HOWTH AND IRELAND'S EYE BRYOPHYTE SURVEY

FINAL REPORT

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CONTENTS

ACCOMPANYING DATA:

Bellinghams_Farm_Species_and_releve_details.xslx
East_Mountain_Species_and_releve_details.xslx
Red_Rock_Species_and_releve_details.xslx
Shilemartin_Species_and_releve_details.xslx
Summit_Species_and_releve_details.xslx
Ireland's_Eye_Species_and_releve_details.xslx

SHAPEFILES: To be provided with final report
PHOTOGRAPHS: As listed in the Excel data files

1 INTRODUCTION

1.1 Background

Denyer Ecology and Nimbosa Ecology were commissioned by Fingal County Council to undertake a bryophyte study of Howth and Irelands Eye in Co. Dublin in 2019. This draft report summarises the results of the desktop research and 2019 survey. Separate site reports (Appendices A-F) and species and permanent quadrat data (Excel files) accompany this report.

1.2 Aims and objectives

There is approx. 200ha of heathland on Howth, combined with a matrix of bracken, gorse, scrub and small woodland copses. The heathland on Howth is located at five sites on Howth: Red Rock, Bellingham's Farm, Shielmartin, The Summit and East Mountain. Fingal County Council are developing a management plans for each of these sites, starting with Red Rock and Bellingham's Farm later in 2019. These management plans will cover heathland management, gorse and scrub management and pathway management and they are to provide a long-term maintenance programme for these sites to protect the heathland and its associated species for which the area is designated.
The aim of this bryophyte study is to provide the baseline data and recommendations in terms of bryophytes for the management plans.
The Dublin Bay Biosphere Conservation and Research Strategy 2016-2020 includes a Bryophyte study for Irelands Eye. Given the proximity of the heathland sites at Howth and Ireland's Eye, the Council decided to run it as one project.

The objectives of this project were to:

1. Survey the 5 sites on Howth and Irelands Eye and give a description of the bryophyte flora community in each area.
2. Compare the survey findings on Howth with Irelands Eye.
3. Collate any historical bryophyte data on Howth and Irelands Eye from reports and individuals and provide a brief summary of the history of recording on Howth and Irelands Eye.
4. Record all legally protected, rare and locally rare Bryophyte species. GPS records of the locations of these bryophytes (ITM based) to be provided in an Excel sheet, be shown on a map in the report and provided as shapefiles.
5. Identify the ecologically significant areas from a bryophyte perspective on aerial photography for each of the 5 Howth sites and Irelands Eye.
6. Make detailed, habitat management recommendations to protect and enhance each site for bryophytes. Priority actions are to be identified and quantified as much as possible and site visits to be undertaken with the FCC Biodiversity Officer as necessary.
7. Provide baseline quadrat data of key sites for any future monitoring program. Set up 20 permanent quadrats (PQ) on Howth and 5 PQ on Irelands Eye, provide the coordinates of these sites (ITM based), provide an overview of the species composition and their abundancies in each PQ and provide a detailed method statement for a future monitoring program that will allow the monitoring of any changes in the bryophyte community. The PQ's are to be numbered and all PQ's and their number are to be displayed on a map in the report.

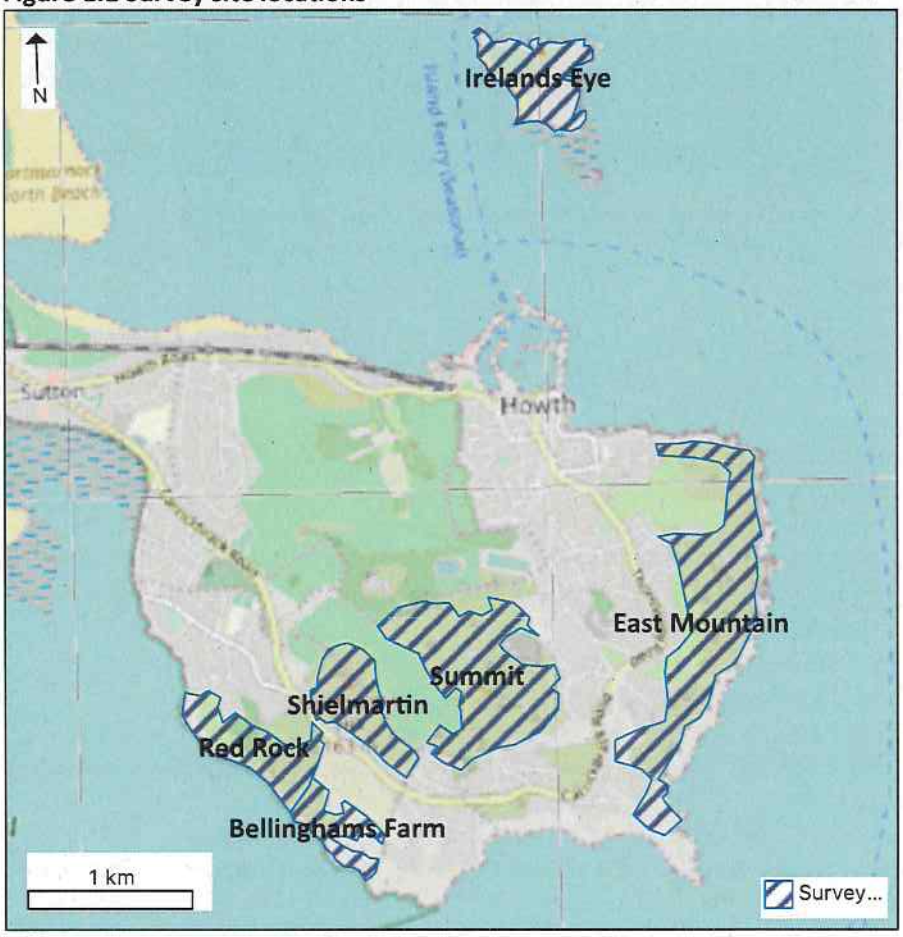
1.3 Sites

There are six survey sites: Ireland's Eye and five survey sites on Howth (Table 1.1 and Figure 1.1).

Table 1.1. Howth and Ireland's Eye bryophyte survey sites

Site name	Abbreviation used for data files	Approx. area (ha)
Red Rock	RR	25
Bellingham's Farm	BF	14
Shielmartin	SH	24
Summit	SU	61
East Mountain	EM	74
Irelands Eye	IE	26

Figure 1.1 Survey site locations



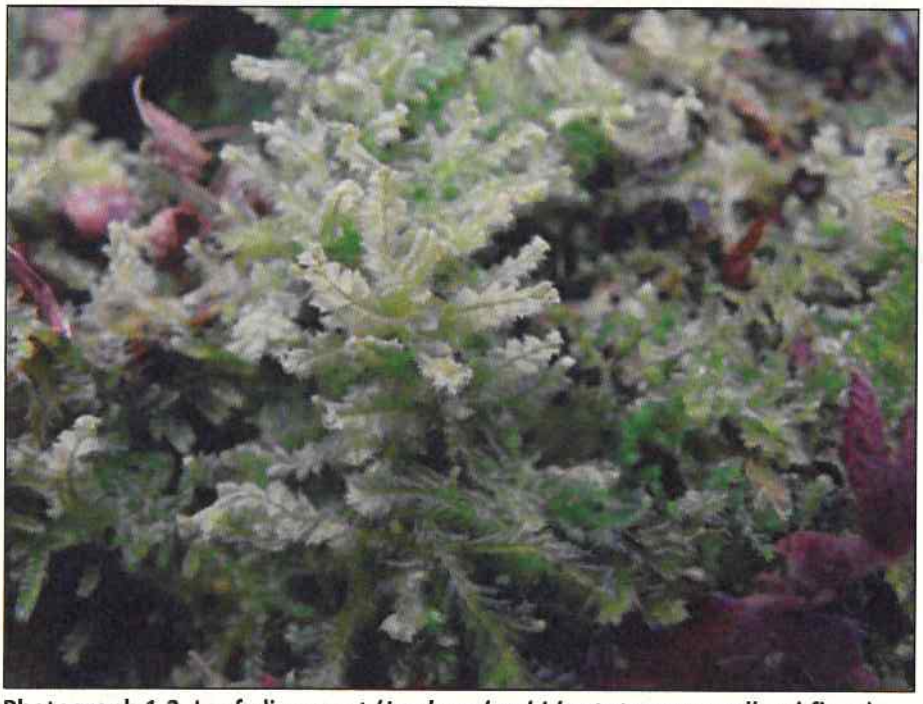
1.4 Bryophytes

The term 'Bryophytes' refers to three groups of land plants: mosses, liverworts and hornworts. Liverworts were the first land plants and all three groups originated before vascular plants. There are *c.* 838 bryophyte taxa (includes species, subspecies and varieties) in Ireland (Hodgetts & Lockhart, 2013). This represents roughly 5% of the World's bryoflora; 40% of Europe's bryoflora and 50% of Europe's liverwort flora. In addition, Ireland supports good populations of a number of species which are rare globally and/ or in Europe.

1.4.1 Liverworts

There are two types of liverwort: thalloid liverwort (e.g. Photograph 1.1), which comprise a thallus without stem or leaves and leafy liverworts (e.g. Photograph 1.2), which have a main stem with leaves. Liverworts tend to be more sensitive to moisture than mosses, and leafy liverworts are generally the most sensitive and humidity requiring of liverworts (although this varies between species). Many (but not all) thalloid liverworts can tolerate disturbed conditions such as man-made surfaces and gardens. Leafy liverworts reach maximum abundance and diversity in humid woodlands and upland areas in the west of Ireland; but are also frequent in woodland, heathland and upland habitats in the east.

Photograph 1.1. Thalloid liverwort (*Lunularia cruciata* on disturbed soil)



Photograph 1.2. Leafy liverwort (*Lophocolea bidentata* on woodland floor)

1.4.2 Hornworts

Hornworts are similar to thalloid liverworts in comprising a thallus without stem or leaves (e.g. Photograph 1.3). However, they produce sexual reproductive structures 'horns' which are not found in liverworts. There are only three species of hornwort in Ireland. They tend to be typical of disturbed damp ground such as arable fields and hedgebanks.

Photograph 1.3. Hornwort (*Phaeoceros laevis* on field bank)

1.4.3 Mosses

Mosses can colonise a wide range of habitats and can be found on dry, exposed habitats such as walls and upland rocks; submerged in bogs and wetland areas; in disturbed arable fields and dominating forest floors. There are three main types of moss: acrocarpous mosses (e.g. Photograph 1.4), pleurocarpous mosses (e.g. Photograph 1.5) and the bog-mosses *Sphagnum* (e.g. Photograph 1.6). Acrocarpous mosses have upright, little branched stems and range from small cushions on walls and rock to tall hummocks in wet woodland and bog. Pleurocarpous mosses tend to grow horizontally along the ground and are often highly branched, they grow in many habitats but can be very abundant in woodland, wet grassland and heathland. Bog-mosses (genus *Sphagnum*) have upright stems with branches and a 'capitula' or head at the top of the shoot. They have specialised cells which are highly absorbent, and which gives them their water holding capacity. They can act as 'ecosystem engineers' to create bog and wetland areas by raising local water levels.

