WESTERN ISLES THATCH AUDIT

AUGUST 2022

HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA

This report has been commissioned by Historic Environment Scotland (HES) to provide information which will support the availability of thatching materials in Na h-Eileanan Siar ~ the Western Isles.

The terms 'Western Isles' and 'Outer Hebrides' refer to the same archipelago of islands. Outer Hebrides is the formal name for the island chain, while Western Isles is a common alternative name. This report presents information, resources and literature using both terms.

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Ainmean Àite na h-Alba's Gaelic Place-name Policy was followed in the approach to place-names in this report.

Front cover image: Cottage near Malacleit, Uibhist a Tuath ~ Malaclete, North Uist. © Courtesy of HES (Society for the Protection of Ancient Buildings Collection).

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1. EXECUTIVE SUMMARY

1.1 Introduction

Historic Environment Scotland (HES) is the lead public body set up to investigate, care for and promote Scotland's historic environment.

In Na h-Eileanan Siar ~ the Western Isles and across Scotland, the conservation of thatched buildings is being impacted by the difficulty of sourcing traditional, local thatching materials. As a result, many buildings have been rethatched with materials that do not match their original roof coverings or that have been transported long distances.

HES has carried out extensive research into historical thatching techniques and the use of thatch in Scotland. The availability of thatching materials however has changed over time, due mainly to changing agronomy, culture, regulations and climate.

Against that backdrop, HES have commissioned this report as a resource to support and safeguard the availability of materials used for thatching in the Western Isles and Scotland. The report summarises research into natural and cultivated thatching materials in the Western Isles and makes recommendations for future research.

1.2 Objectives

This report covers three areas of interest:

- An audit of natural and cultivated thatch materials in the Western Isles
- A constraints and opportunities assessment of potential new sources of materials
- The environmental impacts of growing and harvesting thatch materials

During the research, some gaps in knowledge were identified, arising from limited historic information (for example, on heather use) and from changes in agronomic practices such as cereal cropping.

Marram grass is the main focus of this research, with cereal straw, heather and rush also investigated.

1.3 Findings

1.3.1 Marram grass

Marram grass can be found along much of the coastline of Na h-Eileanan Siar ~ the Western Isles, growing in mobile and semi-fixed dune systems.

The dune systems that exist on some areas of the coasts provide protection for agriculture, human settlements and infrastructure. Harvesting of marram may threaten the nature of dune areas and lead to increased erosion and subsequent loss of arable lands and wildlife-rich ground.

A National Vegetation Classification (NVC) survey in 1998 (Dargie and Duncan 1998) estimated that 242 hectares of mobile dune systems exist in the Western Isles, and 1,209 hectares of semi-fixed dunes contain marram. However, this survey found only 49 hectares where marram dominated the vegetation.

In 2021, using a Geographic Information System (GIS), it was estimated that marram was harvested from areas totalling approximately 63 hectares, mostly around the north and south of Uist (encompassing Beàrnaraigh ~ Berneray, Uibhist a Tuath ~ North Uist, Griomasaigh ~ Grimsay, Beinn na Faoghla ~ Benbecula, Uibhist a Deas ~ South Uist and Èirisgeigh ~ Eriskay).

The limited area of marram cut, compared to the area available, was due to two factors: restrictions by land managers out of concern about

erosion, sustainability and access; and the desirability of the marram grass areas for harvesting under varying topography and quality.

Access issues could be reduced with clear guidelines and communication, perhaps from HES and the Crofting Commission.

The sustainability of marram harvesting is in question, with conflicting views among land managers and conservationists. More scientific research is required on the effects of cutting of marram on plant growth, dune stability and coastal erosion.

1.3.2 Heather, cereal straw and soft rush

Heather is obtainable with far fewer restrictions than marram, but it is less desirable because of the work involved in pulling the plants and the time required to gather sufficient material.

Cereal straw is the most readily available thatching material and the easiest to produce, but the current common method of harvesting damages the straw, making it unsuitable for thatching.

Heather, straw and soft rush are all potentially available as thatching materials, and none of the issues in obtaining these materials are insurmountable.

1.4 Recommendations for further research

Further research, beyond the scope of this report, is required to inform growers and custodians about:

- Best practice in managing and harvesting marram
- Best practice in harvesting cereals
- The practicality of heather as a thatching material
- The practicality of rushes as a thatching material

Research findings would enable HES to provide recommendations of sustainable thatching material and give confidence to land managers and owners.

1.5 Conclusion

All types of thatching materials need to be carefully managed to reduce impacts on biodiversity. When they are grown or managed well, rushes, heather and cereal crops are likely to have positive benefits for biodiversity.

2. EXECUTIVE SUMMARY IN GAELIC

2.1 Geàrr-iomradh Gnìomha

2.1.1 Ro-ràdh

Is e Àrainneachd Eachdraidheil Alba (HES) am prìomh bhuidheann a tha air a stèidheachadh airson àrainneachd eachdraidheil Alba a sgrùdadh, adhartachadh agus cùram a ghabhail dheth.

Anns na h-Eileanan Siar agus air feadh Alba, tha glèidhteachas thogalaichean tughaidh a' tighinn fo bhuaidh an duilgheadais air stuthan tughaidh traidiseanta fhaotainn gu h-ionadail. Mar thoradh air sin, tha mòran togalaichean air an ath-thughadh le stuthan nach eil a rèir an còmhdaichean mullaich tùsail, no a tha air an giùlain astaran fada.

Tha HES air rannsachadh farsaing a dhèanamh air modhan tughaidh eachdraidheil agus air cleachdadh tughadh ann an Alba. Tha faotainneachd air stuthan tughaidh air atharrachadh rè ùine ge-tà, mar thoradh sa mhòr-chuid air atharrachadh ann an saidheans àiteachais talmhainn is bàrr, cultar, riaghailtean agus gnàth-shìde.

Mu choinneamh a' chùl-raoin sin, tha HES air an aithisg seo a choimiseanadh mar ghoireas airson taic agus dìon a chur air faotainneachd stuthan a thathar a' cleachdadh mar thughadh sna

h-Eileanan an Iar agus Alba. Tha an aithisg a' dèanamh geàrr-iomradh rannsachaidh air stuthan tughaidh nàdarra agus àitichte sna h-Eileanan an Iar agus a' toirt seachad mholaidhean a thaobh rannsachadh san àm ri teachd.

2.2 Cinn-uidhe

Tha an aithisg seo a' coimhead ri trì raointean ùidhe:

- Sgrùdadh air stuthan nàdarra agus àitichte sna h-Eileanan an Iar.
- Measadh chuingealachdan agus chothroman de thùsan ùra stuthan as coltaiche.
- Buaidhean àrainneachdail a bhith a' fàs agus a' buain stuthan tughaidh.

Rè an rannsachaidh, chaidh beàrnan a lorg ann an eòlas, ag èirigh bho ghainnead fiosrachaidh eachdraidheil (mar eisimpleir, a thaobh cleachdadh air fraoch) agus bho atharrachaidhean ann an cleachdaidhean àiteachais leithid buain gràn-arbhair.

Tha an rannsachadh seo a' cuimseachadh sa mhòr-chuid air muran le sgrùdadh ga dhèanamh cuideachd air connlach gràin, fraoch agus luachair.

2.3 Toraidhean

2.3.1 Muran

Lorgar muran sìos fad mòran de dh'oirthìr nan Eilean Siar, a' fàs ann an siostaman dhùn-gainmhich gluasadach agus leth-stèidhichte.

Tha na siostaman dùn-gainmhich a tha an làthair ann an cuid de dh'àiteachan air na costaichean, a' toirt dìon do dh'àiteachas, tuineachaidhean daonna agus bun-structar. Faodaidh buain mhurain bagairt a thoirt air nàdar nan raointean dùn-gainmhich agus leantainn gu meudachadh air bleith agus às dèidh sin call air talamh àitich agus fearann a tha saidhbhir le fiadh-bheatha.

Rinn an t-suirbhidh Rangachadh Fàs-bheatha Nàiseanta (NVC) ann an 1998 (Dargie is Duncan 1998) tuairmse gu bheil 242 heactair de shiostaman dùn-gainmhich ghluasadach rin lorg sna h-Eileanan an Iar,

agus 1,209 heactair de dhùin leth-stèidhichte anns a bheil muran. Ach, cha do lorg an t-suirbhidh seo ach 49 heactairean a-mhàin far an robh làmh-an-uachdar aig muran air fàs-bheatha.

Ann an 2021, a' cleachdadh Siostam Fiosrachaidh Cruinn-eòlais (GIS), chaidh a mheas gun deach muran a bhuain ann an raointean de suas ri 63 heactairean, sa mhòr-chuid timcheall ceann a tuath agus ceann a deas Uibhist (a' toirt a-steach Beàrnaraigh, Uibhist a Tuath, Griomasaigh, Beinn na Faoghla, Uibhist a Deas agus Èirisgeigh).

Bha an raon cuibhrichte de mhuran a chaidh a bhuain, ann an coimeas ris an raon a bha ri fhaotainn, mar thoradh air dà adhbhar: cuibhreachaidhean le manaidsearan fearainn air an robh dragh mu bhleith, seasmhachd agus ruigsinneachd; agus miann air raointean murain a ghlèidheadh airson am buain fo dhiofar cumadh-tìre agus càileachd.

Dh'fhaodadh cùisean mu ruigsinneachd a bhith air an lùghdachadh tro stiùiridhean soilleir agus conaltradh, is dòcha bho HES agus Coimisean na Croitearachd.

Tha seasmhachd buain mhurain ann an ceist, le beachdan còmhstritheach am measg mhanaidsearan fearainn agus luchd-glèidhteachais. Tha barrachd rannsachaidh saidheansail a dhìth air a' bhuaidh aig buain mhurain air fàs planntrais, seasmhachd dhùin-gainmhich agus bleith costach.

2.3.2 Fraoch, connlach gràin agus luachair

Tha fraoch ri fhaotainn le mòran nas lugha de chuibhreachaidhean na muran, ach chan eil e cho so-iarrtach air sgàth na h-obrach an lùib a bhith a' spìonadh nan lusan agus an ùine a tha a dhìth airson stuth gu leòr a thional.

Is e connlach gràin an stuth tughaidh as deiseile a tha ri làimh agus as fhasa a thoirt gu buil, ach tha am modh buain cumanta làithreach a' dèanamh milleadh air a' chonnlaich, ga dhèanamh mì-fhreagarrach airson tughadh.

Tha fraoch, connlach agus luachair rim faotainn mar stuthan tughaidh, agus chan eil aon de na cùisean an lùib nan stuthan sin fhaotainn, do-dhèante am fuasgladh.

2.4 Molaidhean airson barrachd rannsachaidh

Tha barrachd rannsachaidh seachad air farsaingeachd na h-aithisg seo, a dhìth airson luchd-fàs agus luchd-glèidhidh fhiosrachadh mu:

- An cleachdadh as fheàrr ann an stiùireadh agus buain mhurain
- An cleachdadh as fheàrr ann am buain gràn
- Freagarrachd fhraoich mar stuth tughaidh
- Freagarrachd luachair mar stuth tughaidh

Bheireadh toraidhean rannsachaidh comas do HES air molaidhean a dhèanamh a thaobh stuth tughaidh seasmhach agus misneachd a thoirt do mhanaidsearan is luchd-seilbh fearainn.

2.5 Co-dhùnadh

Feumaidh a h-uile seòrsa de stuth tughaidh a bhith air an làimhseachadh gu cùramach gus buaidh air bith-iomadachd a lùghdachadh. Nuair a tha iad air am fàs no air an làimhseachadh gu math, tha coltas gum bi buannachdan dearbhach aig luachair, fraoch agus bàrr-gràin dha bith-iomadachd.

3. INTRODUCTION

In this report, the 2016 Society for the Protection of Ancient Buildings Scotland (SPAB) publication *A Survey of Thatched Buildings in Scotland* is supplemented by a short literature review to highlight traditional use of thatch materials. Literature about the cultivation, harvesting and suitability of materials for thatching is included. Studies illustrating opportunities for increased cultivation or alternative options for growing thatch materials are also reviewed.

The main content of the report maps thatching materials in the Western Isles, focusing primarily on the inhabited islands. The maps depict areas where thatching materials grow and where they are harvested. Maps of areas where there is potential for harvesting and an estimate of the area available in the Western Isles are also included.

The results of stakeholder engagement and data collection are presented, including views about how thatch materials which grow within common grazings and Sites of Special Scientific Interest (SSSIs) are managed. According to the Crofting Commission, 'common grazings are areas of land used by a number of crofters and others who hold a right to graze stock on that land'. This data has been anonymised to protect the confidentiality of individual contributors.

Gaps in knowledge lying beyond the remit of this report are highlighted, along with suggestions for promoting the availability of thatch materials in the Western Isles which have emerged from stakeholder engagement.

Marram is the main thatch material focused on within Section 5 of the report. Section 6 sets out alternative materials: cereal straw, heather, rush and water reed. Section 7 outlines environmental impacts.

4. LITERATURE REVIEW

4.1 Background

This literature review focuses primarily on peer-reviewed academic publications, supplemented by grey literature (information produced outside of traditional publishing and distribution channels) to build a more complete review. As well as literature focusing on Na h-Eileanan Siar ~ the Western Isles, literature about other areas of Scotland, the UK, and elsewhere in the world will be included where additional context is useful. A full bibliography can be found in Section 10.

4.2 What is thatch?

Thatch has been described as the 'predominant roofing material in Scotland, from the prehistoric period to about 1900' (Walker 2001: 163). Scotland had 'one of the most diverse ranges of thatching materials and techniques found in Europe' (Herbert 2016: iv). Since the mid-19th century, use of thatch for roofing declined as lifestyles and housing standards changed, and 'other more durable materials became available' (Herbert 2016: 2).

4.3 How is thatch locally significant to the Western Isles?

In Na h-Eileanan Siar ~ the Western Isles, thatched houses were referred to as blackhouses, known as taigh-dubh, blackhouse, or taigh-tughaidh, meaning thatched house in Gaelic (Robson 2019: 3). These houses were 'constructed from local materials, with stone walls, driftwood roof timbers' and there were 'customary practices of peat cutting and heather taking for thatching' (Robertson and Rivett 2019: 172).

Thatch is not a 'standardised vegetative roofing material' (Scott 2007: 139). A diverse range of thatch materials has been used in Scotland in the past, each with different qualities relating to water resistance, wind resistance, heat retention, ventilation and economic viability (Walker et

al. 1996: 20). A recent study of the thermal properties of a relatively thin layer of reed thatch found that it met modern insulation standards for the UK (see Simpson 2022). A 2004 study of four properties in the Western Isles found thatch of oat straw imported from Inbhir Nis ~ Inverness, as well as marram (see Scott 2007). A peat fire can ensure the preservation of oat-straw thatch (Scott 2007; Walker et al. 1996).

Although blackhouses became less frequently used as human dwellings, it was still common in the 1950s for them to be used as byres. Dr Finlay MacLeod describes the thatched byre as 'where the cow was, and where the young lambs were in during the winter, where the hens were' (Robertson and Rivett 2019: 175). As such, these buildings were integral to crofting life in Leòdhas ~ Lewis in the 1950s. Since then, as the number of thatched buildings has reduced, demand for thatching materials has also reduced. There has been an associated neglect of traditional thatch-producing areas that were no longer protected or set aside by crofters (Walker et al. 1996: 26). Thus, as demand for thatch materials has declined, so has their availability.

4.4 How have crofting practices impacted thatch availability?

Changes in crofting practices have also had an impact on the availability of thatch materials (Herbert 2016: iv). For example, in the past in Na h-Eileanan Siar ~ the Western Isles, oat straw was grown in sandy soil in the machair (Walker and McGregor 1996: 18), and although cereal crops are still grown, they are grown as a mix of cereals rather than as one type.

There have been changes in the way machair is managed as the number of active crofters has declined (Pakeman et al. 2011), and the practice of allowing cattle to graze near the shore has become more common (Walker et al. 1996: 7, 11). As cattle graze on marram, they pull up its roots; this reduces the availability of marram and increases the potential for dune instability (Walker et al. 1996: 7). This can, in turn, increase sand

invasion onto machair (Kelley et al. 2018: 1289). Unrestricted grazing (not necessarily by cattle) was identified, along with storm activity resulting in the destruction of fences, as a factor in the removal of marram in Cille Pheadair, Uibhist a Deas ~ Kilpheder, South Uist (Hansom et al. 2017).

4.5 How has climate change impacted the availability of thatch?

There is potential for climate change to impact the availability of marram and other thatch materials that grow on sandy soil near machair. For example, studies from Denmark, the Netherlands, Germany, Belgium, France and the UK (Osswald 2019; Osswald et al. 2019; Van de Walle et al. 2021) have investigated the role of marram grass in stabilising dunes in response to rising sea levels.

The sand fixation capabilities of marram were identified by Reijers et al. (2019). A long-term framework to plant marram was put in place as part of a Belgian pilot project to stabilise dunes for coastal protection (Cosoveanu et al. 2020). In addition to acting as coastal defence structures, dunes 'form a unique habitat full of species' (Provoost and Bonte 2004), and therefore the vegetation that helps to stabilise dunes can contribute to biodiversity.

As well as on the coastal environment, there can be impacts of climate change to the cultural heritage and 'earth-built heritage of Scotland' (Harkin et al. 2020; Parkin et al. 2015).

In addition to marram, a range of other materials have commonly been used for thatching: bracken, broom, eel grass, heather, straw (oat and barley), reed and rye (Herbert 2016: iv).

4.6 How has farming impacted the availability of thatch?

Changes in farming practices have impacted on the availability of thatch materials. Mechanised harvesting and the use of nitrate-based fertiliser,

which break and weaken the stems, have made materials such as straw from the mainland less suitable for use as a thatch material (Walker et al. 1996: 11). As a result, of the reduced availability of thatch materials which emerged from these changes, there has been a shift from the use of straw towards using reeds for thatch (Walker et al. 1996: 68).

The UK's largest continuous reedbed is located 'along the north bank of the River Tay in Perthshire' (Royal Society for the Protection of Birds, 'Tay Reedbeds'). The reed there is cut to manage the habitat for a variety of bird species. This process also supports the commercial production of thatching reed. Commercial thatch operations ceased in 2005.

4.7 Does peatland restoration provide opportunities for growing thatch?

A recent evidence assessment of peatland restoration in Scotland, 'Peatland restoration and potential emissions savings on agricultural land: an evidence assessment', found that there were economic opportunities for the production of reed bundles for thatching. However, it recognised that 'reed growing on peat has not yet been tested at scale in Scotland' but suggested that there was potential value 'in experimental work to evaluate viability, and carbon benefits' (Aitkenhead et al. 2021: 22).

In a study about paludiculture (farming with high water tables), Wichmann has highlighted that despite this potential, harvesting of reed beds in the UK 'is spatially and temporally restricted by nature conservation' and that, as thatching reed is not considered as an agricultural product, it has not been possible to attract agricultural subsidies to promote production (Wichmann 2017: 503).

4.8 How do you gather thatch when it grows on sites with multiple designations?

In Na h-Eileanan Siar ~ the Western Isles, marram grows on 'internationally rare landforms' described as 'calcareous, floristically rich, coastal shell-sand plains' (Gordon et al. 2021: 487). These areas may have multiple designations such as Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protected Area (SPA) and National Scenic Area (NSA). (See also designating bodies: NatureScot and Joint Nature Conservation Committee.)

NatureScot (formerly Scottish Natural Heritage) has a role in advising and monitoring the management of sites as Scotland's nature agency. Management agreements between NatureScot and landowners may include directions about the management of marram and other thatch materials that grow on these sites, including specifications around harvesting.

4.9 What can marram grass teach us about sustainable procurement and site management?

Marram grass (*Ammophila arenaria*) is described as an important species in the stabilisation of mobile dunes and blowouts (Botanical Society of Britain and Ireland [BSBI] 2020). It is the most prevalent subspecies of marram in northern Europe. However, it can dominate the dunes and in some areas of Na h-Eileanan Siar ~ the Western Isles marram has been found to be the only species present (Joint Nature Conservation Committee, 'Special Areas of Conservation'). As elsewhere in Europe, other than site-specific management agreements, there is no legal framework to regulate harvesting of marram (Cosoveanu et al. 2020); although, interestingly, in 1695 an Act of the Scottish Parliament prohibited the harvesting of marram at Cùil Beinne ~ Culbin in the Moray Firth, as the practice was believed to contribute to dune instability (Angus and Hansom 2021: 386).

The regular harvesting of marram has been highlighted as a factor in ensuring a 'plentiful supply', in that it is thought to stimulate growth (Walker et al. 1996: 26). This is because 'cutting of marram grass encouraged the root system to develop and thicken' (Walker et al. 1996: 11). Annual harvesting by hand cutting in the past is described as having been sustainable because it 'left the roots fully intact' (Austin and Walker-Springett 2021: 4).

4.10 Conclusion

Findings in *A Survey of Thatched Buildings in Scotland* state that 'changes to housing standards and lifestyle more recently have increasingly made traditional thatched buildings redundant or difficult to maintain' (Herbert 2016: 2). However, in the foreword to the volume, Matthew Slocombe celebrates the fact that '[m]aterials such as marram grass remain in some Scottish coastal areas and all vernacular thatch survivals' (Herbert 2016: v). Slocombe describes the quality of maintenance of thatch on the roofs of these traditional buildings as 'a good litmus test for the state of vernacular building conservation' (Herbert 2016: v).

Evidence presented in this literature review suggests that there are historical, cultural, agricultural and climatic aspects to the conservation of thatched buildings in Na h-Eileanan Siar ~ the Western Isles. The sustainable production of thatch materials there should be considered in terms of future availability of thatch materials.

Full-page image 1: Detail of weighted marram thatch on a renovated cottage at Rubha Ghaisinis, Uibhist a Tuath ~ Rughasinish, South Uist. © Courtesy of HES (Society for the Protection of Ancient Buildings Collection).

