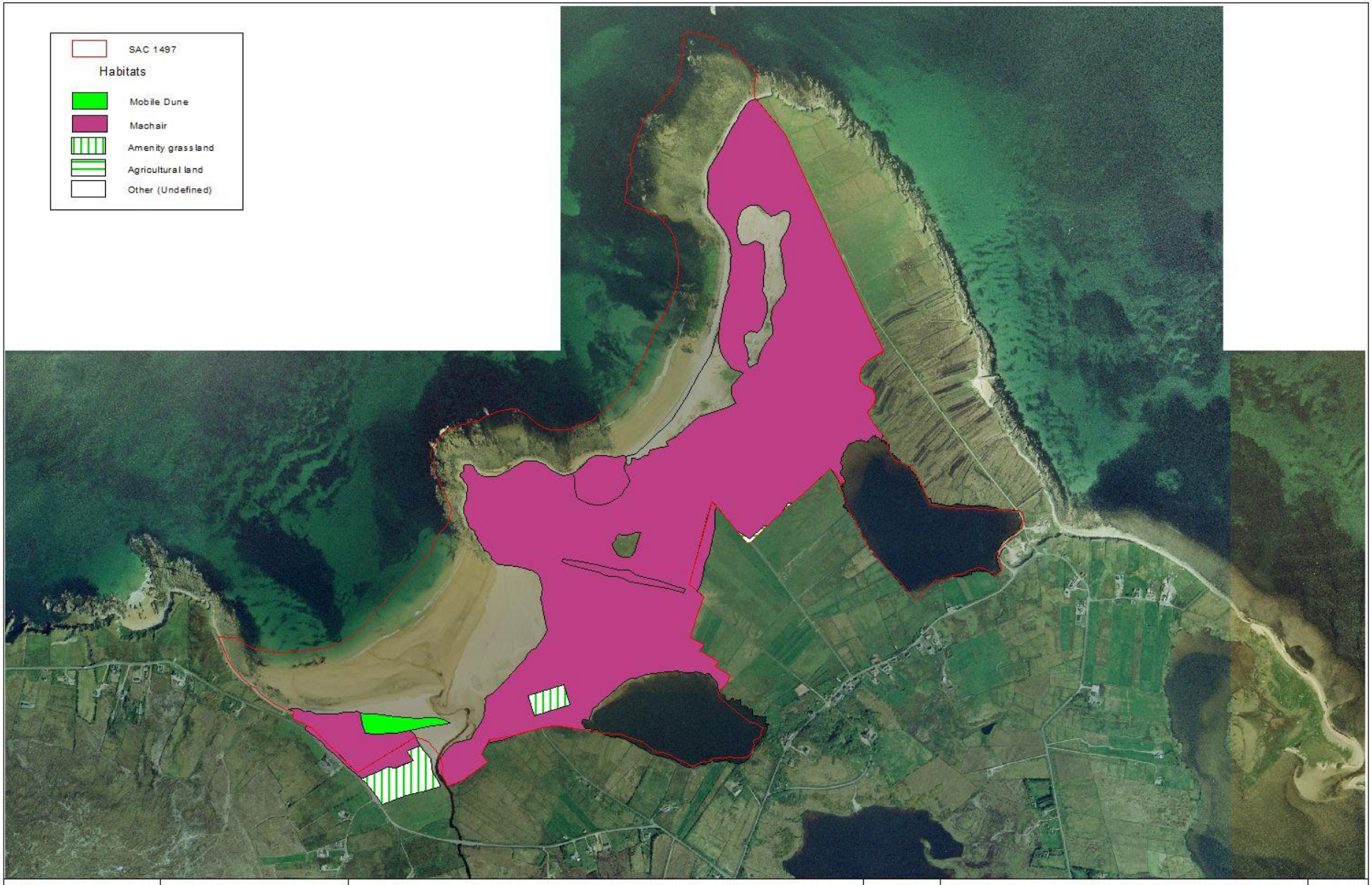
The extent of the mobile dunes at Lough Doo is considered to be *unfavourable-inadequate*. There are very little foredunes present at the site and the remaining, intact areas are subject to natural erosion compounded by anthropogenic activities. According to the ASI survey 1993, this was the only area of foredune present. According to the Machair Survey (1996), there were only badly eroded, relict fore-dunes present.

Two monitoring stops were carried out in the mobile dunes. One passed the criteria and one failed. The structure and functions of the habitat is therefore rated as *unfavourable-bad* as this equates to over 50% of the habitat which is in decline.

The future prospects of the habitat are rated as *unfavourable-inadequate* as a result of the threat from natural erosion compounded by people accessing the beach.

The overall EU assessment is rated as *unfavourable-bad.*

The overall Irish assessment is *unfavourable -declining.*



Coastal Monitoring Project 2004-2006

Lough Doo

Dogort Machair / Menaun Cliffs (SAC 1497)

CMP code: 114

0 200 400 600 800 Meters

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This habitat map was created with a combination of fieldwork, GPS and interpretation of aerial photos. Boundaries of designated areas are subject to revision. Produced from Ordnance Survey material by permission of the Government (Permit number 5953)

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