Photograph 1.4. Acrocarpous moss (*Campylopus introflexus* in rock crevice on Shielmartin)

Photograph 1.5. Pleurocarpous moss (*Hypnum jutlandicum* on acid woodland floor)

Photograph 1.6. Bog-moss (*Sphagnum subnitens* with capsules in East Mountain quarry)

2 METHODOLOGY

2.1 Historical data collation

A detailed desk study was undertaken to collate all available bryophyte records and relevant information on the sites. This included the following data sources:

- National Parks and Wildlife Service (NPWS) records of rare and protected bryophytes.
- Additional survey data and information from NPWS.
- Rare and Threatened bryophytes of Ireland (Lockhart et al., 2012).
- British Bryological Society Atlas dataset.
- National Biodiversity Data Centre records for bryophytes and vascular plants.
- Survey data from ecological surveys undertaken by Denyer Ecology on Howth.
- Information on Petrifying springs on Howth (Melinda Lyons PhD and associated literature)
- Aerial photography and OSI mapping (including historic mapping to locate old place names).
- Additional literature and resources as relevant (see Section 3.0 and reference list).
- Consultation with relevant ecologists/ bryologists and organisations.

2.2 General site bryophyte surveys

Field survey work was undertaken between June and October September 2019 (inclusive).

- All accessible areas of each site were walked over by 1-2 experienced bryologists (Table 2.2). The survey focussed on heathland habitats, but bryophytes were recorded from all accessible suitable habitat within the survey area. The three smaller sites on Howth were surveyed by one bryologist and the two larger sites and Ireland's Eye were surveyed by two bryologists (Table 2.2). Two surveyors worked together on cliffs and steep slopes, but some steep areas of cliffs were not accessible for Health and Safety reasons.
- For each survey site, general site details were recorded. This included details such as site name, date surveyed, surveyor, main habitats present (Fossitt codes), altitude range, ownership, any access issues, signs of site management, threats and recommendations for management. Any areas that were not accessible (e.g. for H&S reasons or dense vegetation) were mapped/ described as 'not surveyed'.

- During the walk-over survey, further details were recorded of any notable species recorded. This includes a grid reference (ITM) of any rare and threatened bryophyte species; habitat notes and a photograph (of the bryophyte and habitat). However, it is not always possible to identify critical species in the field, and so detailed grid references and photographs are not necessarily available for all notable species.

2.3 Permanent quadrats

Once the initial walk over survey was completed, areas were selected to set up permanent quadrats (PQ):

- PQ habitat: The PQ were located to reflect the key habitat present at a particular location, rather than randomly selected, as this provides the most useful information for conservation assessment and future monitoring. The habitat was heathland for most PQs, but other habitats were included where relevant (e.g. where the habitat was of local importance to bryophytes, or where the heathland present had very low bryophyte value).
- Number of PQ per site: The aim was to undertake 4 PQ per site on Howth and 5 PQ on Ireland's Eye. However, only two PQ were undertaken on Bellingham's Farm as there was little suitable bryophyte habitat. An additional two PQ were therefore set up on East Mountain as this was the largest Howth survey site (Table 2.1). Only 4 PQ were set up on Ireland's Eye as there was little diversity in the bryophyte habitats present.
- Size of the PQ: A size of 1m x 1m was used for all habitats (heathland and rocky habitats).
- Attributes recorded: Site name, PQ number, GPS location (ITM), altitude, substrate type, slope, aspect, PQ size, vascular plant height, photographs (close-up of PQ and overall habitat), cover (percentage) of bare soil, rock, surface water, litter, vegetation and bryophyte layer. The cover (percentage) of all bryophyte and vascular plant species within the PQ was recorded.

Table 2.1. Summary of survey details for each bryophyte site

Site name	Approx. area (ha)	Number of surveyors	Number of Permanent Quadrats
Red Rock	23	1	4
Bellingham's Farm	14	1	2
Shielmartin	24	1	4
Summit	61	2	4
East Mountain	72	2	6
Irelands Eye	24	2	4

2.4 Microscope identification

It is not possible to identify all bryophytes in the field and some species require microscope confirmation. Where necessary, a small sample was collected for microscope examination. Samples were only taken where there was sufficient material so that colonies were not damaged. Samples were given a grid reference and habitat notes. Liverwort species that require oil body examination were collected in plastic bags and checked under the microscope within 24 hours, as oil bodies break down on drying. Other species were collected in paper bryophyte collecting envelopes and can be dried before checking. Where relevant, specimens were sent to the relevant British Bryological Referees (e.g. where a species is new to the county). Herbarium specimens will be sent to the National Botanic Gardens herbarium (DBN) at the end of the project.

2.5 Ecological evaluation

The ecological importance of the survey area was assessed using the criteria listed in the *Guidelines for Assessment of Ecological Impacts of National Roads Schemes* (NRA, 2009) and the *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2016). The assessment was based on the

presence and quality of the springs and associated species and does not taken into account fauna species.

Ecological evaluation scheme:

- International ecological importance
- National ecological importance
- County ecological importance
- Local (higher value) ecological importance
- Local (lower value) ecological importance

2.6 Plant species nomenclature

Vascular plant nomenclature will follow that of the *New Flora of the British Isles*. 4th Edition (Stace, 2019). The bryophyte nomenclature adopted by Blockeel et al. (2014a & b) is used; this is based on the *Checklist of British and Irish bryophytes* (Hill et al., 2008) with minor modifications to reflect recent taxonomic changes.

3 HISTORICAL DATA COLLATION

In addition to the resources listed in Section 2.1, a number of publications were reviewed for details of historical bryophyte records for Howth including Davies (1900); King, (1963); Lett (1915); McArdle (1893; 1896a; 1896b; 1904); Megaw (1929); More (1872); Moore (1872); and, The Moss Group (1951).

3.1 History of bryophyte recording on Howth and Irelands Eye

The first published bryophyte record for Howth is from 1816 (the liverwort *Barbilophozia attenuata*, made by T. Taylor). Various bryologists have contributed to the records on Howth (summarised in Table 3.1), with key contributions made in the 19th Century by D. Moore (mosses) and D. McArdle (liverworts). In the 20th century fewer records were made, with usually a small number of additions made by any one recorder. However, D.T. Holyoak recorded 72 species, many of which were new to Howth. There are very few published bryophyte records for Ireland's Eye, but McArdle recorded 3 liverwort species (mentioned in McArdle, 1893).

It should be noted that there was a lot of exchange of specimens between 19th century botanists, so although they may have had Irish bryophyte specimens, it does not necessarily mean that they collected them (Tom Blockeel, pers. comm.).

Table 3.1. Summary of bryologists and bryophyte recording on Howth

Recorder	Date range of Howth records	Recording notes[1]
Taylor, T.	1816-1836	Thomas Taylor (1786-1848) was a student and physician in Dublin from the early 1800s till 1820. He moved to Co. Kerry when he retired in 1830 and his published records are generally based in Co. Kerry. 2 records are attributed to him from Howth: 1 liverwort & 1 moss: *Barbilophozia attenuata* (first published record for Howth); *Scorpidium scorpioide*
Moore, D.	1850-1879	David Moore (1808-1879) was a very productive bryologist in the 19th century and was Director of the Botanic Gardens at Glasnevin during his career[1]. His herbarium is noted for the high accuracy of his identifications[1]. He added 67 mosses to the Irish flora. On Howth he made 21 records for 14 mosses. These include the Red List mosses: *Brachytheciastrum velutinum; Bryum bornholmense; Microbryum starckeanum; Pogonatum nanum; Scleropodium touretii; Tortula atrovirens; Tortula cuneifolia; Tortula wilsonii*

Recorder	Date range of Howth records	Recording notes[1]
Orr, D.	1850-1858	David Orr (1818-1890) was an assistant to Dr Moore at Glasnevin Gardens[1]. However, there is doubt over some of his records and many are not accepted unless corroborated by other bryologists[1]. Records for c20 species have accepted, including the Red List species *Rhizomnium pseudopunctatum*.
Lett, H.W.	1853	Henry William Lett (1838-1920)[1] was a clergyman and was one of the most active and influential bryologists in Ireland in the early 20th Century[1]. It is not clear if he made any actual personal records from Howth. *Schistidium maritimum* is listed as a record by Lett in the BBS Atlas database. However, this is actually listed as a record by D.Orr in Lett (1915).
Hutton, F.W.	1865	2 mosses: *Sphagnum cuspidatum; Plagiothecium nemorale*
Hunt, G.E.	1872	George Edward Hunt (1841-1873) was a botanist probably based in Northern England (Lancashire/Cheshire). It not known if he personally visited Ireland or was sent a specimen. 1 moss: Red List species *Tortula wilsonii*
Lindberg, S.O.	1873	S.O.Lindberg was based in Sweden and it is not known if he visited Ireland. It is more likely that he was sent a specimen from Howth. He is the author of many bryophyte names, with the standard abbreviation Lindb. 1 moss: *Ceratodon purpureus*.
McArdle, D.	1885-1897	Records for 47 liverworts and 1 moss. Includes Red List liverworts: *Barbilophozia barbata; Cephaloziella elachista; Cladopodiella francisci; Solenostoma sphaerocarpum*. Also records for 4 additional liverworts which require further investigation to determine if they are correct, as they would be unusual to find on Howth.
Hughes, Rev. J.B.A.	1901	*Eucladium verticillatum* (cited in Lett, 1915)
Buchanan, Miss M	1929-1930	2 liverwort records: *Fossombronia pusilla* s.l.; *Riccardia chamedryfolia*
King, A.L.K.	1942-1956	A.L. Kathleen King made many records from lowland localities from 1947-1977[1]. She was based in Dublin and there are 3 records from her for Howth: 1 liverwort and 2 mosses, including the first record for Howth of the non-native moss *Campylopus introflexus*.
Hudson, H.J. & Thompson, J.S.	1943	First record for Howth of the non-native moss *Orthodontium lineare*
Perry, A.R.	1975	A. Roy Perry was based in the UK but made bryological visits to Ireland. There is one record from him from Howth: record of the non-native moss *Orthodontium lineare*
Pitkin, P.H.	1975	Peter Pitkin is a bryologist who attended BBS meetings in the early 1980s. He was based in Scotland and it is not known if he visited Ireland. Record of 1 liverwort: *Pellia neesiana*
Kelly, D.L.	1981	Professor of Botany at Trinity College Dublin who has made many bryophyte records across Ireland. Record of 1 liverwort: *Barbilophozia attenuata*
Lockhart, N.	1981	Bryophyte expert working for NPWS. Project managed the bryophyte survey work for the Bryophyte Red List and many other important Irish and European bryophyte projects and is lead author on the Red Data Book and Red List (Lockhart et al., 2012a; 2012b). 1 record of the non-native moss *Orthodontium lineare*.
Robinson, D.W.	1988	First record of the Red List moss: *Didymodon umbrosus* (possible alien)

Recorder	Date range of Howth records	Recording notes[1]
Blockeel, T.L.	2001	BBS Moss Recorder for mosses and author of many bryophyte publications, based outside of Ireland. 4 liverwort records whilst visiting Howth: *Cephalozia lunulifolia; Frullania fragilifolia; Frullania teneriffae; Microlejeunea ulicina* (all NVCRs for Co. Dublin)
Holyoak, D.T.	2007	BBS Referee for Bryum, author of many bryological publications including co-author of the RDB. Based outside of Ireland but has undertaken much bryological survey work here. Records made whilst undertaking NPWS Red List survey work. 139 records of 72 species made, includes Red List species: *Bryum bornholmense*
Hodgetts, N.G.	2008	BBS Liverwort Recorder, lead author of the 'European Red List of mosses, liverworts and hornworts 'and co-author of the RDB. Based outside of Ireland but has undertaken much bryological survey work here. Records made, whilst undertaking survey of *Tortula viridifolia* for NPWS in 2008.
Lyons, M.D.	2009-2012	Surveys undertaken as part of PhD survey work at Trinity College Dublin on Petrifying Springs. c25 records of 15 species from base-rich seepages and petrifying springs (mainly in NE of Howth).