5. THATCH MATERIALS: MARRAM GRASS

5.1 Mapping natural and cultivated resources

5.1.1 Marram locations

Marram grass (*Ammophila arenaria*) is predominantly found in mobile dune and semi-fixed dune habitats, as a result of sand supply stimulating growth (Nolet et al. 2018). These dune systems occur on the western side of Na h-Eileanan Siar ~ the Western Isles archipelago.

There is historical information available on dune locations and dune vegetation. A National Vegetation Classification (NVC) survey was conducted in 1998 by T. Dargie that mapped and quantified NVC habitats (Dargie and Duncan 1998).

The maps below are taken from that survey report and show the location of dunes and machair sites in the Western Isles in 1998. They also show the location of mobile and semi-fixed dunes and the hectares of vegetation covering those areas.

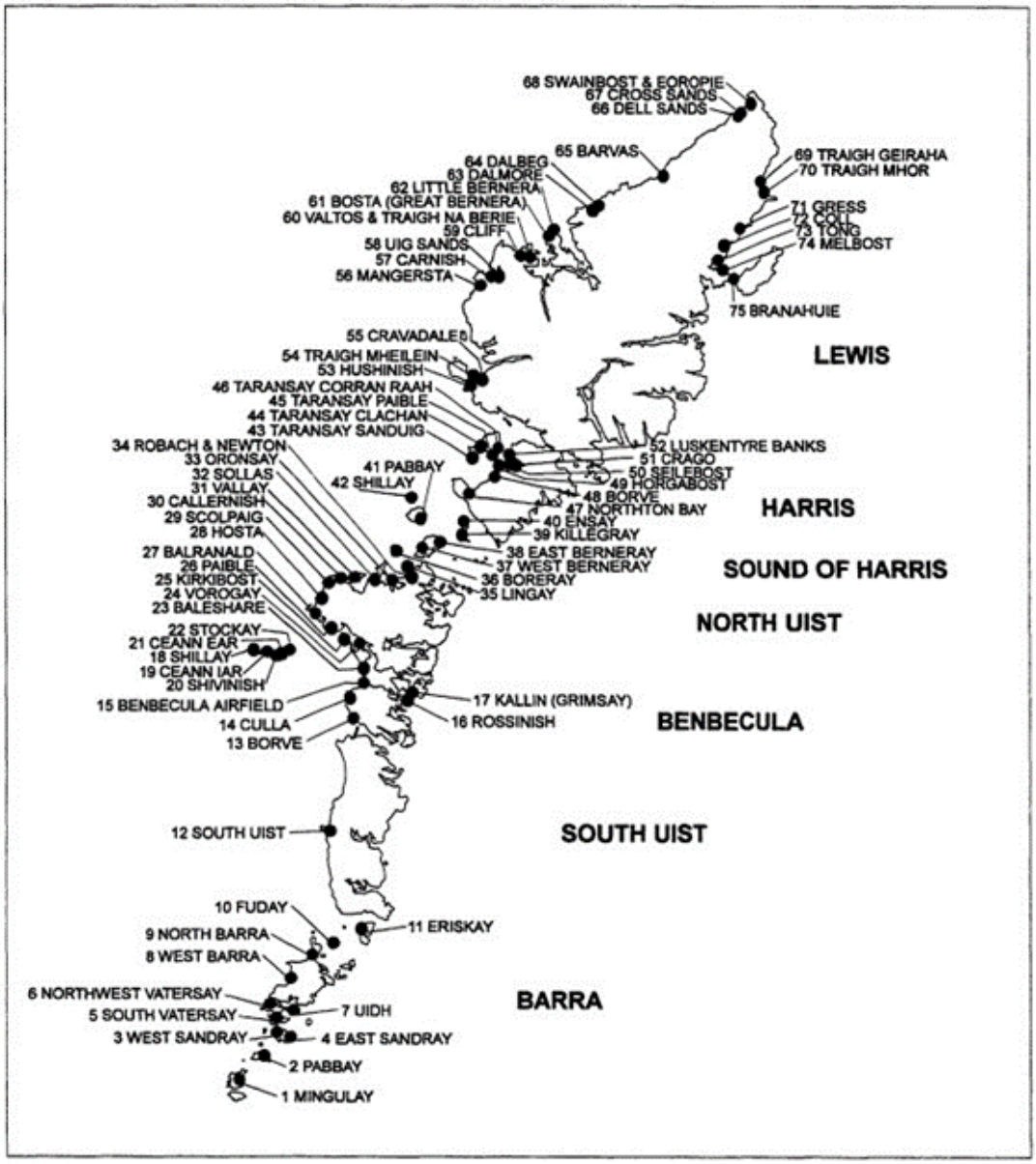

Figure 1: Map taken from *Sand dune vegetation survey of Scotland: Western Isles*, 1998, showing the location sites of dunes and machair.

Figure 1 identifies the locations of dunes and machair. It is a black-and-white outline map of the Na h-Eileanan A-Muigh ~ Outer Hebrides, Scotland and is labelled 'Sound of Harris'. Each main island or island group is also marked. The island locations included are from Lewis in the north to Barra in the south (Leòdhas ~ Lewis, Na Hearadh ~ Harris, Uibhist a Tuath ~ North Uist, Beinn na Faoghla ~ Benbecula, Uibhist a Tuath ~ South Uist and Barraigh ~ Barra). The map has seventy-five

numbered location text labels with circular black points, each with a line to connect the text to a point.

Below is a copy of the numbers on the map in Figure 1 with the associated label, noting the name of survey location:

1 Miùghalaigh ~ Mingulay
2 Pabaigh ~ Pabbay
3 Taobh Siar Shanndraigh ~ West Sandray
4 Taobh Sear Shanndraigh ~ East Sandray
5 Taobh a Deas Bhatarsaigh ~ South Vatersay
6 Ceann Iar-thuath Bhatarsaigh ~ Northwest Vatersay
7 Uidh
8 Taobh Siar Bharraigh ~ West Barra
9 Taobh a Tuath Bharraigh ~ North Barra
10 Fuideigh ~ Fuday
11 Èirisgeigh ~ Eriskay
12 Uibhist a Tuath ~ South Uist
13 Borgh ~ Borve
14 Culla
15 Port-adhair Bheinn na Faoghla ~ Benbecula Airfield
16 Ròisinis ~ Rossinish
17 Ceallan, Griomasaigh ~ Kallin (Grimsay)
18 Siolaigh ~ Shillay
19 Ceann Iar
20 Sibhinis ~ Shivinish
21 Ceann Ear
22 Stòcaidh ~ Stockay
23 Am Baile Sear ~ Baleshare
24 Bhorogaigh ~ Vorogay
25 Eilean Chirceboist ~ Kirkibost
26 Paibeil ~ Paible
27 Baile Raghaill ~ Balranald
28 Hòstadh ~ Hosta
29 Scolpaig ~ Scolpaig
30 Calarnais ~ Callernish
31 Bhalaigh ~ Vallay
32 Solas ~ Sollas
33 Orasaigh ~ Oronsay
34 Robach & Baile MhicPhàil ~ Robach & Newton
35 Lingeigh ~ Lingay
36 Boraraigh ~ Boreray
37 Taobh Siar Bheàrnaraigh ~ West Berneray
38 Taobh Sear Bheàrnaraigh ~ East Berneray
39 Ceileagraigh ~ Killegray
40 Easaigh ~ Ensay
41 Pabaigh ~ Pabbay
42 Siolaigh ~ Shillay
43 Sanndaig, Tarasaigh ~ Taransay Sanduig
44 An Tràigh Siar, Tarasaigh ~ Taransay Clachan
45 Paibeil, Tarasaigh ~ Taransay Paible
46 Corran Rà, Tarasaigh ~ Taransay Corran Raah
47 Tràigh an Taoibh Thuath ~ Northton Bay
48 Na Buirgh ~ Borve
49 Horgabost
50 Seileabost ~ Seilebost
51 Crago
52 Bruaichean Losgaintir~ Luskentyre Banks
53 Hùisinis ~ Hushinish
54 Tràigh Mheilein
55 Crabhadail ~ Cravadale
56 Mangarstadh ~ Mangersta
57 Càrnais ~ Carnish
58 Tràigh Ùige ~ Uig Sands
59 Cliobh ~ Cliff
60 Bhaltos agus Tràigh na Beirigh ~ Valtos and Traigh na Berie
61 Bostadh, Beàrnaraigh ~ Bosta (Great Bernera)
62 Beàrnaraigh Beag ~ Little Bernera
63 Daile Mòr ~ Dalmore
64 Daile Beag ~ Dalbeg
65 Barbhas ~ Barvas
66 Tràigh Dhail ~ Dell Sands
67 Tràigh Chrois ~ Cross Sands
68 Suaineabost agus Eòrrabaidh ~ Swainbost and Eoropie
69 Tràigh Ghearadha ~ Traigh Geiraha
70 Tràigh Mhòr ~ Traigh Mhor
71 Griais ~ Gress
72 Col ~ Coll
73 Tunga ~ Tong
74 Mealabost ~ Melbost
75 Bràigh na h-Aoidhe ~ Branahuie

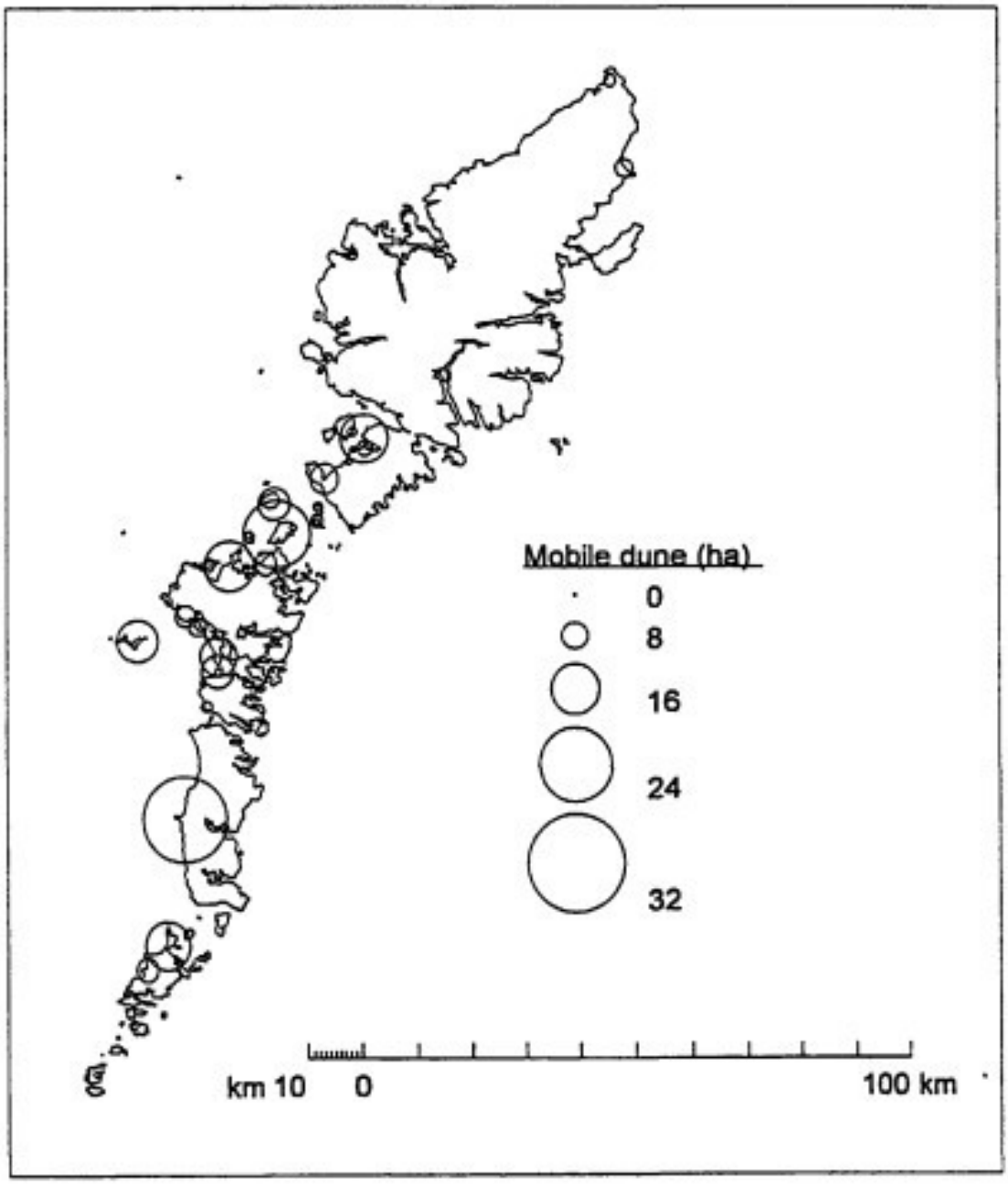

Figure 2: Map taken from *Sand dune vegetation survey of Scotland: Western Isles*, 1998, showing the location and hectares of mobile dune vegetation.

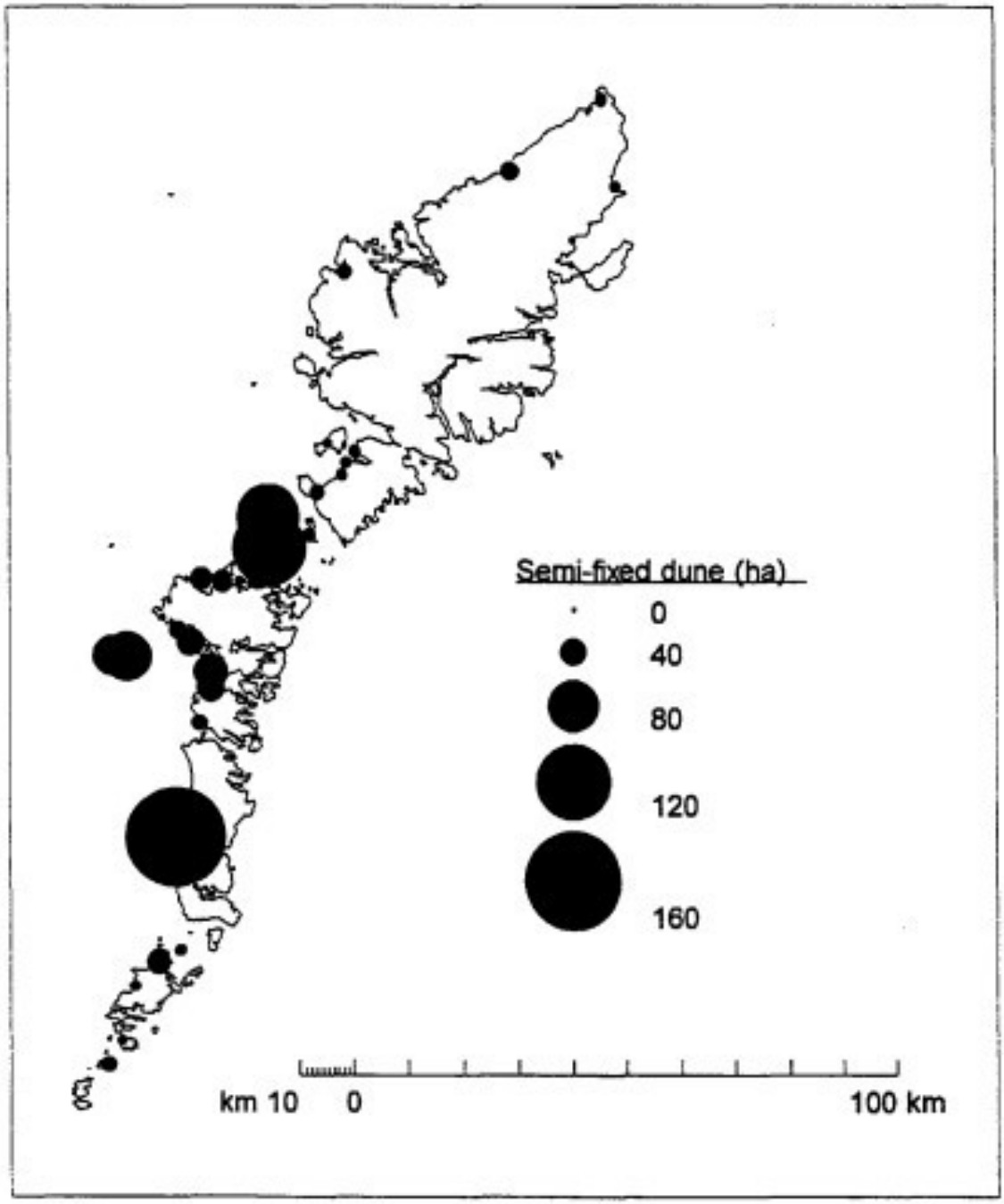

Figure 3: Map taken from *Sand dune vegetation survey of Scotland: Western Isles*, 1998, showing the location sites and hectares of semi-fixed dune vegetation.

The *Sand dune vegetation survey of Scotland: Western Isles*, 1998 reported that there were 242.2 hectares of mobile dune systems in the Western Isles and that the semi-fixed dune habitats covered 1,210 hectares. However, although marram is found in these locations, it is important to consider that it is not always the dominant vegetation

species. The survey concluded that there were only 49 hectares of mobile dunes where marram grass was the dominant species with few other species present, due, it was thought, to optimal sand supply conditions.

5.2 Marram harvest locations

The number of locations where marram is harvested has reduced in recent years. This is possibly because fewer people are harvesting, and also because of permission restrictions. Consultation with stakeholders and local people identified sites where harvesting still takes place. A GIS measuring tool was used to estimate how many hectares the marram grass covers. However, this approach does not take into account the presence of other vegetation growing in the area, bare sand cover, or the quality of marram grass in relation to thatching use.

Table 1: Locations and hectares of current marram harvesting.

Location of current marram harvesting	Number of hectares of (ha) potential marram grass cover (GIS measurement)
Beàrnaraigh: Cùl-cinn Ruisigearraidh (Taobh Siar Bheàrnaraigh) ~ Berneray: Rushgarry Common Grazing (West Berneray)	13.11
Beàrnaraigh: Tràigh Bheastaire ~ Berneray: East Beach	4.77
Beàrnaraigh: Cùl-cinn Bhuirgh (Taobh Siar Bheàrnaraigh) ~ Berneray: Borve Common Grazing (West Berneray)	32.23
Eilean Chirceboist ~ Kirkibost Island	13.33
Total number of hectares	**63.44**

Three maps for each area where harvesting currently takes place are provided on the following pages: the historic 1998 survey, GIS measurement, and aerial photography.

5.2.1 Taobh Siar Bheàrnaraigh agus Taobh Sear Bheàrnaraigh ~ West Berneray and East Berneray

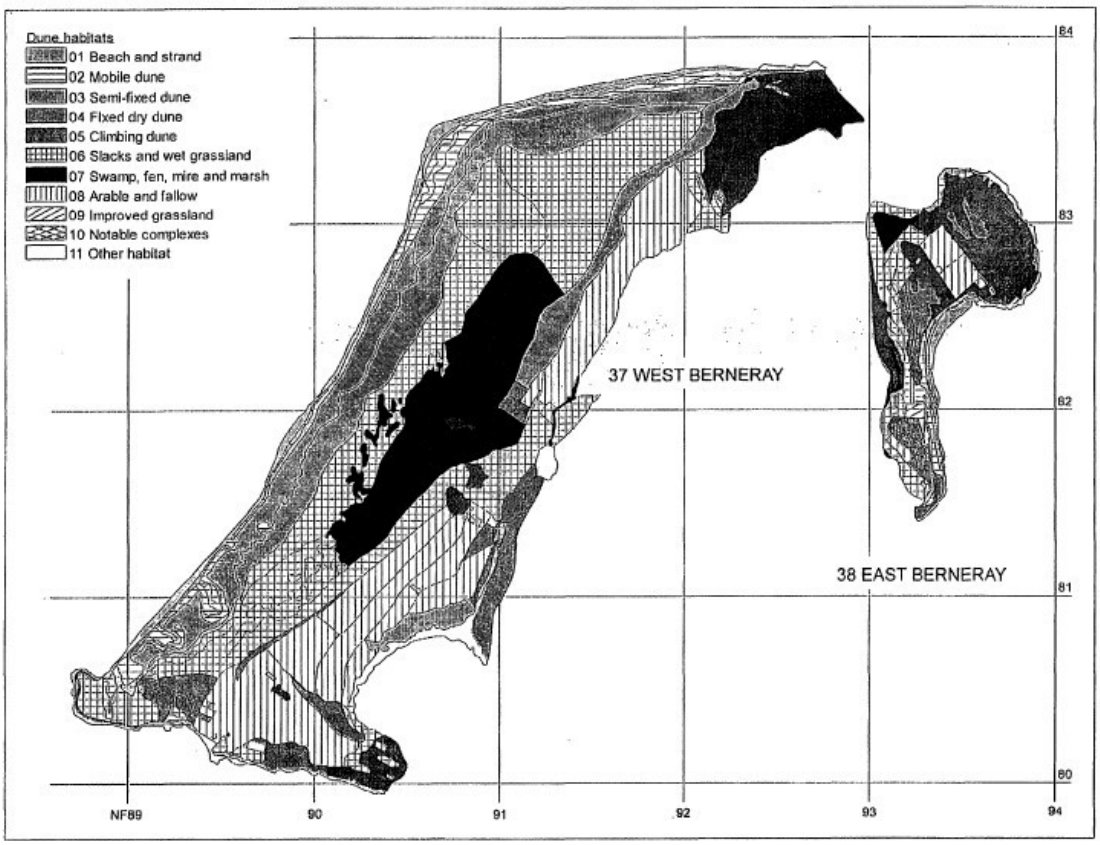

Figure 4: Map of West Berneray and East Berneray showing dune habitats, from *Sand dune vegetation survey of Scotland: Western Isles*, 1998.