[1]Some notes on historical recorders have been taken from the Chapter 3 *'Bryophyte Recording in Ireland'* in Lockhart et al. (2012b). Tom Blockeel (BBS General Recorder for Mosses) also provided background information on some of the historical recorders. **Red List** = Irish Bryophyte Red List (Lockhart et al, 2012a); **RDB** = Red Data Book (Lockhart et al., 2012b); **NVCR** = New Vice County Record

3.2 Historical data and records from Howth and Ireland's Eye

Historical records were collated from a range of sources (refer to Section 2.1). These have been compiled into a single data table with one entry per species (see the Excel file which accompanies this report). This table includes the following for each species entry:

- Species name and group (moss/ liverwort).
- Species distribution, rarity (national and local) and protected status.
- Whether the species record is included in the BBS Atlas dataset.
- Surname(s) of historical recorders, in date order (oldest records first).
- Available details of the record location and species habitat - sometimes this data has been taken from several sources. For instance, the publications by McArdle (1893; 1896) and Moore (1872) frequently contain additional details on sites and habitats which are not listed in the BBS Atlas database. These have been added to the relevant species entry.
- Whether the species was recorded from Ireland's Eye (only 3 historic records specifically mention Ireland's Eye).
- Historic grid references. These have been kept in the original Irish Grid format as published.
- Date of first and last record, prior to the current 2019 field surveys.
- Whether the species was recorded during the current 2019 field surveys and which site(s) it was recorded.
- Whether the 2019 record represents a species new to Howth/ Ireland's Eye.
- Additional notes on the species/ recorder and record as relevant.

3.2.1 Ireland's Eye historic bryophyte records

There are very few published bryophyte records for Ireland's Eye. No records are listed in the BBS Atlas Database. However, McArdle recorded 3 liverwort species (mentioned in McArdle, 1893). No historic records for mosses have been traced, although it seems unlikely that there was no historic

recording. The three liverwort species recorded from Ireland's Eye are: *Cephaloziella divaricata. C. elachista* and *Frullania dilatata* (1892-1893). *C. elachista* has not been recorded from Howth or Ireland's Eye since 1892 and has not been recorded from elsewhere in Co. Dublin. It is listed as 'Data Deficient' on the Irish bryophyte Red List (Lockhart et al., 2012b) and was not assessed.

3.2.2 Howth historic bryophyte records – liverworts and hornworts

A total of 65 liverwort species have been recorded historically from Howth. Four of these records however are considered unconfirmed as they are not in the BBS Atlas dataset and it would be extremely unlikely for them to occur on Howth (*Anthelia juratzkana, Lejeunea flava* subsp. *moorei, Scapania aequiloba* and *Scapania aspera*). These require further investigation as they were not reviewed for the Red List (Neil Lockhart, pers. comm.). No hornwort species have been recorded from Howth or Ireland's Eye.

Of the 61 species recorded prior to 2019, 37 have not been re-recorded since the 18th Century; 3 have not been re-recorded since the 19th Century and five 20th century records were not re-found in the 2019 survey.

Three Red List liverwort species have been recorded historically (Table 3.2). Further details are available in the Excel data supplied with this report. The record of an additional two Red List liverwort species (*Anthelia juratzkana* and *Lejeunea flava* subsp. *moorei*) is unconfirmed, but details are included in Table 3.2. for reference. There are no historic records for any liverwort listed on the Flora (Protection) Order, 2015.

Table 3.2. Historic Howth records for Red List liverwort species

RDB species	Red List Category	Location and habitat	Year range recorded
Anthelia juratzkana	NT	Sparingly in the crevices of the rocks near the Baily lighthouse.	1893
Barbilophozia barbata	CR	Among rocks in Howth demesne .	1885
Cladopodiella francisci	VU	Ballykill (growing on 'black peat' on the side of a small channel on a small shallow bog, on lower Carboniferous limestone which belts the hill, round to the village of Sutton). Kilrock Quarry (no habitat information)	1892-1894
Lejeunea flava subsp. *moorei*	VU	On stones and on the trunks of trees in the demesne.	1895
Solenostoma sphaerocarpum	NT	Very scarce, in a boggy place near the quarries opposite Sutton.	1893

CR = Critically Endangered; **VU** = Vulnerable; **NT** = Near Threatened

3.2.3 Howth historic bryophyte records – mosses

A total of 105 moss species have been recorded historically from Howth. Seven of these records however are considered unconfirmed as they are not in the BBS Atlas dataset and have only been recorded by Orr, whose records are considered unreliable (data provided by NPWS included a review of a number of these species). Further information is provided in the supplied Excel file. The rejected species records are *Campylopus fragilis, Ceratodon conicus, Dicranella subulata, Grimmia ovalis, Phascum cuspidatum* var. *piliferum* and *Tortula protobryoides*). Many of these species are unknown from Ireland.

Of the 98 species recorded prior to 2019, 26 have not been re-recorded since the 18th Century; four have not been re-recorded since the 19th Century and 14 20th century records were not re-found in the 2019 survey.

Seven Red List moss species have been recorded historically (Table 3.3). Further details are available in the Excel data supplied with this report. The record for the Red List moss species Pseudocalliergon lycopodioides is considered likely to be an error but is currently included in the RDB (Lockhart et al.,

2012b) and BBS Atlas database. One of the Red listed species *Scleropodium touretii* is also listed on the Flora (Protection) Order, 2015.

Table 3.3. Historic Howth records for Red List moss species

RDB species	Red List Category	Location and habitat	Year range recorded
Brachytheciastrum velutinum	EN	Howth 'In fine condition creeping over large stones'	1850-1879
Didymodon umbrosus	VU	Howth 'On garden path which had been sprayed with Simozine over a long number of years'	1988
Microbryum starckeanum	RE	Howth 'Banks and fields'	1860
Pseudocalliergon lycopodioides	VU	No details	1905
Scleropodium touretii	EN	Howth 'Banks and rocks thinly covered with earth'	1872
Tortula cuneifolia	CR	North side of the Hill of Howth 'On banks and on the ground, generally near the sea'	1839-1861
Tortula wilsonii	RE	Howth 'Banks and tops of walls made of mud, especially near the sea'	1829-1877

RE = Regionally Extinct; **CR** = Critically Endangered; **EN** = Endangered; **VU** = Vulnerable

Two non-native bryophyte species have been recorded: *Campylopus introflexus* (first recorded from Howth,1942) and *Orthodontium lineare* (first recorded 1943). Both of these records are the first records for these species for Ireland (King, 1963; The Moss Group, 1951).

4 2019 FIELD SURVEY

4.1 2019 Field survey results – liverworts and hornworts

A summary of the main survey results is included below. Refer to the site reports, maps and Excel species lists and Permanent Quadrat data for full survey results. Species record summary:

- A total of 23 liverwort species were recorded from Howth and Ireland's Eye in 2019.
- Three liverwort species were recorded from Ireland's Eye, of which two are new species records (Table 4.1).
- Twenty-three liverwort species were recorded from Howth, of which four are new species records (Table 4.1).
- No hornwort species were recorded from Howth or Ireland's Eye.
- No Red List or FPO liverwort species were recorded.
- One County 'rare (Howth only)' species, which is only found on Howth in Co. Dublin, was recorded.
- Seven species which are County 'rare' (occur at <5 sites in Co. Dublin) were recorded.
- Six species which are 'occasional' (occur at <10 sites in Co. Dublin) were recorded.

A summary of 'notable' liverwort records is included in Table 4.1 below.

Table 4.1. Notable liverwort species records 2019

Species	'Notable' record criteria
Barbilophozia attenuata	Last recorded 1981
Calypogeia arguta	New to Howth in 2019
Calypogeia muelleriana	New to Howth in 2019
Frullania fragilifolia	New to Ireland's Eye in 2019; only confirmed record for Co. Dublin
Lepidozia reptans	No records since 1893

Species	'Notable' record criteria
Lunularia cruciata	No records since 1897
Marchantia polymorpha subsp. *ruderalis*	New to Howth
Metzgeria furcata	No records since 1893; New to Ireland's Eye in 2019;
Metzgeria violacea	New to Howth
Radula complanata	No records since 1893
Scapania undulata	No records since 1893

4.2 2019 field survey results – mosses

A summary of the main survey results is included below. Refer to the site reports, maps and Excel species lists and Permanent Quadrat data for full survey results. Species record summary:

- A total of 84 moss species were recorded from Howth and Ireland's Eye in 2019.
- Twenty-eight moss species were recorded from Ireland's Eye, of which all 28 are new species records (Table 4.1).
- Seventy-nine moss species were recorded from Howth, of which 34 are new species records (Table 4.1).
- Two Red List moss species were recorded (Table 4.1).
- Two species were 'de-brackets' for Co. Dublin (Table 4.1). A species is 'de-bracketed' when a post-1960 specimen is sent to the relevant BBS recorder to update the species. The herbarium specimens of these two species have been submitted to the herbarium at the National Botanic Gardens, Glasnevin, Dublin (DBN).
- Twenty-four species which are County 'rare' (occur at <5 sites in Co. Dublin) were recorded.
- Fourteen species which are 'occasional' (occur at <10 sites in Co. Dublin) were recorded.

A summary of 'notable' moss records is included in Table 4.2 below.