Below is a copy of the text in the Key in Figure 4, noting dune habitat numbers and labels:

1 Beach and strand
2 Mobile dune
3 Semi-fixed dune
4 Fixed dry dune
5 Climbing dune
6 Slacks and wet grassland
7 Swamp, fen, mire and marsh
8 Arable and fallow
9 Improved grassland
10 Notable complexes
11 Other habitat

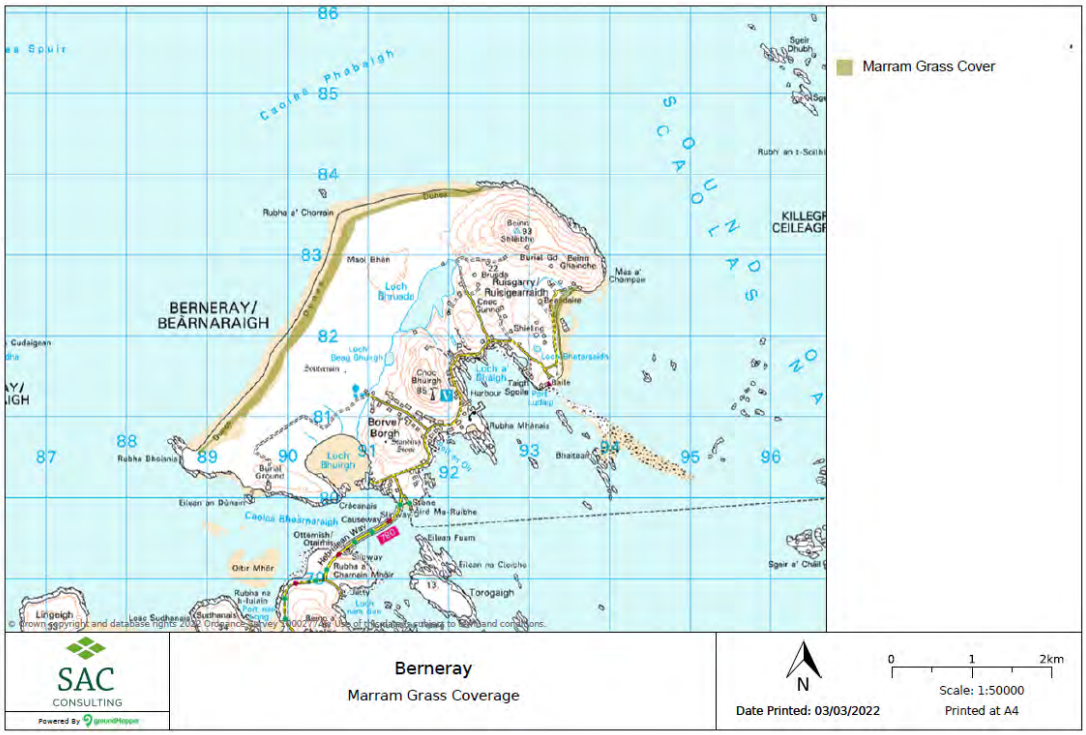

Figure 5: Map of Berneray showing marram grass cover estimated using GIS aerial imagery, 2021. Marram cover is marked in mossy green.

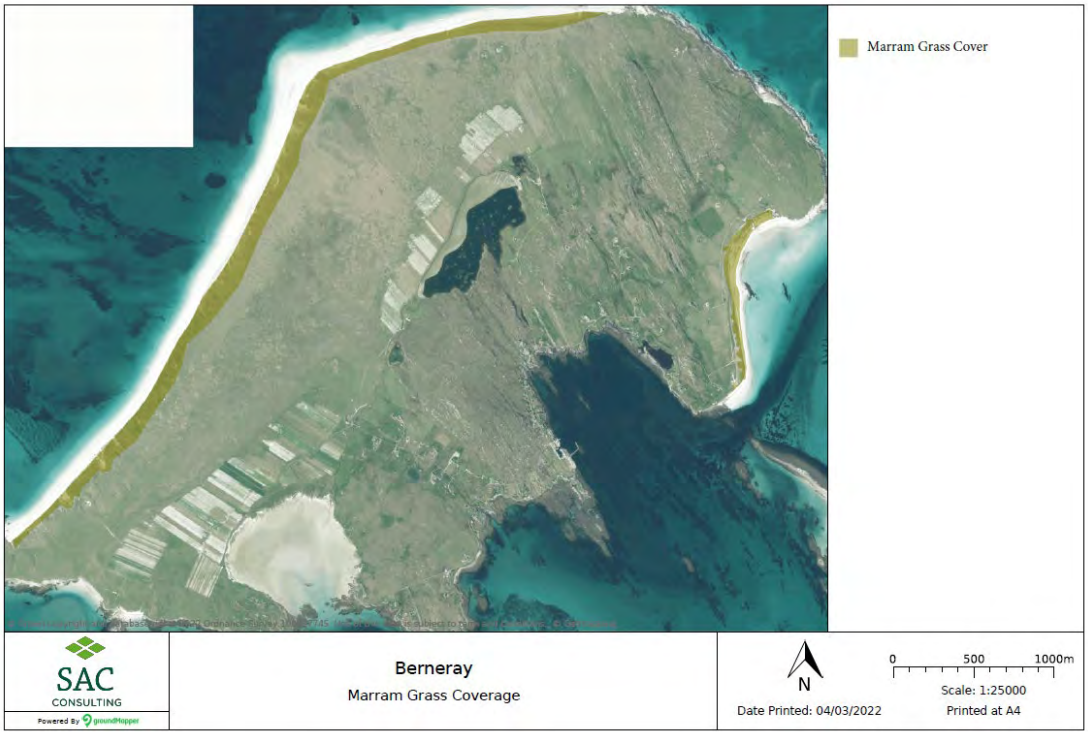

Figure 6: Map showing estimated marram grass cover marked on aerial imagery of Berneray, 2021. Marram grass is marked in mossy green.

5.2.2 Cùl-cinn Ruisigearraidh, Beàrnaraigh ~ Rushgarry Common Grazing, Berneray

The Ruisigearraidh ~ Rushgarry township as recorded in 2022 has seven blackhouse cottages with marram thatched roofs. A further two are potentially being restored (guidance given from HES to thatch with marram or reed).

The marram grass in Rushgarry is noted by thatchers as being of quite good quality. There are contradictory views within the township and the Common Grazings Committee about who is allowed to cut marram there, for example, whether permission should be limited to crofters within the township or extended to anyone with a thatched house on Berneray.

The common grazing is within an SSSI as well as an Agri-environment Climate Scheme (AECS), which restricts grazing to certain dates over much of the common grazing. The AECS scheme also limits vehicle use and creation of new track marks. In return for adhering to the scheme rules, the common grazing receives annual payments.

The marram in this township is fenced off from the machair, where the livestock graze, although sheep are occasionally able to access the marram area from neighbouring crofts.

The marram here is transported off the common grazing by 4×4 vehicle and trailer. In winter, heavy rainfall can cause flooding that makes access difficult.

Figure 7: Close-up aerial photograph showing patches where marram has been cut within Rushgarry Common Grazing, Berneray.

5.2.3 Cùl-chinn Bhuirgh ~ Borve Common Grazing

The marram grass on Borgh ~ Borve has been referred to by thatchers as not being as desirable as the marram grass found within the Rushgarry area. This is due to the quality of the marram and the topography of the land, which features lots of hillocks, making vehicle access and cutting more difficult. It is 0.5km from the road-end to the dune system where the marram grass grows.

The Borve Common Grazing sits within an SSSI and is also in an AECS scheme that dictates grazing dates and encourages cattle grazing in the winter months in return for payment. The marram grass areas in this township are not fenced off, so livestock have access to them.

5.2.4 Tràigh Bheastaire, Beàrnaraigh ~ East Beach, Berneray

The marram grass within the Tràigh Bheastaire ~ East Beach area is on croft land but is beyond a common grazing or an SSSI, and therefore permission to harvest should be obtained from the croft tenant, landowner, and/or croft owner-occupier. Marram grass has been harvested from this area in recent years.

This dune system is also a popular place for people to stay in the spring and summer months with tents, campervans and motorhomes, resulting in trampling of marram. It is accessible on foot and is only 50m from the roadside.

Figure 8: Photograph showing areas of cut marram on Tràigh Bheastaire or East Beach, Berneray.

5.2.5 Eilean Chirceboist, Uibhist a Tuath ~ Kirkibost, North Uist

Eilean Chirceboist ~ Kirkibost Island is within an SSSI and is a tidal island requiring the use of a boat to access it.

The island currently only has one person harvesting marram grass from it: a commercial thatcher who has asked for permission from the owner. The owner also grazes their cattle in this area.

The thatcher reports that the marram on this island is fast growing, which they attribute to good levels of sand blow. This enables them to

cut up to twice a year from the same area. The harvester cuts from the seaward side of the dune and finds the marram of good quality for use as a thatch material.

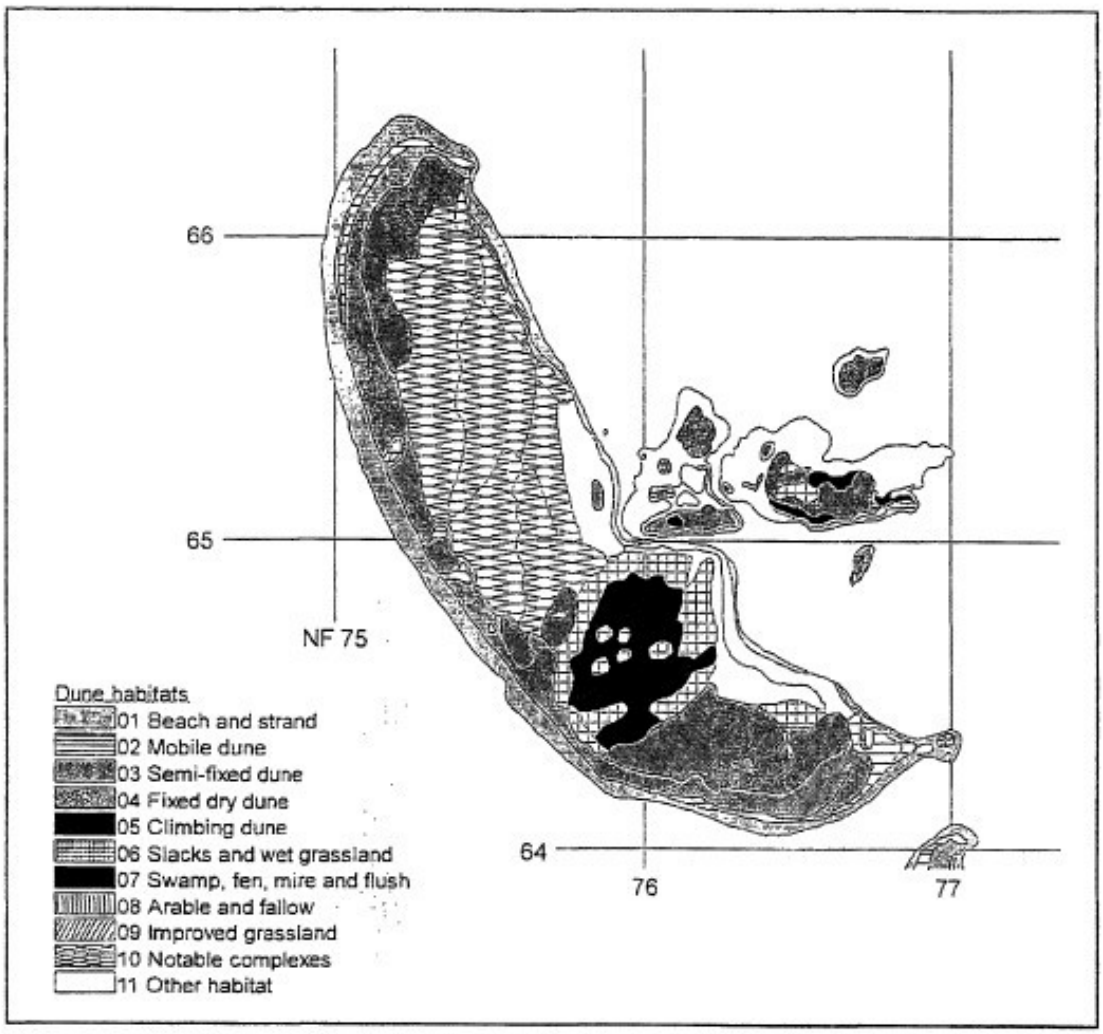

Figure 9: Map of Kirkibost from *Sand dune vegetation survey of Scotland: Western Isles*, 1998.

Below is a copy of the text in the Key in Figure 9, noting dune habitat numbers and labels:

1 Beach and strand
2 Mobile dune
3 Semi-fixed dune
4 Fixed dry dune
5 Climbing dune
6 Slacks and wet grassland
7 Swamp, fen, mire and marsh
8 Arable and fallow
9 Improved grassland
10 Notable complexes
11 Other habitat

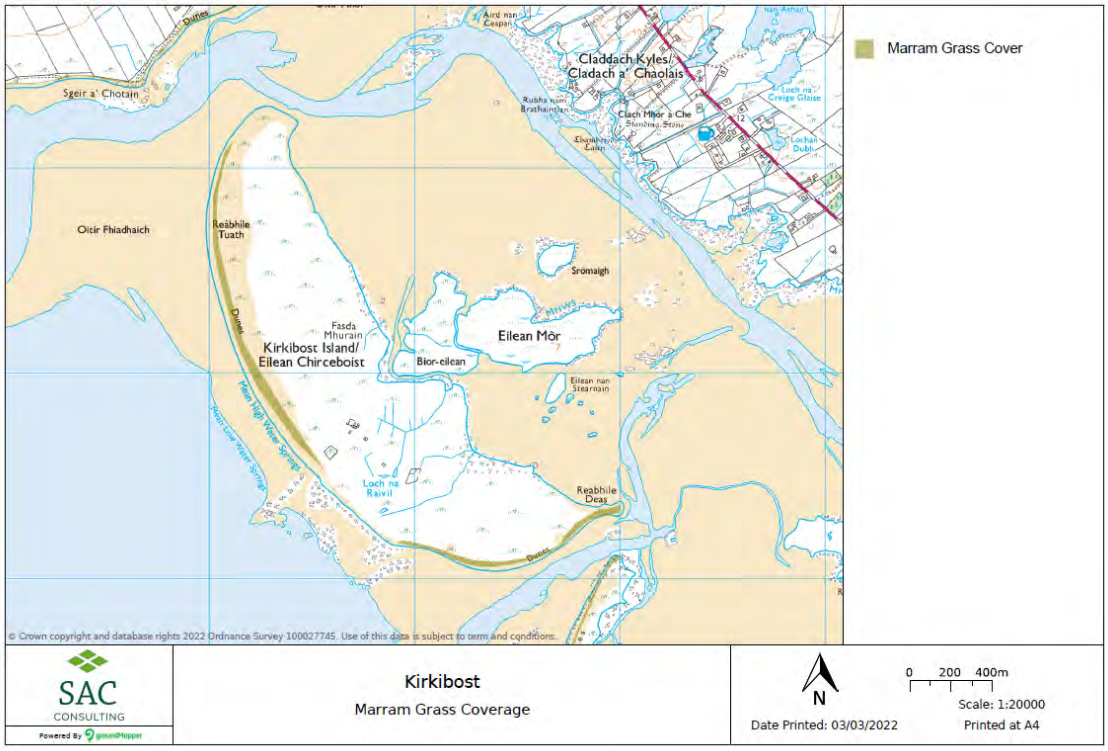

Figure 10: Map of Kirkibost showing marram cover estimated using GIS aerial imagery, 2021. Marram grass is marked in mossy green.

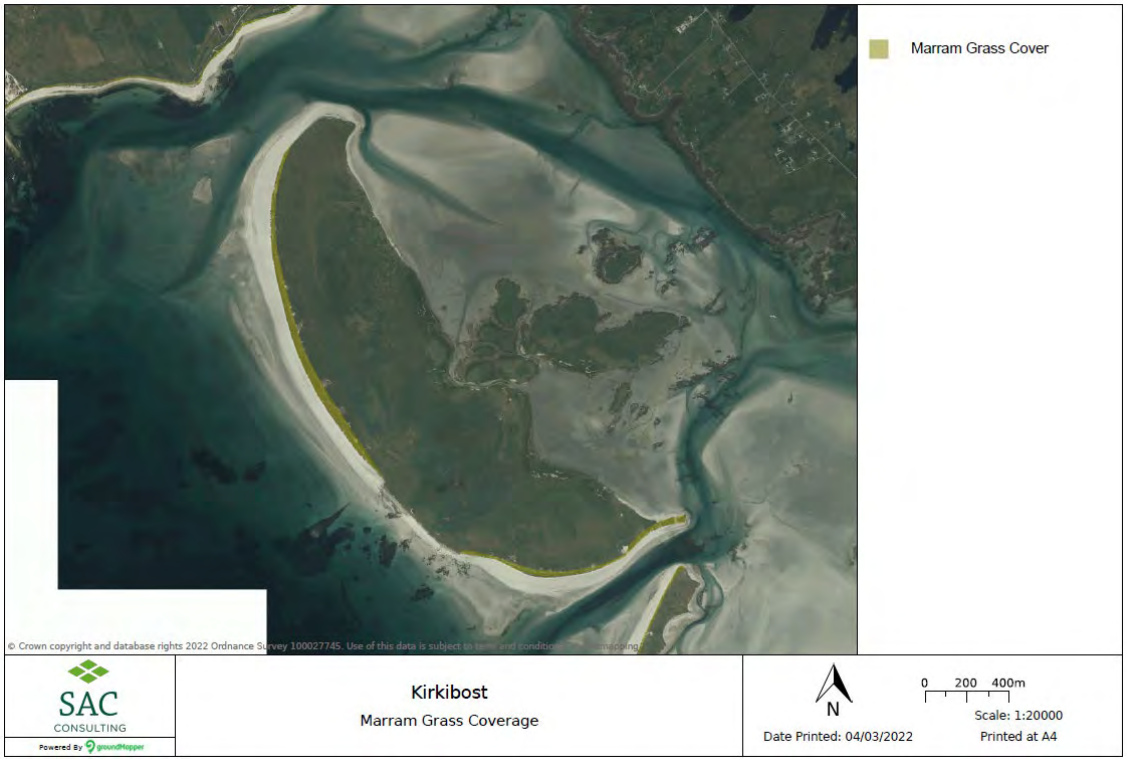

Figure 11: Map showing estimated marram grass cover marked on aerial imagery of Kirkibost. Marram grass is marked in mossy green.

5.2.6 Historic harvesting areas

In the past, marram grass was harvested from other areas in Na h-Eileanan Siar ~ the Western Isles, but this has stopped for reasons including access issues, permission restrictions and erosion. The information shown in Table 2 has been collated from interview data with thatchers and stakeholders who were contacted as part of this study.

Table 2: Reasons provided for harvesting no longer occurring.

Area	Location	Reasons provided for harvesting no longer occurring
Port-adhair Bheinn na Faoghla ~ Benbecula Airfield	Beinn na Faoghla ~ Benbecula	Access stopped by Highlands and Islands Airports Limited (HIAL) due to coastal erosion worries
Udal	Uibhist a Tuath ~ North Uist	Common Grazings Committee restricted access due to concerns around increased sandblow and erosion
Malacleit ~ Malaclete	Uibhist a Tuath ~ North Uist	Reports of a loss of marram due to dune erosion. Marram available there now is not desirable to thatchers due to grazing livestock
Solas ~ Sollas	Uibhist a Tuath ~ North Uist	Topography of land makes access and harvesting difficult as well as area being grazed by livestock
Clachan Shannda ~ Clachan Sands	Uibhist a Tuath ~ North Uist	Topography of land makes access and harvesting difficult as well as area being grazed by livestock
Am Baile Sear ~ Baleshare	Uibhist a Tuath ~ North Uist	Reduction in marram available due to erosion
Eòrrabaidh ~ Eoropie	Leòdhas ~ Lewis	No data available
Cealasaigh ~ Kealasay	Island off Harris	No data available

5.2.7 Port-adhair Bheinn na Faoghla ~ Benbecula Airfield

Highland and Island Airports Limited (HIAL) at Benbecula Airfield have stopped the harvesting of marram in recent years to allow further coastal protection works to take place in an attempt to stabilise the dunes, which run parallel to the runway.

Dargie reported that marram was being cut from the mobile dunes in 1995 in the northwest of the airfield, with approximately 1,500m^2 being harvested (0.15 hectares). He also described how adjacent areas had also been harvested in previous years and that patchy regrowth of marram was apparent. The areas of marram that were growing back also had Rosebay Willowherb (*Chamaenerion angustifolium*) growing amongst it, which he described as a rare occurrence on dunes in the Western Isles.