Table 4.2. Notable moss species records 2019

Species	'Notable' record criteria
Barbula unguiculata	New to Ireland's Eye
Brachythecium albicans	New to Ireland's Eye
Brachythecium rivulare	New to Ireland's Eye
Bryum argenteum	New to Ireland's Eye
Bryum bornholmense	New to Ireland's Eye; Red List (NT)
Bryum capillare	New to Ireland's Eye
Bryum dichotomum	New to Ireland's Eye
Bryum rubens	New to Howth
Bryum ruderale	New to Howth
Campyliadelphus chrysophyllus	New to Howth
Campyliadelphus elodes	New to Howth; Red List (NT); De-bracket for Co. Dublin (not recorded in Dublin since 1852)
Campylopus flexuosus	New/ confirmed for Howth (possible 1881 record but unconfirmed); De-bracket for Co. Dublin (previously no herbarium specimen/ confirmed record post 1960)
Campylopus introflexus	New to Ireland's Eye
Campylopus pyriformis	New/ confirmed for Howth (possible historic record 1857 but unconfirmed and not recorded since)
Ceratodon purpureus	New to Ireland's Eye
Cirriphyllum crassinervium	New to Ireland's Eye
Dicranella heteromalla	New to Ireland's Eye
Dicranoweisia cirrata	New/ confirmed for Howth (possible historic record 1857 but unconfirmed and not recorded since)
Didymodon fallax	New to Howth

Species	'Notable' record criteria
Didymodon insulanus	New to Ireland's Eye
Didymodon luridus	New to Howth
Eurhynchium striatum	New to Howth
Fissidens bryoides var. bryoides	New to Howth
Fissidens taxifolius	New to Howth
Funaria hygrometrica	New to Ireland's Eye
Grimmia pulvinata	New to Ireland's Eye
Grimmia trichophylla	New to Howth
Hypnum cupressiforme var. *cupressiforme*	New to Howth; new to Ireland's Eye
Hypnum cupressiforme var. *resupinatum*	New to Ireland's Eye
Kindbergia praelonga	New to Ireland's Eye
Mnium hornum	New to Ireland's Eye
Neckera complanata	New to Howth; new to Ireland's Eye
Orthotrichum anomalum	New to Howth
Orthotrichum cupulatum	New to Howth
Orthotrichum diaphanum	New to Ireland's Eye
Plagiothecium nemorale	New to Ireland's Eye; not recorded from Howth since 1865
Plagiothecium undulatum	New to Howth
Polytrichastrum formosum	New to Howth
Polytrichum commune	New to Howth
Polytrichum juniperinum	New to Ireland's Eye
Ptychomitrium polyphyllum	New to Howth
Rhizomnium punctatum	New to Howth
Rhytidiadelphus squarrosus	New to Howth
Schistidium crassipilum	New to Howth
Schistidium maritimum	New to Ireland's Eye
Scorpidium cossonii	New to Howth
Sphagnum subnitens	New to Howth
Syntrichia laevipila	New to Howth
Syntrichia papillosa	New to Ireland's Eye; abundant in an atypical habitat*
Syntrichia ruralis var. ruraliformis	New to Ireland's Eye
Syntrichia ruralis var. ruralis	New to Ireland's Eye
Thuidium tamariscinum	New to Howth
Tortula muralis	New to Ireland's Eye
Trichostomum brachydontium	New to Ireland's Eye
Ulota bruchii	New to Howth
Ulota phyllantha	New to Howth

**Syntrichia papillosa* was recorded from coastal rock on Ireland's Eye ('very abundant on one outcrop with c25% cover in a 1m x 1m plot'). This is an unusual habitat for this species, which is more typically found as an epiphyte on trees. This record was submitted to the BBS publication '*Field Bryology*' for the 'Rare and Interesting column and will be published in the next issue.

4.3 Site summary data

A site report (including maps) for each site is included in the Appendices, with an Excel data file of the species and Permanent Quadrat data:

- Appendix A – Bellingham's Farm site report
- Appendix B - East Mountain site report
- Appendix C - Shielmartin site report
- Appendix D – Summit site report
- Appendix E – Red Rock site report
- Appendix F – Ireland's Eye site report

A summary of the number of species recorded in the 2019 field survey and site ecological importance for bryophytes is included in Table 4.3. The highest number of species was recorded from East Mountain, which was also the largest site. There is little difference in the number of species per ha site/ survey area between the sites, but Bellingham's Farm and Summit were slightly below the overall average for Howth (1.1 species/ ha) and Shielmartin and Red Rock were slightly higher than this. The most liverwort species were recorded from East Mountain and Shielmartin. As Shielmartin is a much smaller site, it has the highest relative number of liverwort species recorded.
Further details on the main bryophyte habitats at each site, their condition and management and monitoring recommendations are included in each site report (Appendix A-F and accompanying Excel data).

Table 4.3. Summary of 2019 records from each site and ecological importance

Site name	Area (ha)	No. of mosses	No. of liverworts	Total no. bryophytes	Sp. per ha	Rare/ threatened/ protected species	Ecological importance*
Bellingham's Farm	14	12	1	13	0.9	*Bryum bornholmense* (NT)	Local (higher)
East Mountain	74	66	11	77	1.0	*Bryum bornholmense* (NT) *Campyliadelphus elodes* (NT) (de-bracket)	County
Shielmartin	24	24	10	34	1.4	*Bryum bornholmense* (NT)	County
Summit	61	41	6	47	0.8	*Campylopus flexuosus* (de-bracket)	Local (higher)
Red Rock	25	29	8	37	1.5	*Bryum bornholmense* (NT)	Local (higher)
Ireland's Eye	26	28	3	31	1.2	*Bryum bornholmense* (NT)	County

*Refers to bryophyte ecological importance only

5 DISCUSSION

5.1 A comparison of the results of the bryophyte on Howth with Irelands Eye

There is little historic data from Ireland's Eye to be able to assess any changes in the bryoflora over time. Therefore, any comparison with Howth refers to the current habitat condition and bryophyte flora only. The average number of species per ha of site/ survey area is 1.2 on Ireland's Eye and 1.1 for all sites on Howth; so, there is no large difference in general species richness. Ireland's Eye had a lower number of liverworts recorded, however. This is most likely due to the drying effects of wind exposure on the Island as there is little shelter amongst rocks and scrub cover is low.

On the Howth sites the main habitats of bryophyte interest are mature heathland, burnt heathland, exposed rock, wetland areas (e.g. East Mountain old quarry and seepage/ flush on Summit), mature scrub, N-facing boulders and disturbed soil at the edges of paths. Ireland's Eye does not support many of these habitats and much of the site is overgrown with tall grass. The areas which have the main bryophyte interest are exposed rocks and soil, particularly low on the hill and close to the coast, presumably as these are subject to less drying impacts than higher on the hill. The stabilised sand and rocks behind the beach were also of bryophyte value. There did not appear to be any major differences

in rock type/ rock habitat between Howth and Ireland's Eye, but the rocky areas were more exposed (and drier) on Ireland's Eye.

Both Howth and Ireland's Eye are likely to have changed considerably since bryophyte records began in the early 19th century. Ireland's Eye does not seem to be subject to the same extent of burning and disturbance as some areas of Howth (although some recent burning was evident). There has also been no development and obvious loss of wetland habitat on Ireland's Eye (wetland habitats were probably never present). However, both sites were probably grazed historically which would have created different habitat niches, particularly within heathland areas, created open bare soil for ephemeral and coastal bryophyte species, reduced the dominance of tall grasses, gorse scrub and bracken and reduced the fire risk potential of the vegetation.

5.2 Condition of sites and changes over time on Howth

Howth has a history of bryophyte recording from 1816. Although there are not many detailed species lists, the number and type of species recorded (and whether they have been re-recorded) give an idea of the habitats present and their condition over time.

5.2.1 Changes to liverwort flora

On Howth, 33 liverwort species have not been recorded for over 100 years. This is 51% of the total number of accepted liverwort records (including 2019). These are: *Anastrophyllum minutum, Barbilophozia barbata, Blasia pusilla, Calypogeia azurea, Cephalozia catenulata, Cephalozia connivens, Cephaloziella elachista, Chiloscyphus polyanthus, Cladopodiella fluitans, C. francisci, Conocephalum conicum, Frullania tamarisci, Gymnomitrion crenulatum, Kurzia pauciflora, K. trichoclados, Lejeunea cavifolia, Lepidozia cupressina, Lophocolea heterophylla, L. bicrenata, L. incisa, L. sudetica, Metzgeria conjugata, Nardia scalaris, Nowellia curvifolia, Odontoschisma denudatum, O. sphagni, Plagiochila asplenioides, Riccardia latifrons, Saccogyna viticulosa, Scapania gracilis, Scapania nemorea, Solenostoma gracillimum* and *Solenostoma sphaerocarpum*.

Potential reasons for not re-locating these species in 100 years:

- **Site not re-surveyed**: some of these species are from sites that may not have been re-surveyed recently (and were not within the 2019 survey area), such as Howth Demesne and Ballykill plantation where many historic records were made.
- **Loss of wetland sites**: It is also clear that many species were recorded from wetland sites which appear to have been lost to development 'e.g. boggy area near Sutton'. It is also unclear if the bog at Ballykill[1] is still present, as historic mapping shows the that the current reservoir may have been created in the area previously mapped as bog or marshy ground. This was the site for many historic wetland liverwort records. Historic mapping shows a large increase in development, particularly of coastal areas, since bryophyte recording began in 1816.
- **Drying out/ loss of wetland niches within sites**: many of the liverworts listed above are typical of wet peaty areas within bogs and other humid habitats. The location details of many species recorded in the 19th century, shows that they were recorded from sites which are still present, but which must have previously been much wetter. Habitat comments noted in publications such as McArdle (1893; 1896) include 'boggy place'; 'common in damp shady places'; 'On damp turfy banks between the rocks'; 'On a damp bank'; 'Rare on a moist bank'; 'by the side of a stream'; 'Damp bank by the side of a stream'; 'On moist banks, plentiful on most parts of the hill'; 'On turfy and damp boggy places, abundant on the Sutton side of the hill'; 'to be met with on most parts of the hill, often mixed with species of *Cephalozia* and other liverworts'; 'Damp banks in several stations on the hill'; 'Frequent in boggy places on *Sphagnum*'; 'Plentiful in moist places on the hill'; 'Plentiful on wet boggy places on most parts of the hill'; 'Amongst the damp rocks opposite Sutton'; 'On moist turfy banks, plentiful on most parts of the hill'; 'in

[1] 'Ballykill Bog/ plantation' is shown on old OSI mapping as being in the location of the current reservoir in Howth Demesne at ITM (E) 728140 (N) 738277 (IG TM65 O 28200 38253). It is unclear if any wetland/ bog remains in this area, for instance in the area of adjacent woodland.

a boggy place near the quarries opposite Sutton'. In 2019, wetland areas were scarce, *Sphagnum* was only recorded in one location in Kilrock Quarry (which remains a wetland area). The upland areas today support dry heath with few areas of damp peat but must have been wetter in the past. In 2019, most liverworts are restricted to extant wetland areas, shady boulders and as epiphytes (although a few species are tolerant of exposed, dry/damp peat). It is not clear whether burning or changes to climate are likely to be the main reason for drying, but frequent burning can turn wet heath/ bog into dry heath with the loss of *Sphagnum* and bog liverworts which were clearly once more frequent.