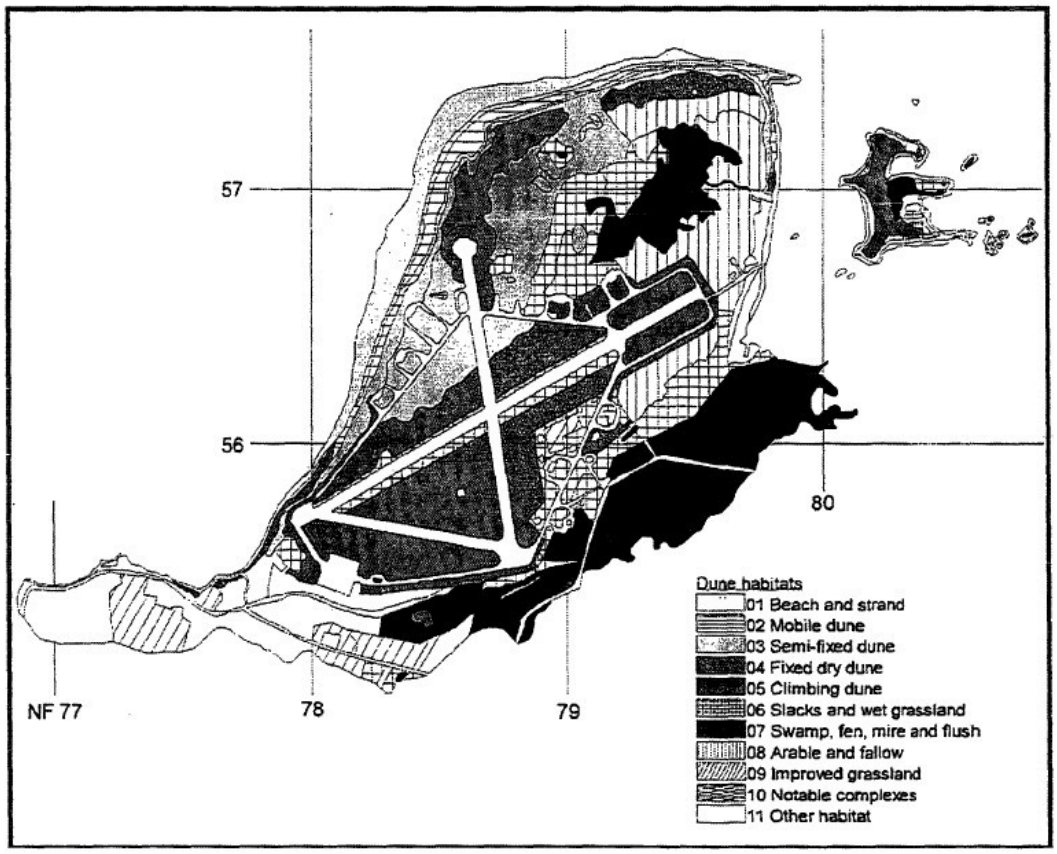

Figure 12: Map showing Benbecula Airfield from *Sand dune vegetation survey of Scotland: Western Isles*, 1998.

Below is a copy of the text in the Key in Figure 12, noting dune habitat numbers and labels:

1 Beach and strand
2 Mobile dune
3 Semi-fixed dune
4 Fixed dry dune
5 Climbing dune
6 Slacks and wet grassland
7 Swamp, fen, mire and marsh
8 Arable and fallow
9 Improved grassland
10 Notable complexes
11 Other habitat

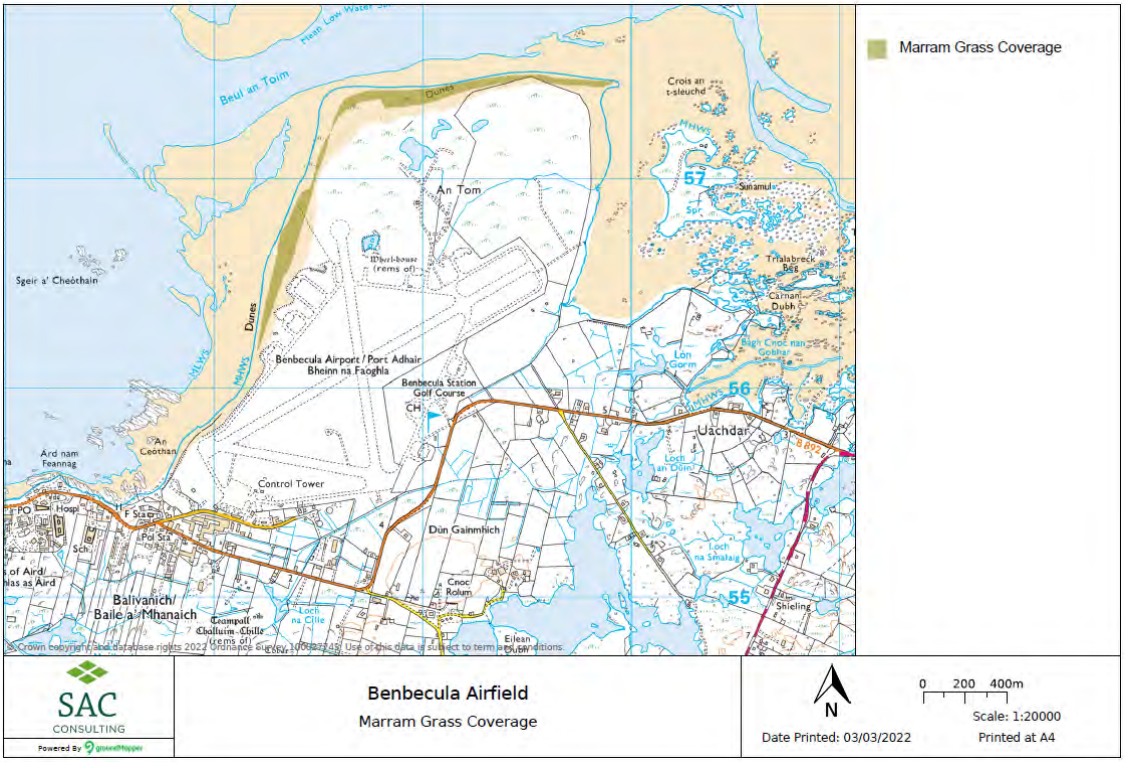

Figure 13: Map of Benbecula Airfield showing marram estimated using GIS aerial imagery, 2021. Marram grass is marked in mossy green.

Figure 14: Map showing estimated marram grass cover over aerial imagery of Benbecula Airfield. Marram grass is marked in mossy green.

5.2.8 Malacleit, Solas agus Grèineatobht ~ Malaclete, Sollas and Grenitote

Malacleit ~ Malaclete

A thatcher reported that they used to harvest here, but in recent years coastal erosion has made this more difficult. The area is grazed by livestock, so the marram that is available often gets damaged early in the winter season. The thatcher also noted that the marram here is not the longest in length but can still be used for thatch.

Solas ~ Sollas

A thatcher reported that this area was not a desirable area to cut due to access issues and livestock grazing. Dargie reported that although Sollas had the largest area of mobile dunes (72 hectares), it had large areas of bare sand. He estimated that only 23 hectares of the mobile dunes were covered with vegetation.

Grèineatobht ~ Grenitote

Marram on Grenitote Common Grazing was harvested but stopped over concerns about increased sand blow onto the common grazing. This area is also in an AECS scheme and has livestock grazing in the winter months. A local thatcher felt that the marram grass on the Udal peninsula part of the common grazing was favourable for thatching.

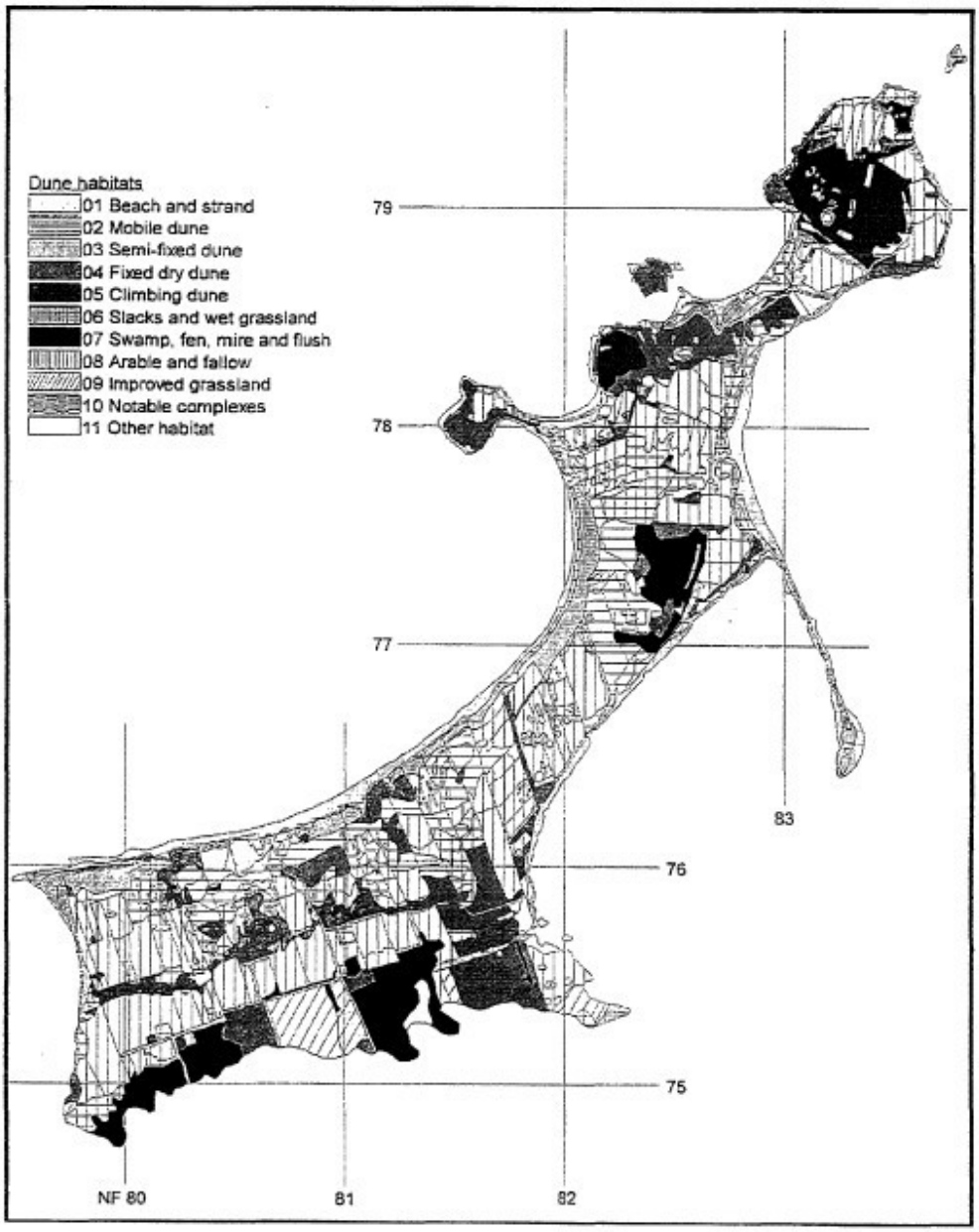

Figure 15: Map of Malaclete, Sollas, Grenitote and Udal from *Sand dune vegetation survey of Scotland: Western Isles,* 1998.

Below is a copy of the text in the Key in Figure 15, noting dune habitat numbers and labels:

1 Beach and strand
2 Mobile dune
3 Semi-fixed dune
4 Fixed dry dune
5 Climbing dune
6 Slacks and wet grassland
7 Swamp, fen, mire and marsh
8 Arable and fallow
9 Improved grassland
10 Notable complexes
11 Other habitat

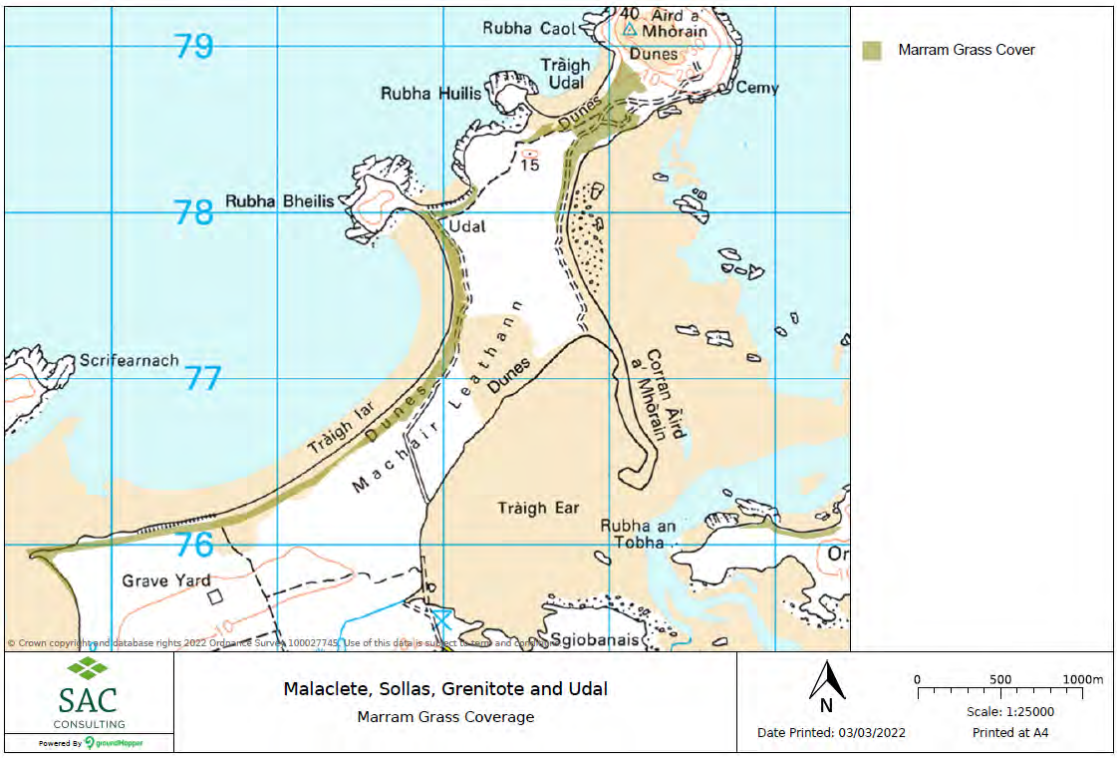

Figure 16: Map of Malaclete, Sollas, Grenitote and Udal showing marram estimated using GIS aerial imagery, 2021. Marram grass is marked in mossy green.

Figure 17: Map showing estimated marram grass cover over aerial imagery of Malaclete, Sollas, Grenitote and Udal. Marram grass is marked in mossy green.

5.2.9 Permissions for harvesting

Crofters

If the marram grass is situated on in-bye croft land (usually land situated close to the croft house and primarily used for grassland production and/or grazing) or an apportioned area of common grazing, the harvester is required to ask permission from the crofter, whether tenant crofter or owner-occupier crofter (A. MacDonald, pers. comm.).

Crofters have to adhere to three duties:

- to be ordinarily resident on, or within 32km of, their croft;
- to cultivate and maintain the croft;
- not to misuse or neglect the croft.

Definitions

cultivate This refers to the croft being used for cultivation or put to another 'purposeful use' such as horticulture, keeping livestock (including poultry and bees), growing crops or planting trees.

maintain To enable the croft to be cultivated, it must be maintained in a fit state, except where another purposeful use is incompatible with the croft being kept in such a state.

Only tenants require the consent of their landlord or, failing that, the Crofting Commission if they wish to put their croft to another purposeful use.

There is doubt around whether harvesting marram would qualify as a purposeful use of croft land in crofting legislation.

Landlord

If harvesting marram grass on a common grazing or an area beyond crofting tenure, permission should be granted by the landlord. The landlord of a common grazing also has the right to resume (i.e., take out

of crofting tenure) the marram grass area if they wish (A. MacDonald, pers. comm.).

Common grazing

It is the common grazings committee's responsibility to manage the grazing on the common. Therefore, if marram cutting impacts the availability of grazing, e.g., vehicle access, then permission should be sought from the common grazings committee (A. MacDonald, pers. comm.).

SSSI

If the marram grass falls within an SSSI, then the harvester is required to have permission from NatureScot and an approved harvesting plan must be agreed (see Appendix 3). Permission must also be acquired from the landlord or crofter.

5.2.10 Marram grass roofing quantities

It has been difficult to acquire quantitative information on how much marram grass is needed to thatch a roof from scratch, rethatch a roof, or top up a layer. The number of people thatching in the Western Isles is limited, and differences in techniques and terminology make it challenging to confirm the amount or hectarage of marram required.

- Harvesters report currently cutting marram from an area of between 0.357 hectares and 0.729 hectares for a rethatch of marram.
- Cutting an area of 0.35 hectares produces around 350 'bundles'.
- The number of years between a rethatch varied three to seven years.

In Ireland, thatchers report cutting an area of about 0.4 hectares to thatch a roof. The marram is quantified in 'gatherings'. A gathering is as much as one person can hold under their arms, and two gatherings make a 'sheaf'. To top up, there are 110 sheafs required to put a new layer of marram onto a roof. For a new roof, 550 to 660 sheafs are required.

Therefore, depending on the density of marram in a patch, an area of around 0.3 to 0.8 hectares is required for a rethatch.

5.3 Conflicts and constraints

5.3.1 Other vegetation

The *Sand dune vegetation survey of Scotland: Western Isles*, 1998 concluded that there was only 49 hectares of mobile dunes where marram grass was the dominant species, with few other species present due to best sand supply conditions. The survey noted Bruaichean Losgaintir ~ Luskentyre Banks; aoidh-ghainmhich Eòlaigearraidh ~ Eoligarry tombolo; Port-adhair Bheinn na Faoghla ~ Benbecula Airfield; Am Baile Sear ~ Baleshare; and Taobh Siar Bheàrnaraigh ~ West Berneray as examples of areas where marram grass was the dominant species in the mobile dune.

Harvesters have reported not being willing to harvest marram from areas where there are lots of other vegetation types growing amongst the marram. This requires more labour to clean the marram before making it into sheafs and bundles, and it also increases the area required to cut.

Figure 18: Photograph showing marram being harvested in Rushgarry Common Grazing, Berneray. Credit: The Birlinn Yarn Company.

5.3.2 Common grazings committees

Each common grazing should have a set of regulations outlining how the grazing is managed and the rights of the shareholders. However, not all common grazings have up-to-date regulations or committees in place to enact them.

There are currently no protocols included in any grazing regulations concerning the harvesting of marram grass (Crofting Commission, pers. comm.). Some regulations mention the right to gather seaweed and cut peats, however there are none with rights for marram grass. If there are no regulations it can lead to conflict when trying to make decisions within a committee. Sometimes this can result in no clear decisions being made at all.

Common grazings can update their regulations and could include marram harvesting with the landlord's permission.

Additionally, if common grazings receive payment for the marram grass, then they have a set of finance procedures to follow. If a common grazing does not have a functioning committee, this could be complicated to manage.

Within a common grazing, it is likely that only the landlord has the right to take marram for thatching, and then only if the marram is not being used for grazing. If the marram is being grazed, then it is the decision of the common grazings committee as to who can graze the area. The committee and the crofting shareholders only have a right to graze the common; unless the landlord agrees, they would not have the right to harvest the marram for thatch.

5.3.3 Livestock

There are different vested interests when it comes to livestock. The thatchers felt that livestock had an impact on marram grass quality due to trampling and eating the marram and using the dune systems as shelter. Cattle can also trample any windbreaks left by the harvesters. Traditionally, the machair areas are grazed in winter, which is also when thatchers want to harvest the marram.

Whereas for crofters and common grazings the interest lies in maximising the amount of grazing their livestock have access to. Sometimes they are also in AECS schemes that might encourage the grazing of livestock in these areas over winter.

Figure 19: Photo showing an area of marram grass where cows have had access. Credit: N. Nicholson.

5.3.4 Coastal erosion

There are differing views about the impact of marram harvesting on coastal erosion. It is widely agreed that marram grass root systems help to stabilise dunes, and the leaf prevents sand blow. Some thatchers in Na h-Eileanan Siar ~ the Western Isles and in Donegal, Ireland believe that cutting on the shoreline encourages growth, making dune systems stronger; other thatchers and stakeholders believe it can destabilise the dune systems and increase erosion through sand blow.

NatureScot states that marram grass plays an essential role in stabilising the soft sediment coastline. They believe that encouraging the harvesting of marram grass is detrimental to the stability of the dune habitat. However, their cutting guidelines (unpublished) state that research on Col ~ Coll in the late 1980s suggested regular cutting by scythe had no significant effect on the dune vegetation. (The authors have not been able to locate this study.) NatureScot's guidelines also imply that the relative stability of dunes in the Uists coincided with the introduction of alternative roofing materials.

Nolet et al. (2018) note that although research has been conducted around marram grass growth, many of the results have been taken from experiments that relied on artificial sand burial treatments and therefore may not be fully representative of burial conditions due to natural coastal aeolian dynamics. The research states that coastal dunes containing marram grass are advantageous for stabilising dunes, due to high tolerance to burial by windblown sand and more vigorous growth under the right conditions.

The research concludes that the maximum tolerance of sand burial for marram grass per growing season is between 0.78m for cover and 0.96m for Normalised Difference Vegetation Index (NVDI). The optimal sand burial rate for the marram grass to obtain its maximum growth response is 0.31m of sand per growing season for both cover and NDVI (Nolet et al. 2018). This study was focused on a large area of sand laid down for coastal protection in the Netherlands. The authors advise that the growth function parameters they established are site specific and are not to be used as a rule of thumb for generic growth response of marram grass to sand burial by wind.

5.3.5 Winter harvesting

Traditionally, marram has always been harvested over the autumn and winter months, and this is what is currently happening in Na h-Eileanan Siar ~ the Western Isles. Thatchers have stated that this is because they have to wait for the sap to leave the marram to get the best material to thatch with. None of the thatchers working on the Western Isles seemed to want to harvest marram in the spring and summer months, as the marram was still green. One thatcher stated that they had tried storing green marram ready for the winter once before, but this was not successful as the marram decomposed.

NatureScot's guidelines encourage people to harvest in the spring and summer, allowing time for the marram to grow back before the winter storms.

5.3.6 Harvesting practice

There are differing views among locals and stakeholders on the correct style of harvesting. The conflicts are around which areas of the dunes should or should not be cut, what length of marram grass should be left uncut, and how long a rest period should be before cutting an area again. Some thatchers say marram that is cut regularly is more suitable for thatching because of its thickness. All agree that a windbreak should be left.

5.3.7 Maintenance of thatch

Many people are not maintaining their roofs between rethatches in the way they would have been done in the past. The commercial thatchers felt this resulted in more marram grass being needed in rethatches. In addition, length of time between rethatches differ between the thatchers.

5.3.8 Not enough vs too many

There are differing views on whether too many people require marram grass as a thatching material. This may be a localised concern in Beàrnaraigh ~ Berneray, where there are six cottages in the township requiring marram grass.