5.2.2 Changes to moss flora

On Howth, 27 moss species have not been recorded for over 100 years. This is 21% of the total number of accepted moss records (including 2019). These are: *Andreaea alpina, Brachytheciastrum velutinum, Bryum donianum, Calliergon cordifolium, Calliergon giganteum, Campylopus brevipilus, Dicranum fuscescens, Microbryum davallianum, M. starckeanum, Physcomitrium pyriforme, Pogonatum nanum, Pseudocalliergon lycopodioides, Rhizomnium pseudopunctatum, Rhynchostegium murale, Sanionia uncinata, Sarmentypnum exannulatum, Scleropodium touretii, Scorpidium revolvens* s.l., *Scorpidium scorpioides, Sphagnum compactum, S. cuspidatum, S. subsecundum, Straminergon stramineum, Tortula atrovirens, T. cuneifolia, T. wilsonii* and *Warnstorfia fluitans.*

There is a proportionately lower number of mosses not re-recorded (21%) compared to liverworts (51%). The reasons for species loss/ decline are likely to be largely similar to those listed for liverworts above. Many of the species listed are typical of wetland/ bog habitats. However, liverworts tend to be more sensitive to change, particularly drying out. Other species not re-recorded are typical of open, lightly disturbed coastal habitats which may have been lost by the impacts of grazing removal/ reduction (e.g. leading to an increase in tall, homogenous vegetation and loss of areas of lightly disturbed soil); increase in burning severity/ frequency; and increase in localised trampling of coastal rocks. It is unclear how burning frequency and severity has changed in the early 19th century. There is a recent history of burning as a survey work in 1962-1963 (Clark, 1968) noted that several heathland areas on Howth (particularly the Summit area) 'had been burnt within the last fifty years and many of the communities, especially those of the more recently (up to 10 years) burnt heaths, were short-lived stages in a burn succession'. Bryophyte cover was low in some plots (less than 1% cover) but some mature heathland on Summit had higher bryophyte cover (c65%). The heathland bryophyte community recorded was similar to 2019, but of slightly higher diversity, despite burning.

5.3 Recommendations

5.3.1 Management recommendations

Management recommendations for each site are detailed in the site reports (Appendices A-F). The key requirement for optimising the suitability of sites for bryophyte communities is to maintain a diversity of habitats at each site and prevent further degradation, particularly from burning.

Recommendations include:

- Reducing the frequency of burning/ avoiding further burning in some areas.
- Retaining/ expanding the amount of mature gorse scrub.
- Control the growth of dense bracken.
- Maintain/ create small areas of open bare soil.
- Reducing/ minimising disturbance to some over-trampled areas.
- Protecting N-facing boulders.
- Grazing of sites that are large enough to support grazing animals. If practicable then most sites would benefit from light grazing (except wetland areas). This has been listed in each site report where appropriate. The levels and timing of grazing will most likely be dictated by the requirements of other species groups (e.g. vascular plants and birds). Bryophytes do not have 'seasons' in the same way that other species groups do and the habitats present on Howth could be grazed lightly all year round or seasonally. Either/ both goats and horses would be

recommended das they will graze poorer quality forage such as heathland and scrub. The grazing levels should be sufficient to create and maintain structural diversity at each site (e.g. the creation of open areas whilst maintaining some taller vegetation). Monitoring will be required to assess the effectiveness of grazing and to make recommendations as to changes in the timing, duration and level of grazing at each site.

5.4 Monitoring recommendations

Monitoring recommendations for each site are detailed in the site reports (Appendices A-F). These include:

- Re-survey of Permanent Quadrats.
- Monitoring of the condition and extent of populations of locally/ nationally rare species.
- Monitoring of sites to identify any new bryophyte habitat that may have formed and any new threats and impacts to bryophyte species and communities.
- Assess the effectiveness of new grazing regime (where relevant) and provide feedback on any changes required.
- The data should be analysed in comparison to the baseline collected in this survey, and, when repeat monitoring, data from the previous monitoring period(s). Based on these analyses, a trend of the habitat quality and suitability for bryophytes should be determined, in order to determine whether habitat suitability for bryophytes is increasing or declining.

5.4.1 Further survey work

As a high proportion of species have not been re-found on Howth in the last 100 years, it is recommended that (subject to funding being available), further bryophyte survey work is undertaken on Howth. This could include:

- Survey of historical sites (such as Howth Demesne and Ballykill plantation and any others which can be identified) to a) re-survey for historic bryophytes and b) determine if suitable habitat is still present at the site.
- Survey and monitoring of any wetland sites, particularly springs/ seepage/ base-rich flushes which have been identified through previous bryophyte surveys, PhD work by Lyons and any other sources.
- Re-survey of areas of the 2019 sites which have historically supported more species, such as the rocks and coast by the Baily Lighthouse in case conditions are more suitable for rare bryophytes (2018 was a very dry summer and this may have affected the species present in 2019 survey).

REFERENCES

Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014a). *Atlas of British and Irish bryophytes*. Volume 1. British Bryological Society (Pisces Publications, Newbury).

Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014b). *Atlas of British and Irish bryophytes*. Volume 2. British Bryological Society (Pisces Publications, Newbury).

Clark, S.C. (1968). The Structure of Some *Ulex gallii* Heaths in Eastern Ireland. *Proceedings of the Royal Irish Academy,* 66B: 43-51.

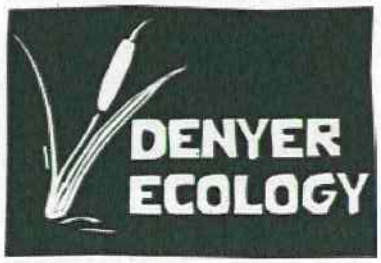
Davies, J.H. (1900). Some Mosses from North-East Ireland. *The Irish Naturalist* 9 (7): 171-176.

Denyer, J.L. & Hodd, R.L. (2019). *Howth and Ireland's Eye Bryophyte Survey*. Unpublished report for Fingal County Council.

Fossitt, J.A. (2000). *A guide to habitats in Ireland.* Heritage Council.

Hodgetts, N. & Lockhart, N. (2013). *Revision of the bryophyte schedule for the Flora (Protection) Order (FPO)*. Unpublished report for National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Hill, M.O., Blackstock, T. H., Long, D.G, Rothero G.P. (2008) *A checklist and census catalogue of British and Irish Bryophytes*. British Bryological Society.
King, A.L.K. (1963). *Campylopus introflexus* (Hedw.) Brid., with Capsules. *The Irish Naturalists' Journal*, 14 (6): 123.
Lett, H.W. (1915). Census Report on the Mosses of Ireland. Proceedings of the Royal Irish Academy, 32B: 65-166.
Lockhart, N., Hodgetts, N. & Holyoak, D. (2012a) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
Lockhart, N., Hodgetts, N. & Holyoak, D. (2012b) *Rare and threatened Bryophytes of Ireland*. National Museum of Northern Ireland, Holywood, Northern Ireland.
Megaw, W.R. (1929). Why Not Study Mosses? *The Irish Naturalists' Journal*, 2 (9): 185-187.
McArdle, D. (1904). A List of Irish Hepaticae. *Proceedings of the Royal Irish Academy*, 24B: 387-502.
McArdle, D. (1893). On the Hepaticae of the Hill of Howth. Proceedings of the Royal Irish Academy, 3: 108-120.
McArdle, D. (1896a). Additions to the Hepaticae of the Hill of Howth. Proceedings of the Royal Irish Academy, 4: 112-118.
McArdle, D. (1896b). Mosses and Hepatics. The Irish Naturalist, 5 (9): 235-238.
Moore, D. (1872) A synopsis of the mosses of Ireland. *Proceedings of the Royal Irish Academy*. Science, 1: 329-474.
More, A.G. (1872). On Recent Additions to the Flora of Ireland. *Proceedings of the Royal Irish Academy*. Science, 1: 256-293
Stace, C.A. (2019). *New Flora of the British Isles*. 4th Edition. C&M Floristics, Stowmarket, UK.
The Moss Group (1951). *Bryological Records*. The Irish Naturalists' Journal, 10 (7): 186-188.



APPENDIX A

SITE REPORT: Bellingham's Farm

Rory Hodd (Nimbosa Ecology) and Joanne Denyer

CONTENTS

1 INTRODUCTION

Six sites were surveyed and assessed as part of the 2019 Howth and Ireland's Eye Bryophyte Survey, commissioned by Fingal County Council. This Appendix contains the site report for Bellingham's Farm. Refer to the main report (Denyer & Hodd, 2019) for details of the methodology and Excel files for species lists and relevé data.

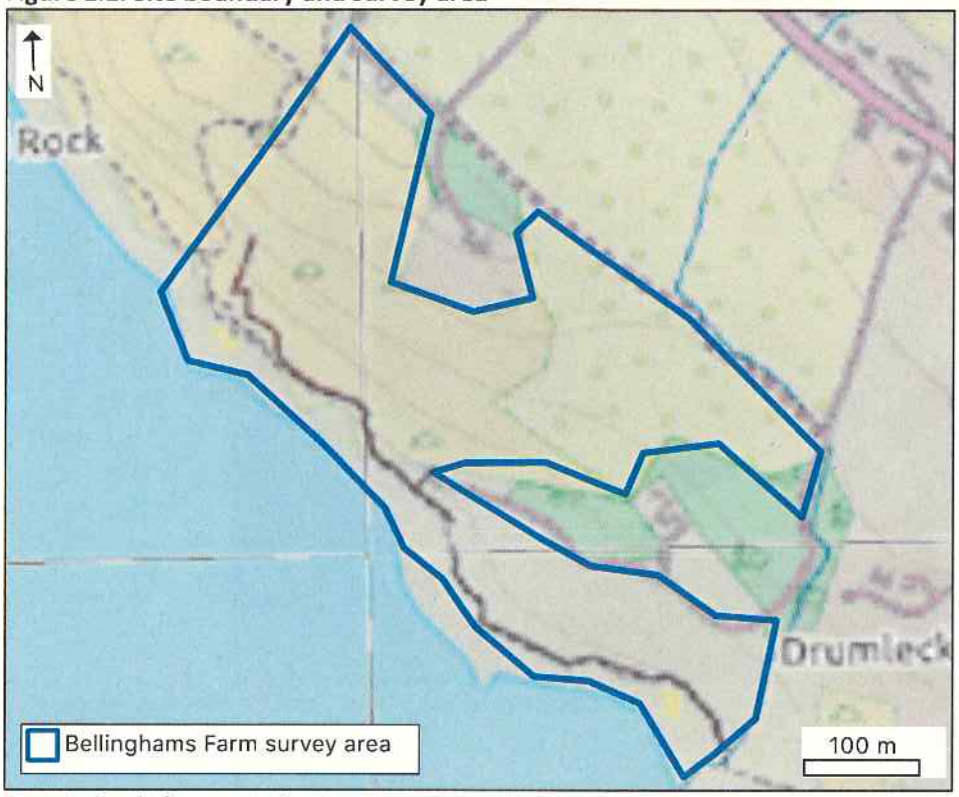
2 SITE AND SURVEY DETAILS

Date from the site summary card and other relevant information is shown in Table 2.1. The site boundary and survey area are shown on Figure 2.1.

Table 2.1. Site and survey details

Site name	Bellingham's Farm
Survey date(s)	22/07/2019
Recorder(s)	Rory Hodd
Altitude range (m)	0-60m
Fossitt habitats present on site	CM2 Upper saltmarsh CS1 Rocky sea cliffs ER1 Exposed siliceous rock GS3 Dry-humid acid grassland HD1 Dense bracken HH1 Dry siliceous heath WS1 Scrub
Annex I habitats present on site	1330 Atlantic salt meadows 4030 European dry heaths
Relevé numbers	BE1 BE2
Site description	This site covers a rocky south-facing hillside sloping down to the sea, mostly covered, or previously covered by dense scrub dominated by Gorse (*Ulex europaeus*). Small areas of heath are present, alongside rocky outcrops. A path runs along the seaward side of the site, below which there is rocky coastal habitat with rudimentary patches of saltmarsh. A small house is present towards the eastern end of the site. It is contiguous with Red Rock, from which it is divided by a broken down fence.
Site notes (e.g. geography, management, damaging operations)	Much of this area has been burnt, some very recently and is mostly now bare soil, or reverting to dense bracken. The habitat is in very poor condition, with few species present, due to the intensity of burning and poor, thin soils. This area is grazed by cattle, although there is little vegetation for them to graze.
Survey limitations	Much of the area was not surveyed in detail, due to the dense gorse and bracken. The area in the immediate vicinity of the house was also not surveyed, out of respect for the privacy of the occupants. It is very unlikely that many bryophyte species were missed, as all of the areas not visited were not good bryophyte habitat.

Figure 2.1. Site boundary and survey area



Maps © Thunderforest, Data © OpenStreetMap contributors

3 BRYOPHYTE SURVEY RESULTS

3.1 Key bryophyte habitats

This site contains very little variety of habitats, primary among them being recently burnt heath and gorse scrub, and siliceous rock outcrops in these areas (Photograph 3.1). There are also some coastal rocks and soil banks, which also support a limited number of species.

Photograph 3.1. View across Bellingham's Farm, consisting primarily of recently burnt gorse scrub and heath, being colonised by dense bracken.

3.2 Bryophyte species recorded

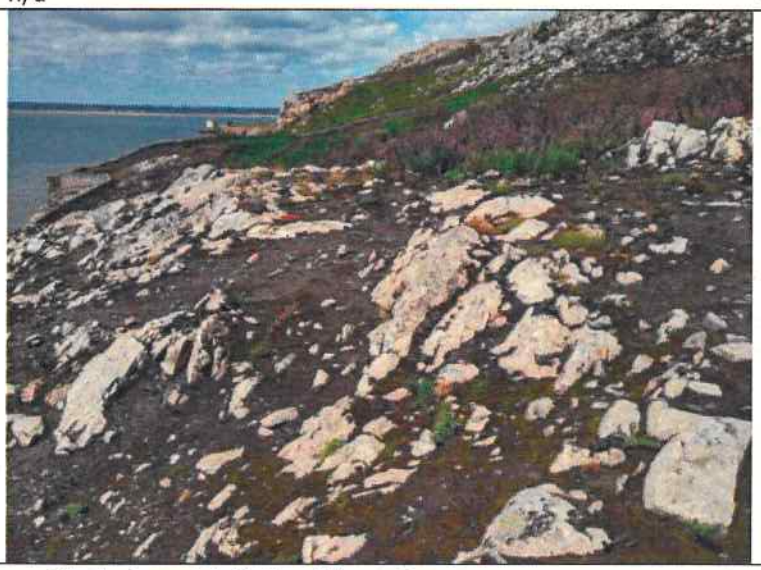
A total of 12 mosses and one liverwort was recorded from Bellingham's Farm, reflecting the poor quality of habitat present. The areas of heath were mainly dominated by a small number of species, colonising recently burnt bare ground, particularly *Funaria hygrometrica, Ceratodon purpureus* and *Bryum bornholmense*, as well as patches of the thalloid liverwort *Marchantia polymorpha* subsp. *ruderalis.* The coastal rocks and soil banks were found to support a number of coastal specialist species (Blockeel et al., 2014), including *Schistidium maritimum*, *Tortella flavovirens* and *Trichostomum brachydontium*.

3.3 Notable bryophyte species recorded

Summary details of any notable bryophyte species recorded is shown in Table 3.1. Locations are shown on Figure 3.1.

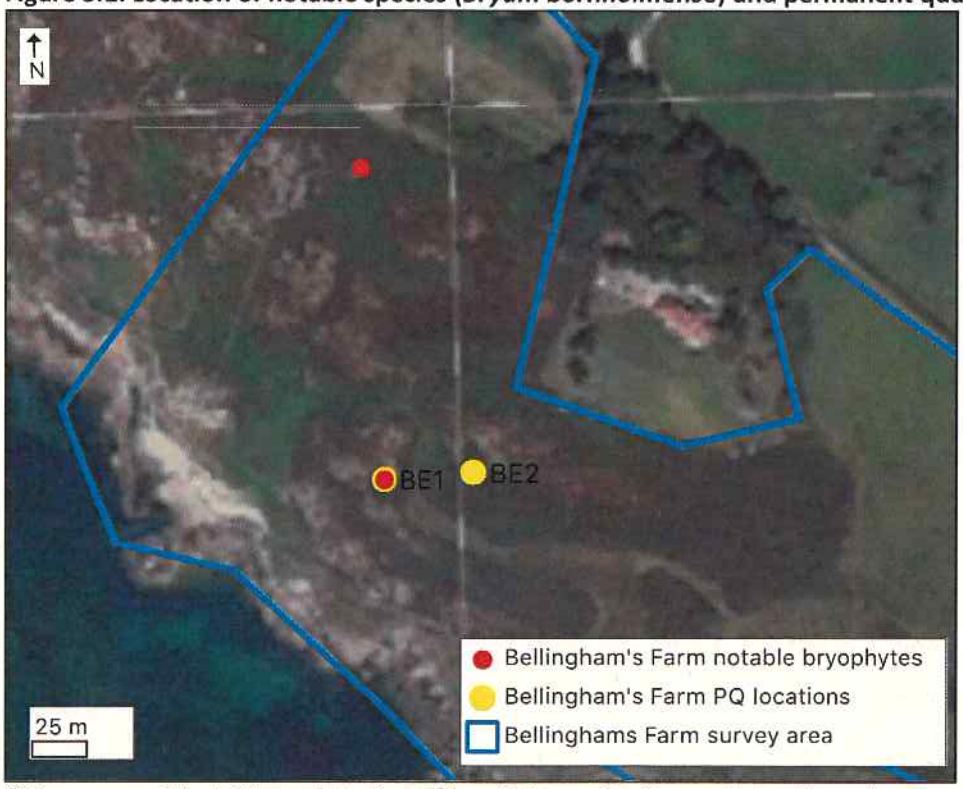
Table 3.1. Notable bryophyte species recorded

Species name	***Bryum bornholmense***
Red Data Book	Near Threatened
FPO	No
New Vice County Record	No
Locally rare (Co. Dublin)	Yes
Other importance/ indicator species	Nationally Scarce
Grid reference(s) (ITM)	(E) 727310 (N) 736873 (E) 727321 (N) 736735
Population notes	This species was frequent on recently burnt bare peat. Although it was not possible to confirm the identity of the specimens collected here, due to the lack of diagnostic tubers, it is almost certainly this species, which was previously recorded in this

Species name	*Bryum bornholmense*
	area, as well as elsewhere on Howth during this survey.
Photographs (species)	n/a
Photographs (habitat)	

NB Full list and grid references also provided separately in Excel format.

Figure 3.1. Location of notable species (*Bryum bornholmense*) and permanent quadrats

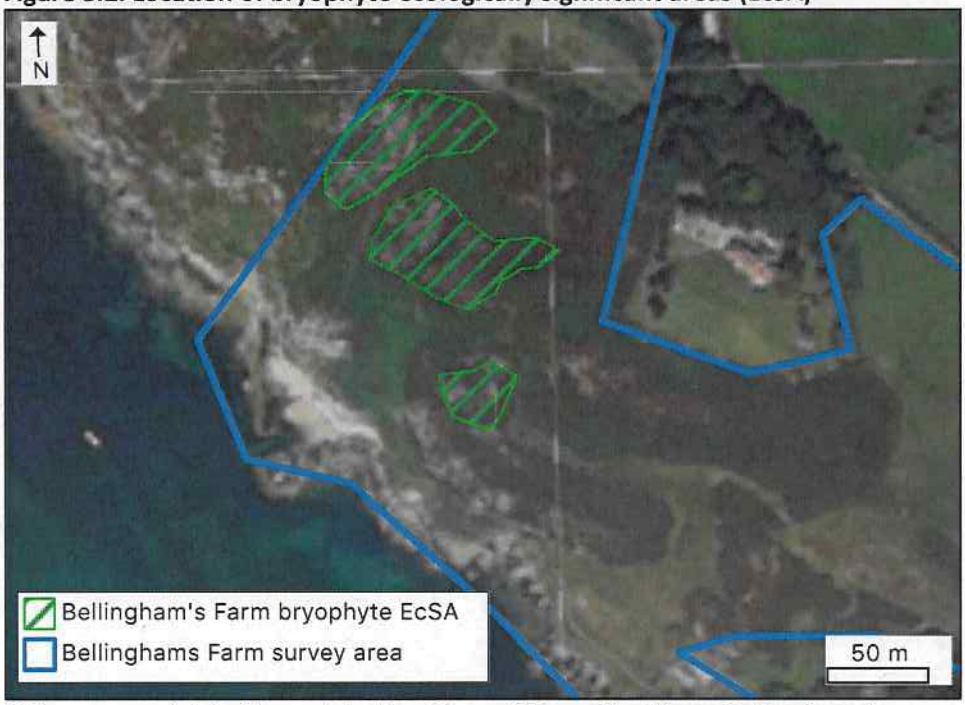


3.4 Bryophyte ecologically significant areas

Bryophyte ecologically significant areas are shown on Figure 3.2. Although low quality habitat, the area of burnt dry heath at the western end of the site is of some ecological significance, due to the

presence of widespread stands of *Bryum bornholmense*, which is Nationally Scarce (Hodgetts and Lockhart, 2013) and Near Threatened on the Irish Red Data List (Lockhart et al., 2012). However, it is likely that *B. bornholmense* will be lost as the burnt peat revegetates.

Figure 3.2. Location of bryophyte ecologically significant areas (EcSA)



3.5 Permanent quadrats

Two permanent quadrats only were undertaken at this site, as there was limited bryophyte habitat present. A summary of the Permanent Quadrat (PQ) data from this site is shown in Table 3.2 and the full data is included in Excel format. The PQ locations are shown on Figure 3.1.

Table 3.2. Permanent Quadrat summary

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
1	(E)72732 (N)736735	Dry heath	Recently burnt dry heath	65	3	*Bryum bornholmense*	
2	(E)727361 (N)736738	Scrub	Recently burnt gorse scrub	80	3		

4 SITE ECOLOGICAL IMPORTANCE FOR BRYOPHYTES

This site can be considered to be of Local (higher value) ecological importance for bryophytes. This is despite the presence of the Near Threatened moss *Bryum bornholmense*, the occurrence of which is due to recent burning, and is likely to be transitory. The other bryophytes present are all common species, although a number of species are restricted to locations in close proximity to the sea.

5 MONITORING

The following site monitoring is recommended:

- The permanent monitoring quadrats should be resurveyed in full every 3 years, using the same methodology as for the present survey.
- The condition and extent of the population of *Bryum bornholmense* should be assessed.
- The site should be walked over to identify any new bryophyte habitat that may have formed and any new threats and impacts to bryophyte species and communities should also be recorded and quantified
- The data should be analysed in comparison to the baseline collected in this survey, and, when repeat monitoring, data from the previous monitoring period(s). Based on these analyses, a trend of the habitat quality and suitability for bryophytes should be determined, in order to determine whether habitat suitability for bryophytes is increasing or declining.