5.3.9 Hierarchy

There are differing views when establishing who is entitled to marram grass and when they are entitled to it (e.g. frequency of thatching, building use, etc.). Assuming permission has been granted by the landlord or landowner, there are no guidelines as to precedence.

5.4 Opportunities

5.4.1 Training for common grazings committees

The Farm Advisory Service (fas.scot), which is funded by Scottish Government, is working in conjunction with the Crofting Commission to provide free workshops for common grazings committees. These include training on the roles of committees and the management of finances. Informed and working committees could make communication and negotiation with landlords, and with harvesters around marram access, clearer and more structured. HES could consult with common grazings committees and produce guidance for managing marram as a resource.

5.4.2 Fencing livestock out of prime marram grass harvesting areas

There is an opportunity to encourage or assist crofters and common grazings committees to fence off areas of marram grass. This could be permanent fencing, or temporary electric-style fencing, or newer electric collar fencing for livestock. There may be a need for compensation or incentivisation for graziers to sacrifice their grazing to protect marram grass growth.

5.4.3 Marram grass planting

There are areas along the Uist coast where marram grass has been planted under agri-environment schemes. There is an opportunity to plant more marram with the intention of it being a harvestable resource.

5.4.4 Best practice guide to harvesting

It would be beneficial for NatureScot to revise and update its best practice guide and circulate it to thatchers and owners of thatched properties. The organisation could also work with thatchers to develop its understanding of what the thatchers are looking for and require, as well as use research to back up findings and provide clarity of best harvesting practice.

5.4.5 Discussion with NatureScot around marram harvesting

NatureScot is currently quite opposed to marram harvesting but are open to discussions around other materials. Working together on what the most appropriate solution or alternative material is would be beneficial.

5.5 Gaps in knowledge

Table 3: Gaps in knowledge on marram, approaches and key contacts.

Gap in knowledge	Approach	Key contacts
Recent sand dune vegetation survey	Find out whether NatureScot plans to conduct a similar survey in the future Contact universities to ask whether there are any similar studies underway; this will help establish quantities of marram grass	NatureScot Environmental Science/Geography departments of Universities
Regrowth rate of cut marram at different cutting heights	Set up a trial to measure the growth rate of marram cut at different heights; repeat over several sites to determine growth rates under varying levels of sand blow; measure growth rate over a growing season Contact NatureScot to see if anyone is planning to monitor growth rate at Benbecula airport; university students may study as part of a dissertation project	NatureScot Scotland's Rural College (SRUC)/James Hutton Institute (JHI)/University of the Highlands and Islands (UHI)
Optimum rest period	Set up a trial measuring growth rates of marram cut annually, or every second year, etc. Replicate trial over several sites	NatureScot SRUC/JHI/UHI
Establish appropriate area of the dune to harvest	Discuss with NatureScot and thatchers the pros and cons of cutting from seaward or landward side of dune	NatureScot, local thatchers
Establish average amount of marram for a whole thatch/and top up	Determine amount of marram required to make up a bundle and number of bundles required for a full thatch and a 'top-up' thatch; work back to m^2 of marram on the ground	Local thatchers
Landowners' stance	Find out whether estate and landowners would grant permission if marram harvesting was standardised and monitored	Stòras Uibhist, North Uist Estates, Scottish Government Rural Payments and Inspections Directorate (SGRPID)

Full-page image 2: A straw-thatched Hebridean-style cottage and outbuildings at Gearrannan, Leòdhas ~ Garenin Township, Lewis. © Courtesy of HES (Society for the Protection of Ancient Buildings Collection).

6. THATCH MATERIALS: ALTERNATIVES

6.1 Cereal crop

6.1.1 Introduction to cereal crops

The cereals grown in Na h-Eileanan Siar ~ the Western Isles are predominantly spring-sown rye, barley and oats. Crofters will often refer to such crops under the generic name of 'corn'.

Cereal crops are not often grown in Leòdhas ~ Lewis or Na Hearadh ~ Harris. In Uibhist ~ Uist most are found on the machair coastal grasslands, a UK priority habitat listed in Annex 1 of the EU Habitat Directive. A very small amount of cereal is occasionally grown on the peatier inland soil of Uist.

The seed most commonly used for Uist 'corn' is unique to the islands. The cereal crops grown include old, local varieties (landraces): usually bere barley (*Hordeum vulgare L.*) and black oat (*Avena strigosa Schreb.*), alongside rye. These varieties are chosen for their tolerance to nutritional deficiency in the soil, ability to grow in a short growing season and tolerance of windy conditions.

Crops tend to be sown out in a mixture of small oats, rye and bere barley. It is not common practice to grow a pure crop of one type.

The crops tend to be grown in a rotation of two or three years of cereal crop followed by two years of fallow (i.e., uncultivated, to allow natural flora to grow).

Wheat is unlikely to grow in the Western Isles due to the weather and length of the growing season. Wheat varieties are generally divided into 'hard' or 'soft' varieties. Although soft textured varieties make up more than 80% of the seed sown in Scotland (Steve Hoad, Scotland's Rural

College, pers. comm.). The ‘hard’ varieties currently grown in England for long straw are highly unlikely to grow in the Western Isles.

In theory, growing a cereal crop specifically for straw production for thatch is possible in the Western Isles, but for economic and agronomic reasons it is difficult to do. Growing of cereal crops is not uncommon; however, it is the method of harvest that prevents the straw being suitable as a thatching material (see Section 6.1.8, Constraints.)

6.1.2 Current cereal-growing areas in the Western Isles

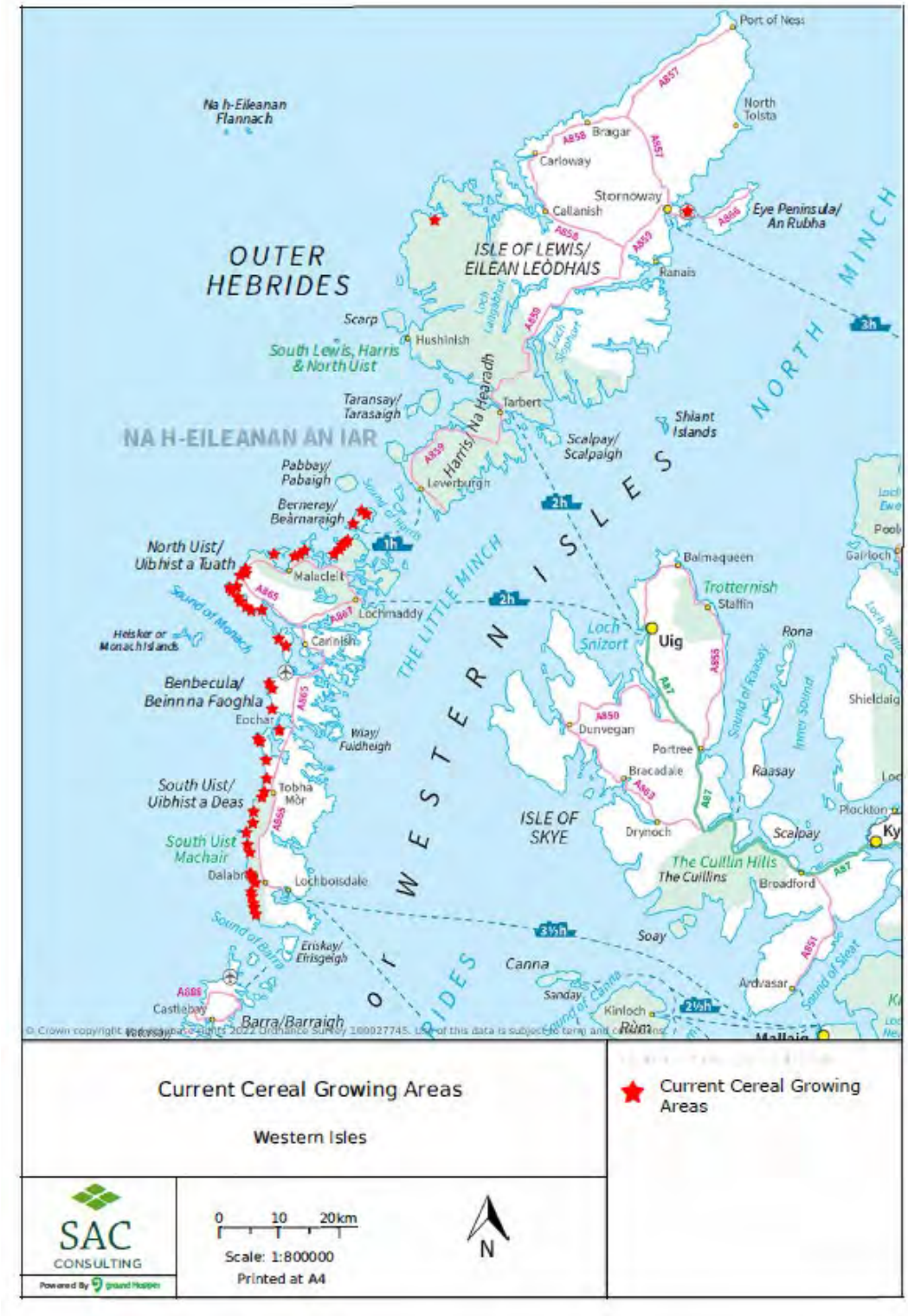

Figure 20: Current cereal-growing areas marked by red stars.

6.1.3 Potential cereal-growing areas in the Western Isles

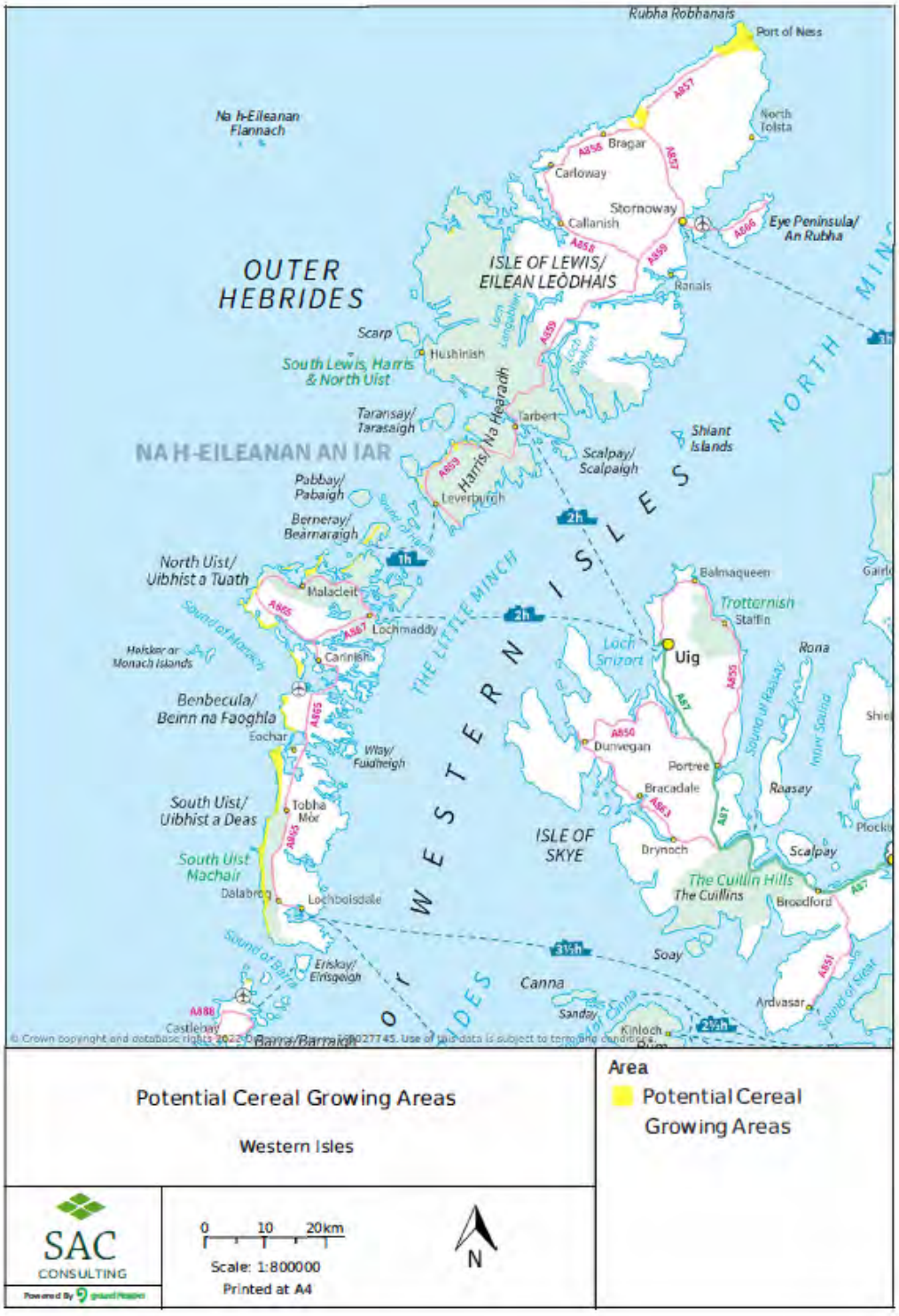

Figure 21: Potential cereal-growing areas in yellow.

6.1.4 Estimates of cereal area available

According to the June Agricultural Census 2021 (see Appendix 4), the area of mixed cereal crop grown in Na h-Eileanan Siar ~ the Western Isles is 245 hectares across 133 holdings, an average of 1.8 hectares per holding.

The area of pure bere barley sown was too small to report in the census results (this concurs with local knowledge of only 10 acres being grown; Neil MacPherson, pers. comm.). However, as of 2022, the proprietors of a recently opened distillery at Baile nan Cailleach, Beinn na Faoghla ~ Nunton in Benbecula were growing a bere barley crop to use in the production of whisky. This new market may create increased demand for bere barley, with straw as a by-product.

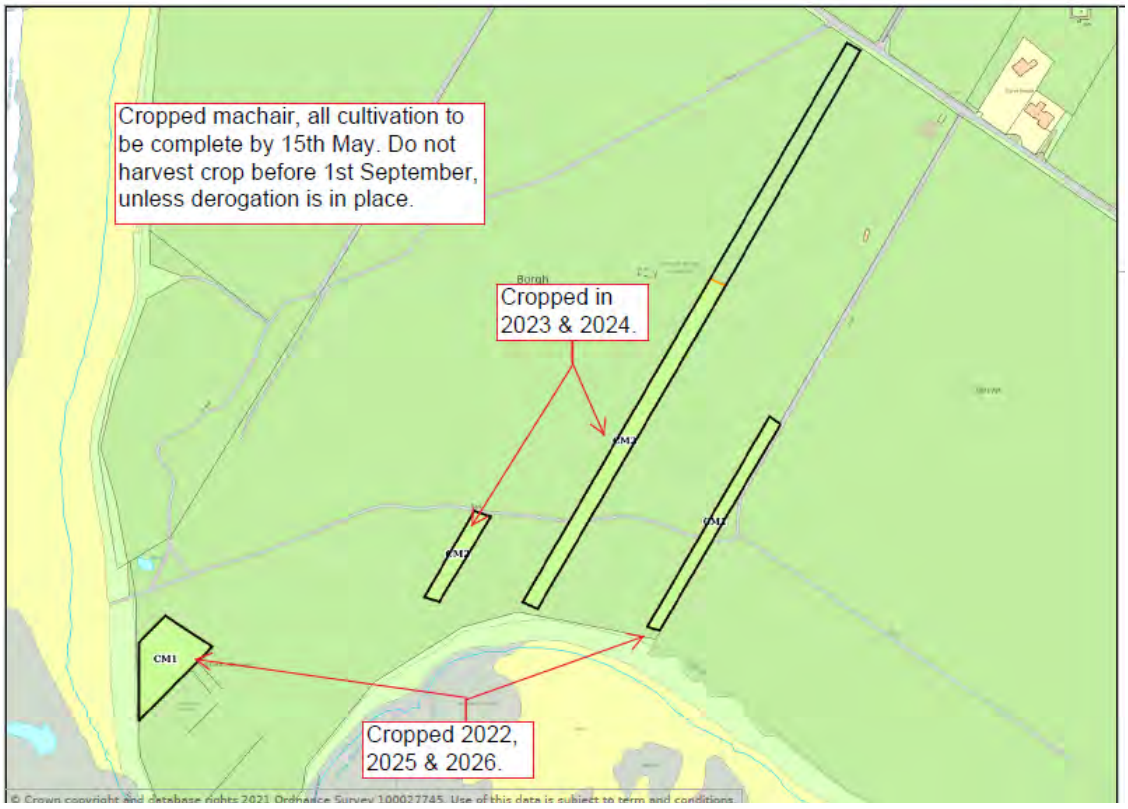

Figure 22: Example of bere barley plots under an agri-environment scheme on the machair in Benbecula.

In Figure 22, areas marked with black outlines are cropped machair locations with various dates for harvesting: 'All cultivation to be

complete by 15th May. Do not harvest crop before 1st September unless derogation is in place.' The two central areas have been cropped in 2023 and 2024. The two outer areas were cropped in 2022 and are to be cropped in 2025 and 2026.

6.1.5 Quantity and quality

The yield from bere barley crops in Uibhist ~ Uist is unknown; the current growers of pure bere barley are cutting the crop high to avoid weeds, as they are primarily harvesting seed and are less interested in harvesting the whole crop or the straw.

Although there are many studies on the yield and constitution of the grain of bere barley under different agronomy practices, there appears to be no literature on the yield of straw. However, the agronomy institute in Orkney grows trial plots of bere, and in 2021 had yields of straw of between 2.9 and 4.5 tonnes per hectare (Peter Martin, pers. comm.). This is a higher yield than modern varieties, which will have shorter straws and yield around 2 to 4 tonnes per hectare.

According to ThatchingInfo.com, in terms of long straw, about 150 bundles make a tonne, which covers about four squares, or 37m^2, of long-straw thatching. Most mechanical tyers are set to produce bundles of about 14lb (6.3kg). It takes approximately 40 bundles to thatch a 100ft^2 area, or approximately four bundles per square metre.

The number of straws is of importance in working out the area required to be cut to thatch a roof, but there are no records of the number of straws per hectare from bere barley grown in Na h-Eileanan Siar ~ the Western Isles. However, conventional modern varieties of barley will grow at around 300 plants per square metre, and with tillering (the production of lateral shoots by a plant, especially a grass or cereal, from the base of the stem), will produce around 700 heads. This will vary according to factors such as fertility and competition.

The sowing rate and germination rate give an indication of plant numbers per hectare, but again, this is very variable and therefore only gives an indication of the number of straws per hectare. Modern barley is sown at around 190kg per hectare, and bere barley (in Orkney) is sown at a rate of 160kg per hectare. Modern barley will have a thousand-grain weight of about 43g and bere barley (sown in Orkney last year) of 37.49g. The germination rate is highly variable, typically ranging from 60% in a poor year to 85% in good conditions. The UHI Agronomy Institute in Orkney has records of bere producing 320 heads per square metre. Straw length falls mostly in the range of 80 to 100cm (soil level to base of the ear) (Peter Martin, UHI, pers. comm.).

6.1.6 Suitability for thatching

Thatchers currently working in Na h-Eileanan Siar ~ the Western Isles would be happy to use straw and have used straw in the past. However, the limiting factor is the work involved in preparing straw to make it suitable for use.

Thatchers using wheat straw in England are harvesting and preparing the straw by using reaper-binders to cut the crop while there is some sap in the straw; building the cut crop into stooks (a group of sheaves of grain stood on end to aid drying; see Section 6.1.8) in the field until the straw is stiff; and storing it inside to thresh the grain from the straw at a later date. To produce suitable straw, the wheat crop is threshed using a threshing drum, and the resulting straw is then tied in trusses ready for the thatcher.

6.1.7 Permissions

Physical access

Access to straw for thatching is much less problematic than access to marram. Many crofters will grow a cereal crop or have the ability to grow a cereal crop, and most crops are grown in places accessible by tractor

and on flat ground. As cereal crops are grown for sale or home use by farmers and crofters, access to the crop would be given by individual crofters, or they would sell the crop to the thatcher.

Ownership and permissions required

Most crofters who are growing a cereal crop will use an area designated for their sole use on the common grazing. Most common grazings will allow livestock to graze in the years when the crop areas are in fallow (following a two to three-year crop and fallow pattern). Each croft will normally have a 'share' of the common grazing, and the area used for cropping remains static. Some crofters and farmers can use the land on their croft (or 'in-bye') for cropping.

The only restrictions on growing a cereal crop might be:

- the area of the share allowance that each crofter has if the crop area is on common grazing;
- the years in which crop can be grown;
- and if the crofter has entered into and is bound by an agri-environment agreement as to how the land is used.

In terms of limitations from designations such as Special Areas of Conservation and SSSIs, the restriction is not on area but on chemical use and fertiliser use. Otherwise, the crofters and farmers have full control over the crop and cropping area. In summary, there are no ownership or permissions of concern.

6.1.8 Constraints

Sowing method

Nearly all cereal crops in Uibhist ~ Uist are grown in combination rather than as a single crop type. This is to help ensure that at least some of the crop survives in the challenging growing conditions found in the exposed machair on Na h-Eileanan Siar ~ the Western Isles. This means

that there are few areas of single crop grown, and most straw will be a mix of species and length.

Harvesting

In the Western Isles, mixed cereal crops are grown primarily for cattle feed. They are harvested by mowing, combining or, more rarely, using a reaper-binder.

Mowing

The most popular method of harvesting a cereal crop in the Western Isles is through mowing. The mown crop is made into 'wholecrop silage'. This harvesting method is preferred by crofters as it is less weather dependent, less time consuming, reduces the risk of damage by geese, and is an easier method of feeding cattle. Wholecrop silage is a preserved crop of straw and seed, wrapped in plastic to exclude air. The crop is cut when the seeds are not fully ripened and the straw will have a higher moisture content. The whole of the plant is then baled, into round bales, and wrapped in several layers of plastic to exclude air (ensile) the crop. This will preserve the crop to then be fed to cattle over the following winter. It is popular as modern equipment is available which is labour saving. The silage can be cut earlier in the summer, when weather tends to be better and drier, and the crop is cut before geese find it attractive to graze.

Combine harvesting

Combine harvesting is carried out by few crofters. It involves harvesting the cereal crop when the seed is fully ripened so that the plant can be threshed within the harvester, to separate seed from straw. The separated seed is contained while the straw is expelled onto the ground. The seed is then dried to a moisture content that

allows for long-term storage. The straw is usually gathered up when dry using a baling machine and made into round or square bales.

Combine harvesters are an expensive item of machinery for crofters when compared to the value of the crop grown in the Western Isles. Small models suitable for use in smaller fields are rare, although there are several combine owners on the islands. Straw that has been through a combine is thought to be too damaged to be used for use as thatch, or could be used but will not last as long or be as water repellent as less damaged straw (Neil MacPherson, pers. comm.).

Binders

Binders are used by only a couple of crofters (Neil MacPherson, pers. comm.) to cut and batch the crop, which is then placed in stooks, by hand. The stooking of corn crops is carried out to help dry the harvested crop for feeding out to cattle over the winter months or to be threshed for seed for sowing the following spring. The crop is harvested by a reaper-binder machine, which cuts and ties the corn in small bundles called sheaves. The sheaves are then stacked to dry in the field in piles of four to six (stooks) before being made into larger stacks ready for the winter months. Many of the reaper-binders in Uist are over sixty years old. New parts are very difficult to source and some parts of the machines are made of canvas, which is difficult to maintain.

In order that the cut crop stores well and does not rot, or the grains sprout, the crop is cut when the seed has a low moisture content. However, according to Thatchinginfo.com, ‘the best thatch will result in the crop being cut while the stalk is still partially green, somewhat earlier than cereals destined for the combine’. Cutting early will cause an issue with the storage of grain, so the grain will need to be further dried or treated with preservative in this approach.

In order to separate the seeds from the straw, the sheaves would need to be put through a combine or thresher. The result is that the straw will be damaged in the process. However, the thresher will cause much less damage than a combine and can produce straw suitable for thatching. Thatch suppliers in England use threshing machines to provide straw suitable for thatching.

Seed

As the making of silage has increased in popularity, the area of crops grown and combined to produce seed has reduced.

Few crofters will keep more seed than they need to establish the crop in the following year. Therefore, there are currently no known reserves of seed kept to increase the area grown (Neil MacPherson, pers. comm.).

Only two or three crofters are thought to grow pure crops of bere barley or of oats at present. The single crops of bere barley are currently grown in Beinn na Faoghla ~ Benbecula to a total of around 10 acres (4 hectares) annually grown. The crofters use this seed to establish the next crop and sell surplus to other crofters to use in mixes. The new distillery has arranged for a very small area of bere to be sown, obtaining seed by separating the seeds by hand from a traditional Uist crop mix.

Climate change

Climate change may bring changes to rainfall and temperature patterns that adversely or positively affect the growing of cereals, which would impact the future availability of cereal straw.

6.1.9 Opportunities

Funding

Under current 'agri-environment' schemes, Scottish Government-funded schemes to increase and improve biodiversity, there are opportunities

for crofters and land managers to be paid to produce a cereal crop. The funding provides a payment per year for the crop to be grown on the machair in a traditional two year rotation of crop and fallow. This payment encourages the practice with additional payment available for adding seaweed as a fertiliser.

Growing modern cereals

Modern barley and oat crops could be grown, for which seed is readily available. However, these would need additional nutrients added, such as manganese and perhaps copper, which would be applied as a seed coating or as a foliar spray, along with synthetic fertilisers. On designated sites, consent from NatureScot may be required.

There is a high risk of such crops failing. As well as requiring added nutrients, there is a risk of disease. Modern varieties will respond well to nitrogen fertiliser, which may increase straw length, but the longer straws are liable to break or bend, making the crop difficult to harvest. Currently, suppliers of straw in England aim for a minimum straw length of 750mm.

Income from straw sale

Most crofters will keep straw and seed for feeding to cattle and sheep. However, there is an opportunity to grow additional oat and barley cereals for sale as thatching material. Clearly, the removal of seed from the straw in such a way as to not damage the straw is the time consuming task, whether this would be done by crofters for extra income or by thatchers to control quality. The value of the straw would depend on the crofter providing a reliable supply chain with straw at a price that the end user can afford, plus a price for the crofter that reflects the low yield and additional work in preparation.

It may be possible to grow cereals for thatching in some areas where cropping currently does not take place on the machair, although an audit of the wildlife currently using these areas would be required.

Growing bere or oats primarily for straw

Crofters could bring in additional income by growing more bere or oats, and by changing the harvesting method from mowing for silage to harvesting with a binder and thresher. The value of the straw suitable for thatching would need to cover the loss of winter forage and the cost of buying in forage and be worthwhile for the additional risk of late harvest and losses from geese.

Importing seed

It would be agronomically possible to use bere or oat seed from Orkney in order to establish pure crops. However, it would be inadvisable, as there are differences in the landraces between and even within Na h-Eileanan Siar ~ the Western Isles and the Northern Isles. Results from a recent PhD project (Southworth 2007) indicated that there were three significantly different and isolated sub-populations of bere being grown in Scotland: located in the Shetland islands, the Orkney islands and the Western Isles. The greatest proportion of genetic diversity was found within the populations in the Western Isles.

The UHI Agronomy Institute has been carrying out trials and as a result, has produced seed for larger-scale trials. Therefore, there is a supply of seed, although only one of the trial lots was on a sandy and nutrient-deficient site.

Several crofters on Uibhist ~ Uist would be willing to sow out plots of pure bere and pure oats in order to produce seed stocks.

6.1.10 Gaps in knowledge

Most of the gaps in knowledge relate to the yield and quality of bere barley and oat straw, which could be ascertained through field trials.

Historic Environment England has carried out some similar studies into straw varieties from hard wheats, but no information has been sourced that quantifies straw from the landrace crops grown in Na h-Eileanan Siar ~ the Western Isles. Table 4 lists gaps in knowledge and solutions. Detailed methodology is provided below the table.

Table 4: Gaps in knowledge on cereals, approaches and key contacts.

Gap in knowledge	Approach	Key contacts
Figures for yield of straw from oats and bere barley grown on machair soil	Approach local crofters (through SAC Consulting, or advertise in the Scottish Crofting Federation, local papers, SAC newsletter) for use of machair plots for trials During harvest, take measurements of number, weight and length of straws from hand-cut crops in quadrants from several sites; compare weight and quality of straw from sites receiving no inputs/seaweed/synthetic fertiliser	Agronomy Institute UHI/Crop Trials Team SRUC/JHI
Thatching quality of black oats compared to bere barley	Compare quality (length/breakage) of straw from crops of bere barley and crops of black oats Lab test for fibre content as an indicator of strength Lab test for sugar and protein content as an indicator of speed of degradation of the straw	Researchers from SRUC/Agronomy Institute UHI/Crop Trials Team SRUC/JHI, plus local thatchers
Potential for a mix of cereal straw to be usable for thatching	Compare quality (length/breakage) of straw from crops of bere barley and crops of black oats with mixed crops Determine whether differences in length are an issue for thatching use Determine minimum length	Researchers from Agronomy Institute UHI/Crop Trials Team SRUC/JHI, plus local thatchers
Longevity of straw from different cereals	Subject black oat, bere barley, Uist corn mix and modern variety to prolonged wetting and drying cycles; retest for sugar and protein content to provide some indication of relative degradation	Researchers from SRUC
Quantity of straw needed for a thatch	Determine number of straws required to make up a bundle and number of bundles required for a full thatch and a 'top-up' thatch; work back to m^2 of oats/bere crop	Local thatchers
Viability of the crop and straw length of modern oat or barley varieties	Trial plots of varieties with longer straws known to grow in Scotland	Researchers from Agronomy Institute UHI/Crop Trials Team SRUC/JHI plus local thatchers
Viability of landraces from the Northern Isles when grown on machair soils	Trial plots on the machair in Uist and Lewis with landraces from Orkney and Shetland	Researchers from Agronomy Institute UHI/Crop Trials Team SRUC/JHI

6.1.11 Field trial design and analysis

Training

To allow robust statistical analysis, the team commissioned to deliver field trial components should be able to demonstrate that staff are experienced and trained, that machinery is calibrated and maintained, and that standard operating procedures and protocols are fully documented. Ideally, they should work to a recognised quality standard such as ORETO, ISO 9001 and OHSAS 18001, now replaced by ISO 45001, to ensure processes are standardised, of suitable quality and fully auditable. The European and Mediterranean Plant Protection Organization (EPPO) standards gives the relevant background to the design and analysis of trials, from which the details that follow are drawn.

Selecting trial sites

Trial sites should be selected as representative of growing conditions in terms of croft type or common grazing type, topography, climate and soil type, as well as concerns relevant to this project, such as manganese-deficient sites or salt tolerance. Trial sites should be as uniform as possible in order to minimise plot differences that do not relate to treatment. Good communication with the crofter or common grazings committee is key in ensuring that trial plots or treatments are not confounded by management errors such as accidental fertiliser applications or grazing by stock.

Considerations on cereal crops and assessments

Some annual crop options, such as oats, barley or mixed crops with rye, could be grouped and tested together at sites, with factors such as variety, drilling density and nutrient or other inputs tested as treatments. Standard assessment options such as crop cover, plant counts, disease, pest and weekly cover and growth stage assessments, straw height, lodging and straw strength and yield can be adapted from

variety testing protocols where these assessments are standard. Assessments should be made throughout the season so that conclusions on final yield or quality criteria can be informed by earlier observations. As a minimum, information should be collected at drilling, emergence, stem extension, heading, and prior to and at harvest.

A weekly trial diary should be established to record site observations and management interventions and keep photographs. Site and weather data should also be recorded.

Treatments and analysis of results

Treatments are variables that are being tested in the growing/harvesting trials. These should be replicated. Three replicates are the minimum that would allow robust statistical analysis of the results, and treatment number should be capped to avoid trials covering large areas. Trials should be repeated over a minimum of three seasons so that seasonal weather differences can be included in the final analysis. A randomised block design is a practical option for setting out the trials and allows for some variability over the trial site. Plot sizes should be large enough to give meaningful data. If grain yields are required then 2m by 10m plots should be the minimum size (but can be varied upwards to suit available equipment). Half plots however would probably generate useful data if yield is not required.

Additionally, consideration of dissemination, knowledge transfer and exchange activities should be included in site and trial design decisions. Site visits with crofters, thatchers and other stakeholders can be used both to transfer findings and results and to gather useful participatory data on attitudes, preferences and any potential barriers to uptake.

The EPPO standard EPPO PP1 - PP1/152(4), which sets out the design and analysis of efficacy evaluation trials, should be consulted during the early project design stage.

Full-page image 3: Detail of a netted heather-thatched roof above a doorway at Loch Baghasdail a Deas, Uibhist a Deas ~ South Lochboisdale, South Uist. © Courtesy of HES (Society for the Protection of Ancient Buildings Collection).

6.2 Heather

6.2.1 Introduction to heather

Heather (*Calluna vulgaris*) has been used in the past for thatching, especially on the east side of Uibhist ~ Uist and Beinn na Faoghla ~ Benbecula (Scottish Vernacular Buildings Working Group, SVBWG). Heather is common in Na h-Eileanan Siar ~ the Western Isles, growing on wet and upland heathland. It is abundant over much of the islands and readily available, with the majority of crofting townships having access to areas of moorland grazing where heather is often the dominant plant.

Heather thatch lasts longer than marram thatch or straw, with a duration of 20 to 30 years being cited (SVBWG_VB_15_1991.pdf).

Outside the Western Isles, heather has historically been used along with straw thatch in remoter areas of Scotland such as Gleann Lìobhait ~ Glenlivet and Beinn Ruanais ~ Glenrinnes, including for rural churches (Nuttgens 1959: 266), where it was said to provide 'a thick warm covering'.

Heather can be used in combination with other thatch materials, e.g. as a coarse 'breathing' bed for the main overthatch (finished top layer of a thatched roof) of straw or rushes.

Heather is not currently harvested for thatching in the Western Isles. However, there are recent and upcoming heather thatching examples in Gleann Comhann ~ Glencoe and A' Chomraich ~ Applecross (Brian Wilson, pers. comm.), as well as a recently thatched house in Auchindrain.

Figure 23: Master Thatcher Brian Wilson in front of a heather-thatched cottage at Àrach Blàr Chuil Lodair ~ Culloden Battlefield. © Malcolm McCurrach.

6.2.2 Heather locations

Figure 24: Landcover map showing temperate shrub heathland (category F4) in the Western Isles. Source: 'Scotland National Land Cover Map', Space Intelligence Scotland.

The satellite image in Figure 24 shows the likely location of heathland (category F4 is temperate shrub heathland) across the Western Isles. Below is a copy of the text from the Key in Figure 24, noting landcover types and labels:

- C1 (Blue) - Surface standing and running waters
- D1 (Dark Green) - Raised and blanket bogs
- D2 (Dark Green) - Valley mires, poor fens and transition mires
- D4 (Dark Green) - Base-rich fens and calcareous spring mires
- E1 (Moss-green) - Dry grasslands

- E2 (Light green) - Mesic grasslands
- E3 (Dark yellow) - Seasonally wet and wet grasslands
- E4 (Lilac) - Alpine and subalpine grasslands
- E5 (Ochre) - Woodland fringes and clearings, and tall forb stands
- F2 (Purple) - Arctic, alpine and subalpine scrub
- F3 (Grass green) - Temperate and mediterranean-montane scrub
- F4 (Dark red brown) - Temperate shrub heathland
- F9 (Forest green) - Riverine and fen scrubs
- G1 (Dark grey) - Broadleaved deciduous woodland
- G3 (Dark green) - Coniferous woodland
- G4 (Greenish brown) - Mixed deciduous and coniferous woodland
- G5 (Mid-green) - Lines of trees, small anthropogenic woodlands, early stage woodland and coppice
- H2 (Light brown) - Screes
- H3 (Mid-brown) - Cliffs and rock pavements
- I1 (Orange) - Arable land and market gardens
- J (Black) - Built up
- (Mid-grey) - Bare land

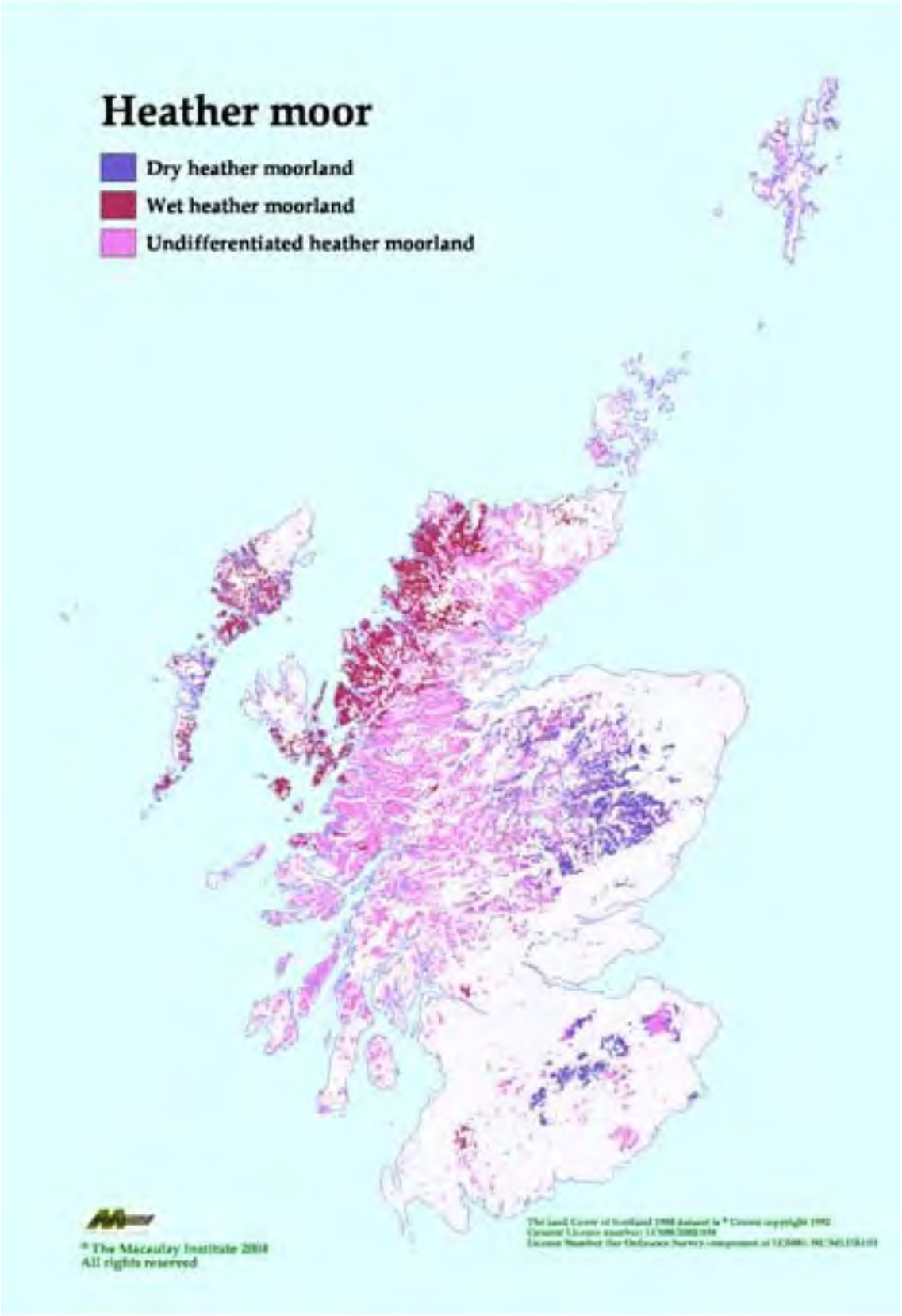

Figure 25: Heather moorland distribution map (dry heather moorland is in blue-purple, wet heather moorland is in maroon and undifferentiated heather moorland is in pink). Source: James Hutton Institute.

6.2.3 Estimates of area available

Peatland and moorland cover approximately 70% of Na h-Eileanan Siar ~ the Western Isles, with heather vegetation accounting for approximately 10% of that (Scottish Natural Heritage landscape assessment, see NatureScot.gov).

Records describe heather being harvested from Beinn Eubhal ~ Eaval (the largest hill in Uibhist ~ Uist) and from islands which were not grazed with sheep. With a reduction in sheep numbers in Uist and Scotland, the grazing of heather is much less of a problem. Areas of long, ungrazed heather will be much more plentiful than fifty years ago.

Heather from moorland which is managed and used 'for sheep grazing and sporting purposes yields unsuitable material for thatching' (Dower 2015: 12).

6.2.4 Harvesting heather, quantity and quality

Heather for thatching was, and is, pulled out by the roots one piece at a time, by hand, and any soil or moss attached wiped off. A length of between 1.5 to 2ft of the above-ground plant is desirable. This size of heather is typically about ten years old and ungrazed. The plant needs to be long and 'stringy', rather than with thick woody growth, with the main stem no thicker than a centimetre.

Longer lengths are used at the building's eaves while shorter lengths are used at the ridge. Other than at the eaves and ridge, heather of the same average length is used over the whole roof.

The plant needs to be cut before flowering so that the flower buds do not fall off, and to allow time for the thatching job to complete before winter.

The heather is laid with the root upmost. The root is tangly and knits with other roots to hold together. The heather is placed with the root

pointing towards the ridge and the body of the plant pointing downwards towards the eaves.

Heather is sometimes found laid with the root downwards, but only for patching timber or to stiffen the eaves.

Four to five bundles of heather are required per square metre of roof. Each round bundle is approximately 25cm radius and takes about half an hour to pull, collect and tie by hand (Brian Wilson, pers. comm.).

Piles of pulled heather are gathered up into large bundles, with about eight bundles considered to take a day's work. A small house of approximately 10m by 5m requires about 130 bundles, i.e., sixteen days' work of gathering material. The pulling and gathering of about eight cuals (sixteen armfuls) was considered a decent day's work for one person. 'Cual' is a Gaelic word meaning a faggot of wood or a bundle. A thatched gabled house in Applecross (approx. 11 by 5 yards externally) took 130 cuals, while a small Plockton house with one hip-end took 150 cuals, or perhaps twenty person-days of gathering (Souness 1991: 13).

Cutting is an alternative method of harvesting heather; however, it is a two-person task, as it requires the plant to be held up and lopped. Cutting with a brush cutter is possible, but any time saved is then lost in sorting through the plants cut to obtain the correct quality (Brian Wilson, pers. comm.).

6.2.5 Suitability for thatching

Dower (2015) considered that the durability of heather thatch was downplayed by thatchers in the past. Some current thatchers consider that heather thatch will last twenty to thirty years. It seems that thatching with heather takes much longer to carry out than thatching with marram or reed, especially when gathering the heather is taken into

account. However, if the thatch lasts longer, perhaps owners will be more willing to pay a premium.

6.2.6 Permissions

Physical access

As most of the heather will be found on common grazings, access should be possible with permission. Many sites will be accessible with a 4×4 vehicle or quad bike. It is likely, however, that the less accessible places will have longer heather, as crofters are less inclined to put sheep out there to graze.

Permissions required

Where the heather is on a common grazing, permission would need to be sought from the common grazings committee if one is in place. If the building to be thatched is within the township and the owner has a share in the common, then taking heather would not necessarily need permission. However, all common grazings are bound by regulations, and it is unlikely that there will be any mention of taking heather in the regulations. The rights on a common grazing are for grazing and sometimes a right to cut peat, but usually no other rights are given.