6 MANAGEMENT

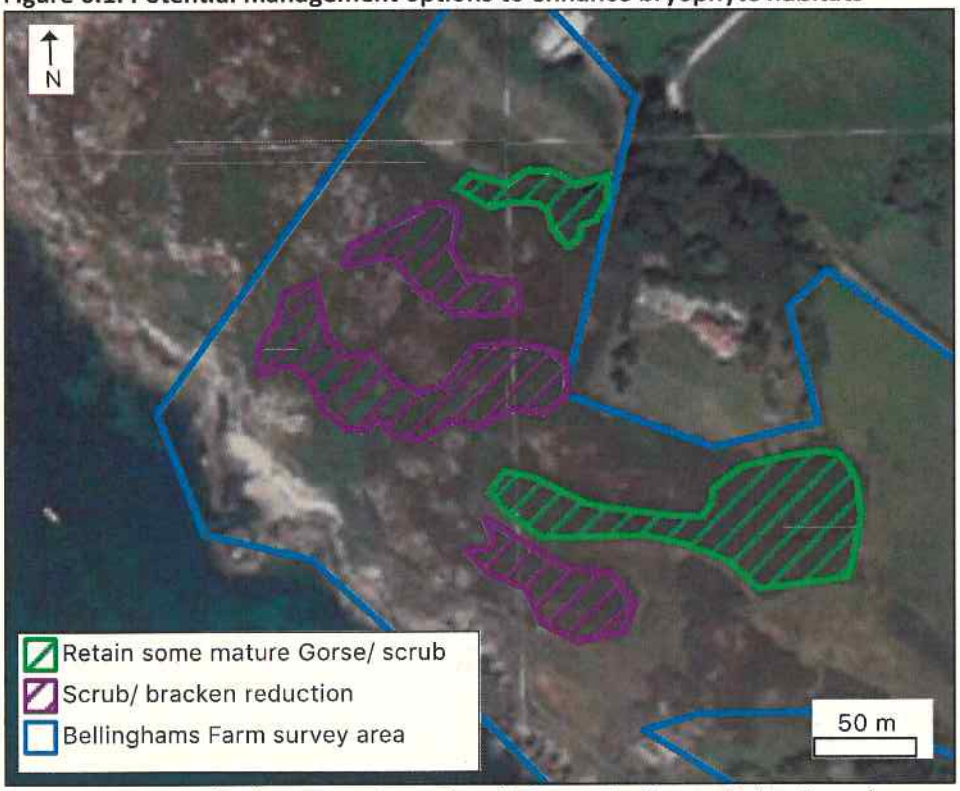
There are few management prescriptions that would be beneficial to both the heathland habitat and the bryophyte communities, particularly the only uncommon species found on the site, *Bryum bornholmense*. In order to retain suitable habitat for *B. bornholmense*, it would be necessary to maintain open, bare peat, to the exclusion of most vascular plants and a healthy vegetation structure. As it currently stands, it is likely that there is much soil erosion and runoff of peat occurring in the recently burnt areas. There are no management strategies that would be likely to significantly increase the bryophyte diversity of this site, but by allowing the heath to regenerate, controlling bracken, and maintaining a diversity of habitats, it is possible to retain and enhance habitat for the occurrence of a basic suite of heathland and coastal bryophytes. As this site is contiguous with Red Rock, these two sites should be managed in tandem with each other, as far as is possible.

General management recommendations to enhance the quality of bryophyte habitat at this site are as follows (and shown on Figure 6.1):

- Reduce frequency of burning. Ensure that repeat burning does not occur in areas that have recently been burnt for a period of 5-10 years, to allow dwarf shrubs to recolonise and the peat surface to stabilise.
- Retain some gorse scrub. Burning of some areas of dense gorse scrub may be desirable as part of the overall management of the site, but mature gorse scrub is a potential habitat for a range of epiphytic bryophyte species, in an area where there are few trees to support them.
- Control the growth of dense bracken, as it is currently colonising recently burnt former areas of heath and scrub and does not provide a suitable habitat for bryophyte growth.
- Maintain small areas of open bare soil, if practicable, to allow the persistence of ruderal bryophytes, in particular *Bryum bornholmense*.
- Minimise disturbance. Ensure that disturbance is minimised to coastal rocks and soil banks, where coastal specialist species grow, by walkers and by any future development of the coastal path.

The key requirement for optimising the suitability of this site for bryophyte communities is to maintain a diversity of habitats, and ensure that excessive burning does not further damage the integrity of the site, and lead to a monospecific sward of dense bracken, or an unstable and biodiversity-poor mix of open bare peat and depauperate dwarf shrubs.

Figure 6.1. Potential management options to enhance bryophyte habitats



REFERENCES

Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014). *Atlas of British and Irish bryophytes.* Volume 2. British Bryological Society (Pisces Publications, Newbury).

Denyer, J.L. & Hodd, R.L. (2019). *Howth and Ireland's Eye Bryophyte Survey*. Unpublished report for Fingal County Council.

Fossitt, J.A. (2000). *A guide to habitats in Ireland.* Heritage Council.

Hodgetts, N. and Lockhart, N. (2013) Rare and scarce bryophytes of Ireland. *Field Bryology* 110:12-26.

Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

APPENDIX B

SITE REPORT: East Mountain

Joanne Denyer

CONTENTS

1 INTRODUCTION

Six sites were surveyed and assessed as part of the 2019 Howth and Ireland's Eye Bryophyte Survey, commissioned by Fingal County Council. This Appendix contains the site report for East Mountain. Refer to the main report (Denyer & Hodd, 2019) for details of the methodology and Excel files for species lists and relevé data.

2 SITE AND SURVEY DETAILS

Date from the site summary card and other relevant information is shown in Table 2.1. The site boundary and survey area are shown on Figure 2.1.

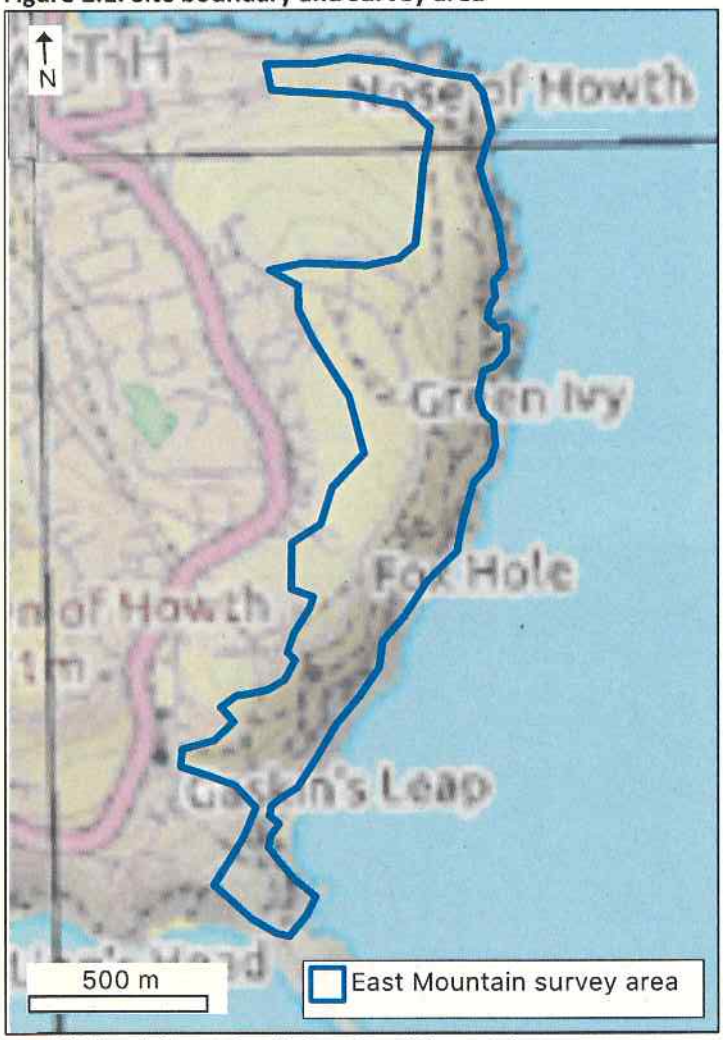
Table 2.1. Site and survey details

Site name	East Mountain
Survey date(s)	18/07/2019; 19/07/2019; 29/09/2019
Recorder(s)	Joanne Denyer and Rory Hodd
Altitude range (m)	40-140m
Fossitt habitats present on site	BL1 Stone walls and other stonework BL3 Buildings and artificial surfaces CS1 Rocky sea cliffs ED3 Recolonising bare ground ER1 Exposed siliceous rock GS3 Dry-humid acid grassland HD1 Dense bracken HH1 Dry siliceous heath PF1 Rich fen and flush WS1 Scrub
Annex I habitats present on site	4030 European dry heaths 7220* Petrifying springs with tufa formation (*Cratoneurion*)
Relevé numbers	EM1 EM2 EM3 EM4 EM5 EM6
Site description	This site comprises a long strip of coastal ground running north to south along the east of the Howth peninsula. The areas closest to the sea cliffs tend to have coastal rock/ grassland with exposed soil. On sloping and higher ground above the cliffs there are large areas of dry heathland. Gorse scrub and dense bracken are frequent throughout the site. There was also a small copse with Sycamore (*Acer pseudoplatanus*) trees and ornamental shrubs. A coastal path runs along the length of the site and there are a number of additional paths within the site (both gravelled and unsurfaced). On the northern end there is a disused quarry with water seepage through the rock.
Site notes (e.g. geography, management, damaging operations)	There are some areas of relatively mature heathland. However, many areas are overgrown with gorse or dense bracken. The coastal rocks and slopes are heavily eroded by walkers in areas adjacent to paths.

Site name	East Mountain
Survey limitations	Most of the survey area was surveyed. Areas of dense gorse scrub were partially accessed. The sea cliffs and slopes above the cliffs could not always be surveyed for health and safety reasons. However, many of these areas had dense bracken/ other vegetation cover and these are unlikely to be of high value for bryophytes.

*Annex I priority habitat

Figure 2.1. Site boundary and survey area



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3 BRYOPHYTE SURVEY RESULTS

3.1 Key bryophyte habitats

The areas of dense bracken and disturbed/ eroded coastal rock have little bryophyte cover (Photograph 3.1). The main habitats for bryophytes are the heathland areas, both burnt (Photograph 3.2) and unburnt (Photograph 3.3); less disturbed rocky coastal areas (Photograph 3.4), patches of mature Gorse scrub (Photograph 3.5) and trees. Areas of soil and rock with light disturbance, such as by smaller paths (Photograph 3.6), also provided additional niches for bryophytes which are typical of

open habitats. The disused quarry to the north provided wetland habitat not found elsewhere on the site, including tufa forming springs (Photograph 3.7).

Photograph 3.1. Heavily disturbed areas by the coastal path have little/ no bryophyte cover

Photograph 3.2. Recently burnt heathland providing habitat for species of open, disturbed soil such as *Bryum bornholmense* and *Campylopus introflexus*.