If the land is outside a crofting area, permission would need to be sought from the landowner, e.g. North Uist Estate.

6.2.7 Constraints

Harvesting

Pulling heather, rather than cutting it, could leave bare peat, which is undesirable due to the release of carbon dioxide. However, NatureScot considers the quantities involved to be small and the method of hand harvesting to be insignificant.

The timing of pulling heather seems to have depended on circumstances rather than there being a difference in the quality of the plant. In the

past, timings varied across Scotland. Spring has been cited as the best time on the mainland, but there are reports of heather being pulled in summer or autumn for thatching while houses were unoccupied (Souness 1991: 14). Dormant heather might have little sap, thought to promote durability over time. However, any time of year seems to be acceptable as long as the heather is left to dry before thatching (SVBWG_VB_15_1991.pdf). No other preparation is undertaken.

Wildfire risk

With fewer livestock grazing some areas of moorland, heather plants have matured and reached tall heights. This is of concern in that there is a higher risk of wildfire, however, the taller plants are better for thatching.

6.2.8 Opportunities

If cutting rather than pulling heather created a suitable material to work with, cutting could be carried out by handheld brush cutter. Cutting has several benefits over pulling:

- It is less labour intensive.
- It leaves a cover over the ground, rather than bare peat.
- It allows heather to regenerate more quickly than heather recolonising bare areas.

The benefits of pulling or cutting are:

- The reduction in heather volume or height reduces the volume of material at risk in case of wildfire.
- It provides shelter and feeding habitat for many birds.
- It allows other species to flourish in an otherwise heather-dominated moor.

Heather cutting could be caried out along current best practice guidelines for muirburn. This involves cutting small areas of no more

than 50m wide, cutting different areas each year to provide a mosaic of heights, and cutting no more frequently than every eight years (NatureScot, 'Muirburn code'; Scottish Natural Heritage (SNH) 1996).

6.2.9 Gaps in knowledge

Table 5: Gap in knowledge on heather, subsequent approach and key contact to make.

Gap in knowledge	Approach	Key contact
Whether cut heather is suitable for thatching, and the minimum length required	Simple trial with heather to compare cut heather usability against pulled heather Cut by hand or with brush cutter heather of differing heights; pull heather of differing heights; compare maximum lengths and ease of fixing	Scottish Thatchers

Full-page image 4: Mr MacMillan of Dalabrog, Uibhist a Deas ~ Daliburgh, South Uist, stands on a ladder thatching the roof of his stone-built byre with rushes and reeds in 1975. © National Museums Scotland. Licensor www.scran.ac.uk.

6.3 Rush

6.3.1 Introduction to rush

Common rush or soft rush (*Juncus effusus*) has been used in the past for thatching in Na h-Eileanan Siar ~ the Western Isles, with one rush-thatched roof existing in Uibhist a Tuath ~ North Uist. Rush thatching is less durable than marram or heather and only lasts for a few years.

Soft rush can dominate pasture and is of less nutritional value and is less palatable to livestock than grass. Therefore, crofters will prefer to remove or reduce it from pastureland. Soft rush pastures have some environmental value, but in areas where rush dominates the sward (expanse of short grass), biodiversity is reduced. For birds, a variation in density and height of rushes is desirable, and therefore cutting and harvesting of rush could have environmental benefits.

Rushes can be cut using a conventional agricultural mower and gathered using a conventional agricultural small baler. The reed-harvesting machine operated by the RSPB on the Tay reedbed appears to be suitable for cutting rushes and could be trialled.

6.3.2 Quality and density

Old rush swards can have a build-up of dead litter at the base of the plants, which may make harvesting more difficult and result in more work to clean the crop for use. Younger plants are likely to be more sparse and easier to mow. It is unknown whether there is a difference in the quality of the stem between young or old plants. For harvesting, if the plants are too dense, a clean cut is difficult and the crop can be too bulky for a baler.

6.3.3 Suitability for thatching

In the past, rushes of three to four feet in length were cut low by hand, laid in sheaves and tied so that the thatcher could take small quantities at a time. Rushes are placed so that only short lengths of the root end of the rush is exposed (ThatchingInfo.com).

6.3.4 Permissions

Rush pasture is widespread in the Western Isles. Rushes will mostly be found on high organic matter or peaty soils, on in-bye croft land and apportionments of common grazings. Most sites of rush pasture are accessible with the permission of the crofter or farmer and can be reached by 4×4 vehicle, ATV or tractor. Therefore, this material is readily available and harvesting is unlikely to meet any objection from crofters, landowners or NatureScot.

6.3.5 Gaps in knowledge

Table 6: Gap in knowledge on rush, approach and key contacts.

Gap in knowledge	Approach	Key contacts
The age and density of rush swards and effect on quality	Compare management regimes for growing and harvesting rushes on length, thickness, waxiness of coating and damage score on usability and longevity of thatch In one uniform, slightly waterlogged field, trial different mowing heights, timing and frequency; compare quadrants within each site for length, damage and visual assessment by thatchers as to quality	SRUC, Scottish Thatchers

6.4 Water reed

Water reed is also known as common reed (*Phragmites australis*). Although it grows in Na h-Eileanan Siar ~ the Western Isles, it is not common, and harvesting would need to be carried out very sparingly in order to be sustainable. Any cutting would need to be carried out in autumn, as some species of birds nest in water reed and others use it for cover. Because water reed is uncommon and of high biodiversity value, it is not presented in this report as a viable mainstream thatching material in the Western Isles.

Full-page image 5: Machair in bloom at Tèarmann Nàdair Baile Raghaill RSPB, Uibhist a Tuath, Na h-Eileanan Siar ~ RSPB Balranald Nature Reserve, North Uist, Western Isles, 2024. © Corallie Hunt.

7. ENVIRONMENTAL IMPACTS

7.1 Marram grass

7.1.1 Introduction to impacts of marram grass

Marram grass (*Ammophila arenaria*) is the dominant species in the mobile stages of the dunes around all the coasts in the UK. It grows in an extreme environment and shows various adaptations to arid conditions, such as in-rolled waxy leaves with tiny hairs along the inside which help to slow airflow and minimise transpiration. The deep roots also work with rhizomes to create a net-like structure that stabilises the sand while allowing marram to survive in nutrient-poor conditions.

Surprisingly, marram is not very salt tolerant and does not withstand frequent tidal flooding. It is well adapted to its niche in the mobile area of the dunes. Salt-tolerant pioneer species such as lyme grass (*Leymus arenarius*), sand couch-grass (*Elymus farctus*), orache (*Atriplex*), sea sandwort (*Honckenya peploides*) and sea rocket (*Cakile maritima*) grow in embryonic sand dunes and just above the high tide level.

7.1.2 Marram growth and its environmental role

Marram is the ecosystem engineer in coastal dune areas. Its stems trap windblown sand, forming a first line of defence against the sea. The culms and leaves slow the wind while the roots and rhizomes stabilise the sand. Marram growth is stimulated by sand movement and burial, and new shoots grow quickly in response to sand deposition.

The dune system and ecological succession

Dunes form as sand is deposited over objects along the strand line (a mark left by the high tide or a line of seaweed and other debris washed onto the beach by the tide) and around pioneer plants that can tolerate

a salty, desiccating environment. These embryonic foredunes can come and go with storms.

The next area is the mobile dunes, typically dominated by marram grass, which helps to stabilise them and gives way to the fixed dunes. Larger varieties of plants are found in the fixed dunes. This is due to their more stable nature as well as the increase in organic material that is available as plants die off, allowing a greater diversity of species to grow. Marram is also present in the fixed dunes, although it is mixed in with other species and tends to be generally weaker than the plants found growing in the mobile dune.

Between the dune ridges, there are low-lying areas referred to as dune slacks. These often flood during the winter. In Uibhist ~ Uist, Beinn na Faoghla ~ Benbecula and Barraigh ~ Barra, as well as some locations in the west of Na Hearadh ~ Harris and Leòdhas ~ Lewis, a low-lying coastal plain known as machair occurs behind the dune system; strictly speaking, the machair includes the dunes and foreshore.

Embryonic foredunes can completely disappear after storms. If enough sand is deposited between extreme weather events, then they can also form mobile dunes.

7.1.3 Biodiversity

The dunes themselves, especially the embryonic foredunes and mobile dunes, are limited in the plants and animals that they support due to the unstable and demanding nature of the habitat. Perhaps the rarest species found in the marram zone of dunes is the solitary mining bee Northern Colletes *(Colletes floralis)*, which is classified as rare under the UK Biodiversity Action Plan. The loss of this open sandy dune habitat and subsequent erosion can be brought about by mismanagement and would greatly affect this species. The foredunes, including the mobile dunes, are important for the protection they provide.

Figure 26: Mobile dune and embryonic foredune on the west side of the airport, Balivanich, Benbecula.

Figure 27: Close-up of the embryonic foredune in Figure 26.

The fixed dune provides a more stable habitat that allows a greater variety of plants, insects and birds to establish themselves. In between

the dune ridges lie lower areas or slacks, which often flood in winter. These slightly damper areas support a different plant community and increase the diversity of the site. The machair at the north end of Beàrnaraigh ~ Berneray is a classic example of this sort of habitat. Here you can find nesting Dunlin (*Calidris alpina*), Redshanks (*Tringa totanus*) and Lapwings (*Vanellus vanellus*), which, along with the Ringed Plover (*Charadrius hiaticula*) and Oystercatcher (*Haematopus ostralegus*), are part of a nationally important assemblage of breeding waders found in Uibhist ~ Uist.

There is a greater variety of flowering plants in this habitat and much less open sand. Red fescue (*Festuca rubra*) is often the most common grass species in this zone; marram is also found, but at much lower density, and is often generally weak and not suitable for thatch. Damp areas support a variety of plants not found elsewhere in the dune system, including Baltic rush (*Juncus balticus*), Adder's-tongue (*Ophioglossum vulgatum*), Early Marsh Orchid (*Dactylorhiza incarnata coccinea*), Northern Marsh Orchid (*Dactyloorhiza purpurella*) and many others.

The most important environmental significance of the dune system, particularly the mobile dune, is the protection they provide for the habitats in their lee. In Uibhist ~ Uist, Beinn na Faoghla ~ Benbecula and Barraigh ~ Barra, as well as smaller areas in Na Hearadh ~ Harris and Leòdhas ~ Lewis, machair occurs along the western seaboard. Machair is a rare habitat found nowhere else in the world apart from the Inner Hebrides, Ireland, and to a much smaller extent in the Northern Isles. Na h-Eileanan A-Muigh ~ the Outer Hebrides supports the largest and richest examples of cultivated machair and a variety of uncultivated machair types.

Floral diversity is greatest where low-intensity crofting is practised on a rotation of fallow and cropped patches. This management maintains a

rich arable weed flora that supports a diversity of insects and birds, most notably, the assemblage of breeding waders and Corncrakes (*Crex crex*). Little Terns (*Sternula albifrons*) also nest on the machair, often amongst the arable crops. Machair also supports the few remaining Corn Buntings (*Emberiza calandra*) along the west coast of Scotland, while in winter large numbers of Twite (*Carduelis flavirostris*) feed in arable areas. Both these latter species are declining in the UK and classified as Red under Birds of Conservation Concern 4 (BoCC4), the Red List of birds (2015).

Selected list of rare or protected species found in the dunes and on the machair

Northern Colletes (*Colletes floralis*) is a solitary mining bee found along the machair. The bees form their colonies in open sandy areas adjacent to flower-rich coastal habitats. Around half of the known global population is found in the UK, with the Outer Hebrides being of particular importance for this species. It is listed as rare in the UK Biodiversity Action Plan.

The Great Yellow Bumblebee (*Bombus distinguendus*) was once widespread throughout the UK. Agricultural intensification and widespread loss of flower-rich meadows caused it to become extinct throughout much of the British range. These bees are now confined to Orkney, Caithness and the Outer Hebrides, with Uist and Barra holding the majority of the remaining population.

The Belted Beauty (*Lycia zonaria*) is a species of moth associated with the machair, where it is widespread throughout the islands. There are no current estimates of the population in the Outer Hebrides, although they are very localised in the UK and have a disjunct global population. The subspecies found in Scotland is classified as 'Nationally Scarce A' – meaning that it has been recorded in only 16–30 10km squares since 1980. It is especially vulnerable because the females are flightless.

The Corncrake (*Crex crex*) has declined significantly in the UK from its past status as a widespread breeding species to become largely restricted to the Hebrides, notably Uist, Tiree and Coll. The most recent figures show another decline to just 850 calling males in 2021, although the Outer Hebrides showed a slight increase in numbers. The islands are critical for this species' survival as a breeding bird amongst machair crops and vegetation. Any loss of machair, especially cultivated machair, would hasten its decline and possible extinction in the UK.

The Little Tern (*Sternula albifrons*) is Amber listed under BoCC4 and protected under Schedule 1 of the Wildlife and Countryside Act 1981. It is a vulnerable species, nesting on the ground, and may abandon nests and eggs if frequently disturbed. In Uist, it nests on cultivated areas of machair in small numbers.

The Twite (*Carduelis flavirostris*) occurs throughout the year, but the importance of the machair is most significant during the winter, when around 3,000 individuals are scattered throughout Uist. Considering the wintering population of Twite in Scotland is estimated at between 14,000 and 35,000 (Forrester and Andrews 2007), the Uists support up to 21% of all Twite wintering in the country.

7.1.4 Harvesting marram for thatching: effect on environment

Harvesting marram can potentially have a huge impact on the coast if it is not collected in a controlled way. In the past, cutting occurred on the airport dunes at Balivanich. Several individual harvesters had access at the time and the airport contact was very specific about the procedures around the harvesting, as they were concerned about the erosion potential (Ian McTaggart, pers. comm.). Individuals were asked to cut with a scythe, as it was felt that cutting using mechanical methods such as strimmers would not leave enough length above sand level and could potentially damage the root system. This requirement was not followed,

and as materials were also being cut and shipped off island, as well as being cut out of airport operational hours, the harvesting was stopped altogether.

Figure 28: A typical area where Marram is harvested for thatching.

The marram resource is very limited, and past over-harvesting has led to villages and arable land becoming covered in sand. The amount of marram available might well increase and more dunes form if the dune edge was fenced off from livestock that graze the dunes in winter. Trampling and consumption of marram along the foredunes by livestock potentially exposes the area to more damaging winds and can lead to a blowout. The healthier the established mobile dunes are, the stronger they are at surviving violent winter storms and tidal surges. The mobile nature of foredunes can also help with the formation of embryo dunes, which in time may stabilise given that enough sand accumulates and is colonised by marram.

Figure 29: In areas where little sand is deposited, the foredune cannot form. This results in the dunes becoming truncated, as depicted in this example from Am Baile Sear, Uibhist a Tuath ~ Baleshare, North Uist.

Little sand is deposited in some sites, and therefore the foredunes cannot form. This results in dunes becoming truncated and the coastline suffers from erosion during the stormy weather, as shown in Figure 29 at Baleshare, North Uist.

As discussed in Section 5.3, best practice and poor practice require further research.

7.2 Cereal straw

7.2.1 Introduction

Cereal crops are grown on the machair to provide fodder for livestock during the winter months. These types of cereals that manage to grow in this dry and nutrient poor soil are limited to old varieties that are especially adapted to this environment. These include varieties of small oats (*Avena strigosa*), rye (*Secale cereale*) and bere barley (*Hordeum vulgare*). Two or more species are often grown together and these are normally small oats and rye. Mixed grain is rarely grown elsewhere in northwest Europe but is practised here as a buffer against risky, unpredictable environments. Occasionally Bere barley is grown on its own and tends to have longer stems that also appear more robust than rye or small oats.

Seaweed is applied during the early spring, and bagged fertiliser is now also regularly applied to some crops. Herbicides and pesticides are infrequently used and are considered expensive for such low-intensity agriculture systems. Herbicides are also likely to leach quickly through the sandy soils, and their use is not encouraged due to the environmental damage they cause.

7.2.2 Biodiversity

The machair crops, farmed in a low-intensity manner, are grown in rotation with a two-year cycle of fallow followed by cropped patches. A rich variety of arable weeds flourishes within the cropped machair system, with different species predominating in different ages of fallow plots as well as actively cropped patches. This patchwork, low-intensity arable system was once widespread but is now confined to very small areas. Uibhist ~ Uist and Barraigh ~ Barra hold the best and most extensive examples of this habitat.

The Uist machair is noted for its rich variety of wildflowers which have all but disappeared from other agricultural areas. The floral diversity in turn supports many insects, some of which are nationally rare, like the Belted Beauty moth (*Lycia zonaria*), as well as an important assemblage of breeding waders. The machair also supports various passerines, or small perching birds, that are linked with agriculture during the breeding season (Corn Bunting, *Emberiza calandra*) and winter (Twite, *Carduelis flavirostris*, and Skylarks, *Alauda arvensis*), as well as important numbers of wintering Greenland Barnacle Geese (*Branta leucopsis*) in Uibhist a Tuath ~ North Uist.

7.2.3 Harvesting cereals for thatching: effect on environment

Growing machair crops for thatching, if done with sensitivity towards wildlife, could provide environmental benefits, although this may not be compatible with providing the best thatching materials.

Methods and effects to take into account

Leaving arable weeds to grow amongst the crops would require the thatch to be cleaned after harvesting. It would be time-consuming to weed the crops on a regular basis and not considered environmentally friendly to use herbicides.

If the crop was dense and plenty of seaweed applied, then it might be possible to grow a crop where weeds were only found on the outer edge. The seed heads would need to be removed before being able to use the stalks.

Most townships in Uibhist ~ Uist are dependent on contractors to cut arable crops when ripe, although when the contractors visit is dependent on other crops maturing in each area.

Cutting cereals with mechanical equipment may damage the stalks, and therefore make some of the thatch unusable.

Arable crops (especially bere barley) attract the resident Greylag Geese during the late summer as they gather to feed on the seed heads. They may damage the crop extensively if they walk amongst it, trampling the cereals. It is possible to fence the edge of the cropped patches with a simple electric wire set-up (this does not need to be electrified). However, this does require maintenance to ensure that geese do not enter the crop.

Blacklands

The ground where the machair meets the peaty interior, referred to as the Blacklands, could be used to grow cereal crops for thatching. A careful examination of wildlife using these areas at the moment would be necessary as some waders, such as Lapwing and the threatened Corncrake, often nest on this ground.

Benefits of producing local landrace cereals for thatching

- Maintains local varieties of crop with seaweed used as fertiliser.
- Allows natural weed growth on the edge of the crop.

Negatives of producing local landrace cereals for thatching

- Inappropriate use of herbicide would be detrimental to the environment.
- Totally eradicating weeds would significantly reduce the environmental benefits of growing crops for thatch.

7.3 Heather

7.3.1 Introduction

There are likely to be a number of environmental benefits to cutting heather by hand, which would create a habitat with different heights and ages of regenerating heather. The variation in growth height and age of heather provides homes to a greater variety of insects and therefore food for birds, creating a mosaic habitat.

Cutting by hand could also replace the damaging practice of muirburn, which is still widely practised to improve grazing for sheep. If done in an uncontrolled manner, muirburn results in extensive burns, damaging infrastructure and wildlife for a number of years after the burn. In cases like this, the fire can enter the peat, destroying the heather growth and releasing large amounts of carbon. Therefore, the replacement of heather-burning with cutting would be desirable.

Figure 30: Heather-thatched house at Hogh Mòr, Uibhist a Deas ~ Howmore, South Uist, February 2022.

7.3.2 Biodiversity

Uibhist ~ Uist is notable for the breeding birds of prey that are largely found on the moorland during the breeding season. Short-eared Owls (*Asio flammeus*), Hen Harriers (*Circus cyaneus*) and Merlins (*Falco columbarius*) all nest in long heather banks. Short-eared Owls are found at a higher density in Uist and Beinn na Faoghla ~ Benbecula than anywhere else in the UK. Likewise, Hen Harriers occur in good numbers. Uist therefore acts as a potential source of birds available to recolonise

areas where they once lived on the mainland. Merlins also breed in good numbers, with Leòdhas ~ Lewis having the highest density in western Europe.

7.3.3 Harvesting heather for thatching: effect on environment

Short-eared Owls start breeding early and are on territory on the moors from early March, while Hen Harriers begin establishing territories later in April, along with Merlins. It would be easy to cause disturbance to these species by cutting heather during the spring. Therefore, an autumn or early winter regime of harvesting would be desirable.

Benefits of harvesting heather for thatching

- Cutting heather is an alternative to damaging, carbon-releasing burning of heather.
- Increased insect and bird diversity by providing a mosaic habitat of different heights and ages of heather.
- The materials are widely available, and cutting by hand in autumn would have a low negative impact on the environment.

Negatives of harvesting heather for thatching

- There are few environmental negatives to using heather for thatching if the plants are cut during the autumn/early winter either by hand or with a brush cutter.
- There may be some low-level trampling of healthy heather when extracting the cut materials from the moorland.

Figure 31: Muirburn out of control in Uibhist a Tuath ~ North Uist, February 2021.

8. CONCLUSION

Conversations were undertaken with stakeholders, local people and HES, as well as information collected for the Section 4 literature review. It is clear that a diverse range of thatch materials has been used in Na h-Eileanan Siar ~ the Western Isles, each with different qualities and availability.

8.1 Marram harvesting

There are many gaps in knowledge and conflicting opinions about the effects and best practice of harvesting marram. Although current harvesting is small scale and sensitively carried out, it is difficult to recommend any increase in local marram harvesting until these gaps are addressed.

8.2 Growing cereals for straw

Growing cereal crops could be a good additional source of thatching materials. Growing these on the machair, where cereal crops are currently grown, provides a rich and diverse environment for various species of plants, insects and birds.

Increasing the area of actively cropped machair could help to enrich biodiversity. The main issue with growing cereals for straw for thatching is in the harvesting technique and the availability of suitable machinery. However, with an agreement between grower and end user, partnerships could be formed to encourage investment in machinery.

8.3 Cereals and marram grass in combination

Using cereals and marram grass may be possible if done in combination with other similar materials. Common reed has been used in combination with both marram and straw, which would help the scarcer materials be used more widely. Soft rush has also been used for

thatching and is widespread. The RSPB are promoting the cutting of soft rush to improve habitats therefore using materials that are local and already being cut may also be a benefit to those that wish to thatch.

8.4 Harvesting heather

Heather is widespread and reasonably accessible, although the harvesting and laying of it for thatching is said to be more difficult than using the other, more linear materials. It also takes more time to harvest than most other materials. If harvested in late summer to early winter it would avoid disturbing much of the wildlife that currently uses it, while also providing an alternative to muirburn. The harvesting could be completed on a rotation and form a patchwork of long and short (fresh) heather that would promote biodiversity.

8.5 Summary

It is not the quantities of each material that is the limiting factor. Marram, cereal straw, heather and rush are all available in Na h-Eileanan Siar ~ the Western Isles. With marram, although it grows in abundance in many areas, much of it is unsuitable for harvesting because it is growing amongst other vegetation, the quality is not good enough for thatching, or the terrain makes harvesting time-consuming.

The main issue this research has identified with marram is the lack of definitive guidance on its management and harvest. This uncertainty results in landowners and land managers restricting access to the marram. The lack of guidance is due to the lack of scientific research to inform best practice. If studies identified ways to sustainably harvest marram, then land managers and owners might be more willing to allow harvesting; indeed, such guidance could lead to better dune stabilisation.

Cereals have the advantage of positive biodiversity associated with their management and harvest. Accessibility is not an issue as it is with marram since straw can be purchased from the grower. Cereals are grown across much of the machair in Uibhist ~ Uist, and although not grown in useful quantity in Leòdhas ~ Lewis, if there was an end market, production would be encouraged. The main issues with cereal straw are a lack of knowledge of the attributes of good thatching straw, the lack of pure crops of bere or of oats, and the lack of appropriate machinery. All of these issues may be relatively easy to solve.

Heather is abundant and harvesting it is unlikely to meet with any objections from landowners or managers. The main issue with heather is the time taken to find areas of long heather plants, and the time required for pulling the heather and applying the thatch. However, harvesting would come with positive biodiversity benefits.

Likewise, soft rush is abundant, and its harvesting would likely be viewed positively by land managers. The main issue with rush is not the availability but longevity of the material as thatch.

Defining best-practice guidance for marram will be time consuming whereas research on cereal straw could yield results within three years and research on heather would take less still. Therefore, although there is scope for harvesting of marram, the use of other locally grown or sourced thatching materials should also be investigated and encouraged.

Full-page image 6: Entrance to Taigh-dubh Àrnol, Eilean Leòdhais ~ The Blackhouse at Arnol, Isle of Lewis. This traditional, fully furnished thatched house once sheltered a family and its animals under the same roof.

9. KEY CONTACTS

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11. Lists of figures and tables

11.1 List of figures

11.2 List of full-page images

11.3 List of tables

APPENDICES

Appendix 1 Methodology

A mixed methods approach was undertaken for this report, drawing on the expertise of the project team. Methods were selected which were considered most effective in gathering diverse data and most appropriate for the stakeholders involved. Information has been extracted from interviews and anonymised, where appropriate, for the purposes of the report.

In addressing gaps in knowledge, the team carried out:

- A literature review
- Interviews with key stakeholders: thatchers, landowners and CG clerks, HES, NatureScot, Comhairle nan Eilean Siar
- Correspondence with UHI, the Crofting Commission, SAC Consulting, SRUC, NU distillery
- Survey questions for common grazings committees (with options for follow-up interviews)
- Survey questions for the public
- Interviews with crofters
- Triangulation of results with literature

Ainmean Àite na h-Alba's Gaelic Place-name Policy was followed in the approach to place-names in this report.

Appendix 2 Acknowledgements

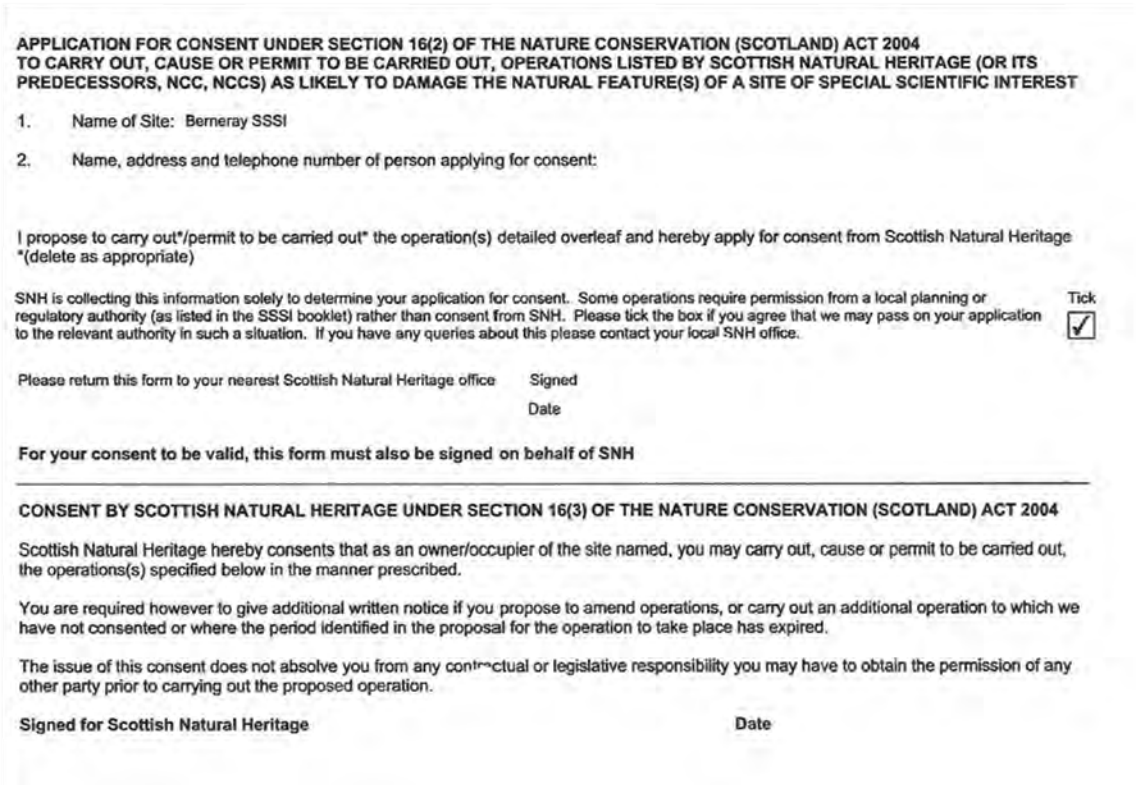
The authors wish to thank HES for commissioning this report, and for helping to safeguard historic buildings and crofting practices in the Western Isles.

Many thanks to all who contributed time, photographs and insight into practical thatching, harvesting and use of thatching materials.

Thanks also to Professor Fiona Burnett and David Lawson of SRUC for information on trial design, and to SAC Consulting colleagues for information on Western Isles agricultural practices.

Appendix 3 Example of a NatureScot consent application form

The NatureScot consent application form can be found online at: https://www.nature.scot/doc/application-consent-form-sssis



APPLICATION FOR CONSENT UNDER SECTION 16(2) OF THE NATURE CONSERVATION (SCOTLAND) ACT 2004 TO CARRY OUT, CAUSE OR PERMIT TO BE CARRIED OUT, OPERATIONS LISTED BY SCOTTISH NATURAL HERITAGE (OR ITS PREDECESSORS, NCC, NCCS) AS LIKELY TO DAMAGE THE NATURAL FEATURE(S) OF A SITE OF SPECIAL SCIENTIFIC INTEREST

1. Name of Site: Berneray SSSI

2. Name, address and telephone number of person applying for consent:

I propose to carry out*/permit to be carried out* the operation(s) detailed overleaf and hereby apply for consent from Scottish Natural Heritage *(delete as appropriate)

SNH is collecting this information solely to determine your application for consent. Some operations require permission from a local planning or regulatory authority (as listed in the SSSI booklet) rather than consent from SNH. Please tick the box if you agree that we may pass on your application to the relevant authority in such a situation. If you have any queries about this please contact your local SNH office. Tick ☑

Please return this form to your nearest Scottish Natural Heritage office Signed

Date

For your consent to be valid, this form must also be signed on behalf of SNH

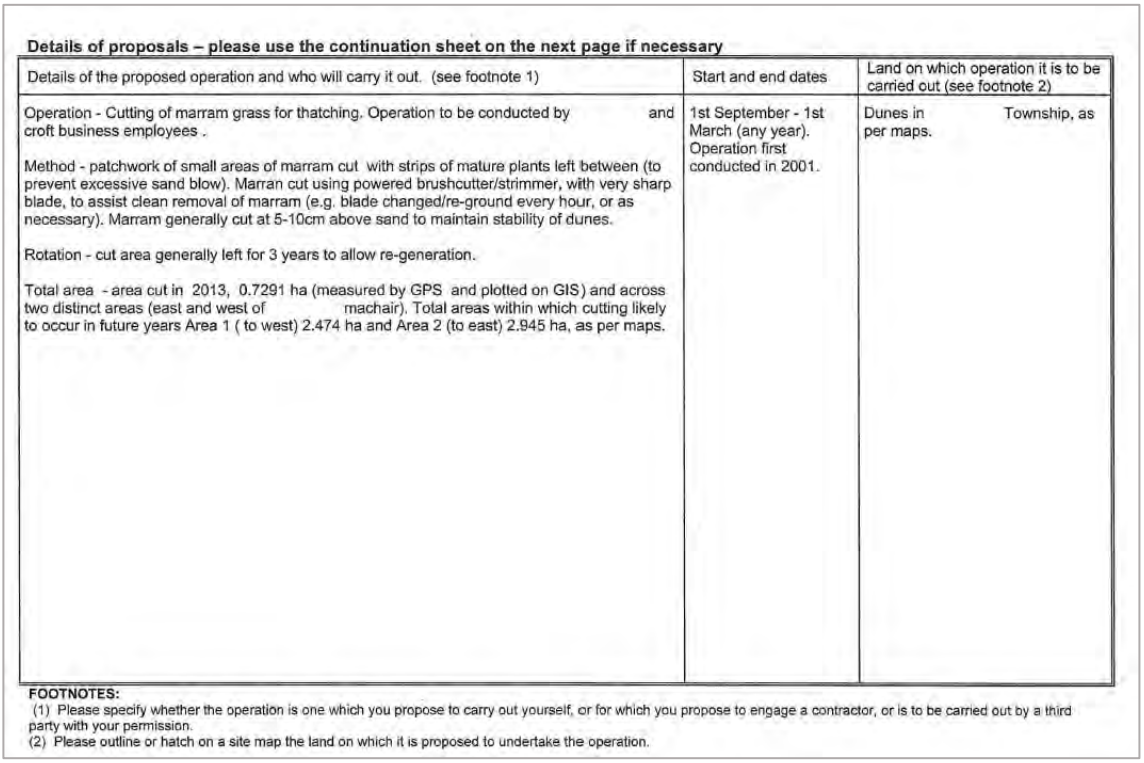
CONSENT BY SCOTTISH NATURAL HERITAGE UNDER SECTION 16(3) OF THE NATURE CONSERVATION (SCOTLAND) ACT 2004

Scottish Natural Heritage hereby consents that as an owner/occupier of the site named, you may carry out, cause or permit to be carried out, the operations(s) specified below in the manner prescribed.

You are required however to give additional written notice if you propose to amend operations, or carry out an additional operation to which we have not consented or where the period identified in the proposal for the operation to take place has expired.

The issue of this consent does not absolve you from any contractual or legislative responsibility you may have to obtain the permission of any other party prior to carrying out the proposed operation.

Signed for Scottish Natural Heritage **Date**



Details of proposals – please use the continuation sheet on the next page if necessary

Details of the proposed operation and who will carry it out. (see footnote 1)	Start and end dates	Land on which operation it is to be carried out (see footnote 2)
Operation - Cutting of marram grass for thatching. Operation to be conducted by and croft business employees . Method - patchwork of small areas of marram cut with strips of mature plants left between (to prevent excessive sand blow). Marran cut using powered brushcutter/strimmer, with very sharp blade, to assist clean removal of marram (e.g. blade changed/re-ground every hour, or as necessary). Marram generally cut at 5-10cm above sand to maintain stability of dunes. Rotation - cut area generally left for 3 years to allow re-generation. Total area - area cut in 2013, 0.7291 ha (measured by GPS and plotted on GIS) and across two distinct areas (east and west of machair). Total areas within which cutting likely to occur in future years Area 1 (to west) 2.474 ha and Area 2 (to east) 2.945 ha, as per maps.	1st September - 1st March (any year). Operation first conducted in 2001.	Dunes in Township, as per maps.

FOOTNOTES:
(1) Please specify whether the operation is one which you propose to carry out yourself, or for which you propose to engage a contractor, or is to be carried out by a third party with your permission.
(2) Please outline or hatch on a site map the land on which it is proposed to undertake the operation.

Text used for the above example

1. Name of Site: Berneray SSSI
2. Name, address and telephone number of person for consent: empty

Details of proposals:

Operation: Cutting of marram grass for thatching. Operation to be conducted by croft business employees.

Method: Patchwork of small areas of marram cut with strips of mature plants left between (to prevent excess sand blow). Marram cut using powered brush cutter/strimmer with very sharp blade to assist with clean removal of marram (e.g., blade changed/reground every hour or as necessary). Marram generally cut at 5–10cm above sand to maintain stability of dunes.

Rotation: Cut area generally left for three years to allow regeneration.

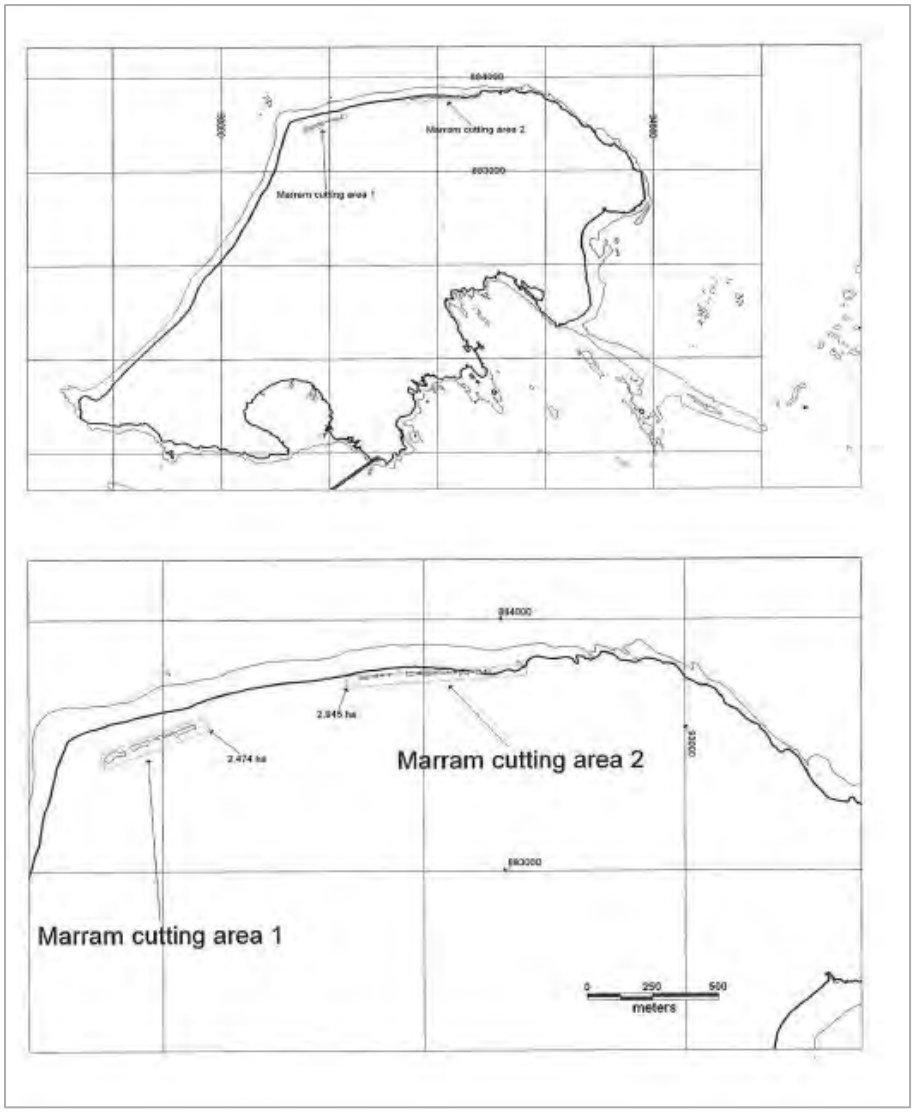
Total area: Area cut in 2013, 0.7291 hectares (measured by GPS and plotted on GIS) and across two distinct areas (east and west of [redacted]

machair). Total areas within which cutting likely to occur in future years: Area 1 (to west) 2.474 hectares and Area 2 (to east) 2.945 hectares, as per maps.

Start and end dates: 1st September to 1st March (any year). Operation first conducted in 2001.

Land on which operation is to be carried out (see footnote 2): Dunes in [redacted] Township, as per maps.

Example of a completed form (maps)



Appendix 4 Final results of the June 2021 Agricultural Census

General findings from these census results are also on the Scottish Government website at https://www.gov.scot/publications/results-scottish-agricultural-census-june-2021/.

Final Results of the June 2021 Agricultural Census

	Na h-Eileanan Iar
Crops and fallow:	holidings
Wheat	c
Barley: Winter	0
Spring	c
Total	c
Oats, triticale and mixed grain	133
Rape for oilseed and linseed	c
Potatoes	308
Peas and beans for combining	c
Stockfeeding crops(1)	41
Vegetables for human consumption	256
Orchard and soft fruit	130
Bulbs, flowers and nursery stock	71
All other crops	57
Fallow land: 5 years or less	115
more than 5 years	152
Total crops and fallow	**828**
Grass and rough grazing:	
Grass under 5 years old	600
Grass 5 years old and over	3,678
Sole right grazing	2,772
Common grazing	320
Total grass and rough grazing	**5,840**
Utilised Agricultural Area (UAA)(2)	**6,102**
Woodland	555
Other land	2,112
Total agricultural area(3)	**8,134**
Crops and fallow:	hectares
Wheat	c
Barley: Winter	0
Spring	c
Total	c
Oats, triticale and mixed grain	245
Rape for oilseed and linseed	c
Potatoes	36
Peas and beans for combining	c
Stockfeeding crops(1)	30
Vegetables for human consumption	54
Orchard and soft fruit	6
Bulbs, flowers and nursery stock	19
All other crops	13
Fallow land: 5 years or less	282
more than 5 years	356
Total crops and fallow	**969**
Grass and rough grazing:	
Grass under 5 years old	615
Grass 5 years old and over	24,421
Sole right grazing	63,414
Common grazing(2)	210,720
Total grass and rough grazing	**299,170**
Utilised Agricultural Area (UAA)(3)	**300,189**
Woodland	5,849
Other land	997
Total agricultural area(3)	**306,965**

(1) Includes lupins and maize.
(2) Inclusion of common grazing land brings total agricultural area in Scotland to a higher level than that published in the June agricultural census.
(3) Utilised agricultural area excludes woodland and other land such as yards and derelict land etc.

c data suppressed to prevent disclosure of individual holdings.

Transcribed copy of the above Final results of the June 2021 Agricultural Census

'Na h-Eileanan Siar', the Western Isles.

Crops and fallow (types)	Holdings (number of)
Wheat	c
Barley: Winter, Spring	0
Total	c
Oats, triticale and mixed grain	133
Rape for oilseed and linseed	0
Potatoes	308
Peas and beans for combining	0
Stock feeding crops (1)	41
Vegetables for human consumption	256
Orchard and soft fruit	130
Bulbs, flowers and nursery stock	71
All other crops	57
Fallow land: 5 years or less	115
Fallow land: more than 5 years	152
Total crops and fallow	828

Grass and rough grazing (types)	Hectares (number of)
Grass under 5 years old	600
Grass 5 years old and over	3,678
Sole right grazing	2,772

Grass and rough grazing (types)	Hectares (number of)
Common grazing	320
Total grass and rough grazing	5,840

Utilised Agricultural Area (UAA) (2)	6,102
Woodland	555
Other land	2,112
Total agricultural area (3)	6,134

Crops and fallow (types)	Hectares
Wheat	c
Barley: Winter, Spring	0
Total	c
Oats, triticale and mixed grain	245
Rape for oilseed and linseed	C
Potatoes	36
Peas and beans for combining	C
Stock feeding crops (1)	30
Vegetables for human consumption	54
Orchard and soft fruit	6
Bulbs, flowers and nursery stock	19

Crops and fallow (types)	Hectares
All other crops	13
Fallow land: 5 years or less	232
Fallow land: more than 5 years	356
Total crops and fallow	999

Grass and rough grazing (types)	Hectares (number of)
Grass under 5 years old	615
Grass 5 years old and over	24,421
Sole right grazing	63,414
Common grazing (2)	210,720
Total grass and rough grazing	299,170

Utilised Agricultural Area (UAA) (3)	300,169
Woodland	5,849
Other land	937
Total agricultural area (3)	306,955

(1) Includes lupins and maize.

(2) Inclusion of common grazing land brings total agricultural area in Scotland to a higher level than that published in the June Agricultural Census.

(3) Utilised agricultural area excludes woodland and other land such as yards and derelict land etc.

C [means that] data suppressed to prevent disclosure of individual holdings.

HISTORIC ENVIRONMENT SCOTLAND | ÀRAINNEACHD EACHDRAIDHEIL ALBA

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