Photograph 3.3. Mature dry heathland with small path

Photograph 3.4. Rocky coastal areas provide habitat for a range of bryophytes of open coastal habitats

Photograph 3.5. Mature Gorse scrub provides habitat for epiphytic bryophytes not found elsewhere on the site

Photograph 3.6. Lightly disturbed rocky areas at the edges of paths provide additional habitat for bryophytes of open areas

Photograph 3.7. Quarry with spring/ seepage and tufa formation on exposed rock

3.2 Bryophyte species recorded

A total of 66 mosses and 11 liverworts were recorded from East Mountain, which is relatively diverse given the narrow range of habitats present. Areas of mature heathland had localised high bryophyte cover (e.g. *Hypnum jutlandicum*), but species diversity was low. Recently burnt heathland supported a limited number of species of open, disturbed ground such as *Bryum bornholmense* and *Campylopus introflexus.* On rocky slopes and exposed soil and at the edges of paths *Ceratodon purpureus* was dominant. Mature gorse scrub and trees supported epiphytes such as the liverworts *Frullania dilatata, Metzgeria furcata, Metzgeria violacea* and *Radula complanata* and mosses *Amblystegium serpens, Cryphaea heteromalla, Neckera complanata, Orthotrichum affine, Orthotrichum anomalum, Orthotrichum diaphanum, Ulota bruchii* and *Ulota phyllantha.* Rocky outcrops close to the sea provided a habitat for the liverworts *Frullania fragilifolia* and *Frullania teneriffae*, both of which are mainly oceanic in distribution, and less frequent on the east coast than the west coast (Blockeel et al., 2014). The coastal rocks and soil supported the coastal species *Trichostomum brachydontium* (Blockeel et al., 2014). The quarry supported a number of species that are typical of springs/ seepages with base-rich influence and were not found elsewhere on the site, such as *Aneura pinguis, Bryum pseudotriquetrum, Campyliadelphus elodes, Didymodon tophaceus, Eucladium verticillatum, Pellia endiviifolia, Riccardia chamedryfolia, Scorpidium cossonii* and *Sphagnum subnitens*. This was the only site where a Bog-moss (*Sphagnum*) species was recorded.

3.3 Notable bryophyte species recorded

Summary details of any notable bryophyte species recorded is shown in Table 3.1. Locations are shown on Figure 3.1.

Table 3.1. Notable bryophyte species recorded

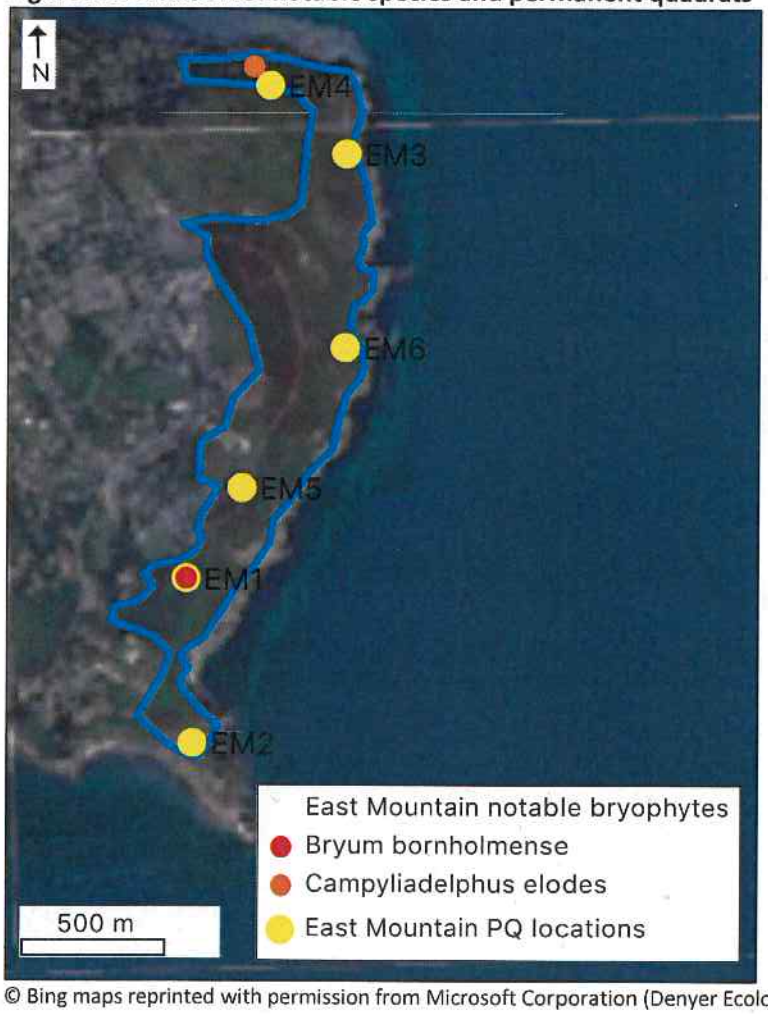
Species name	*Bryum bornholmense*
Red Data Book	Near Threatened
FPO	No
New Vice County Record	No

Locally rare (Co. Dublin)	Yes (<5 records and only one other site)
Other importance/ indicator species	Nationally Scarce
Grid reference(s) (ITM)	(N) 729434 (E) 737229
Population notes	Locally frequent in recently burnt heathland
Photographs (species)	
Photographs (habitat)	
Species name	*Campyliadelphus elodes*
Red Data Book	Near Threatened
FPO	No
New Vice County Record	Yes (de-bracket*) – specimen lodged in DBN**
Locally rare (Co. Dublin)	Rare (only 3 records for Co. Dublin and none post 1852)
Other importance/ indicator species	Indicator of high quality wetland habitat
Grid reference(s) (ITM)	(N) 729622 (E) 738925
Population notes	Occasional in seepage areas in the disused quarry
Photographs (species)	n/a

Photographs (habitat)	

NB Full list and grid references also provided separately in Excel format.
*Bracketed species are those for which there are no previous records post-1960. A species is 'de-bracketed' when a post-1960 specimen is sent to the relevant BBS recorder to update the species.
**Dublin Botanic Gardens (National Botanic Gardens, Glasnevin)

Figure 3.1. Location of notable species and permanent quadrats



3.4 Bryophyte ecologically significant areas

Bryophyte ecologically significant areas are shown on Figures 3.2a and 3.2b. The highest value habitat for bryophytes on the site is the disused quarry with seepage areas and tufa formation (Figure 3.2a). This had the highest diversity of bryophytes per area and contained species not present in the rest of the site such as *Campyliadelphus elodes,* which is Nationally Scarce (Hodgetts and Lockhart, 2013) and Near Threatened on the Irish Red Data List (Lockhart et al., 2012). The area of burnt dry heath at the southern end of the site (Figure 3.2b) is of some ecological significance, due to the presence of frequent *Bryum bornholmense*, which is Nationally Scarce (Hodgetts and Lockhart, 2013) and Near Threatened on the Irish Red Data List (Lockhart et al., 2012). However, it is likely that *B. bornholmense* will be lost as the burnt peat revegetates. Some of the mature heathland supported some typical heathland species, but the coastal rocks and soil generally had low cover of bryophytes or were dominated by *Ceratodon purpureus*, which was the most common species recorded from the site.

Figure 3.2a. Location of ecologically significant areas (East Mountain North)

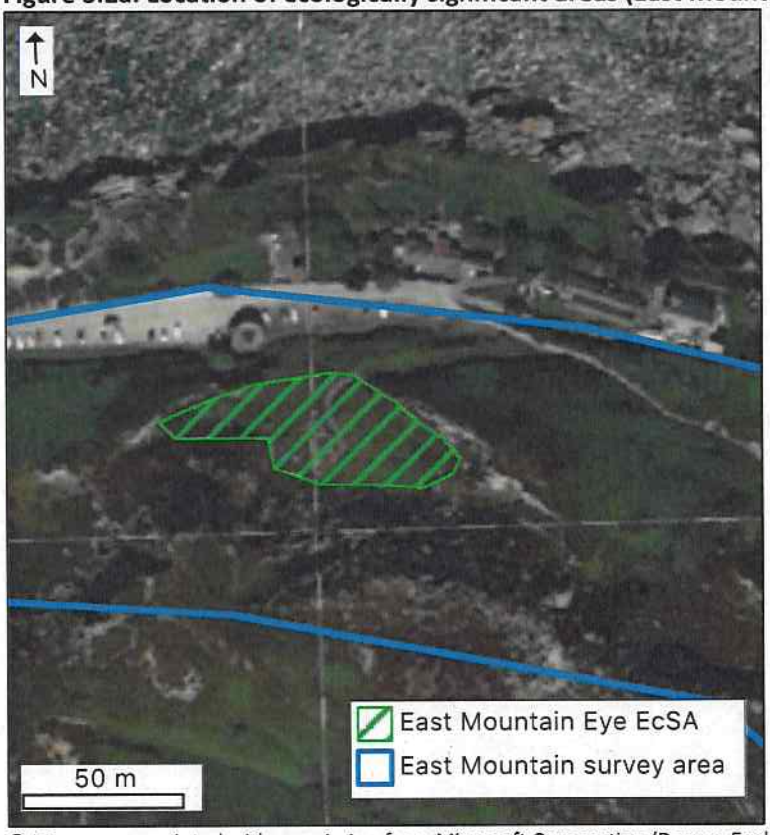


Figure 3.2b. Location of ecologically significant areas (East Mountain South)

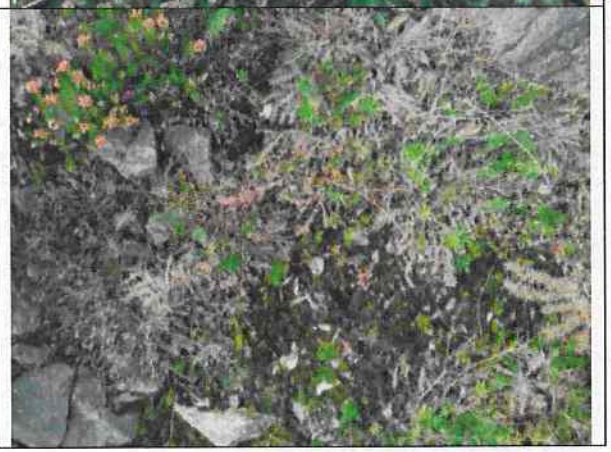
3.5 Permanent quadrats

Six permanent quadrats only were undertaken at this site. A summary of the Permanent Quadrat (PQ) data from this site is shown in Table 3.2 and the full data is included in Excel format. The PQ locations are shown on Figure 3.1.

Table 3.2. Permanent Quadrat summary

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
EM1	(E) 729434 (N) 737229	HH1	Recently burnt dry heath	5%	1	*Bryum bornholmense*	
EM2	(E) 729459 (N) 736657	ER1	Exposed coastal rock and soil	28%	4	n/a	

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
EM3	(E) 729983 (N) 738705	HH1	Mature dry heathland	25%	2	n/a	
EM4	(E) 729716 (N) 738942	HH1	Burnt coastal heath	43%	5	n/a	

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
EM5	(E) 729624 (N) 737544	HH1	Revegetating burnt heath	20%	3	n/a	
EM6	(E) 729982 (N) 738031	HH1	Revegetating burnt heath on steep slope	45%	4	n/a	

4 SITE ECOLOGICAL IMPORTANCE FOR BRYOPHYTES

This site is considered to be of County ecological importance for bryophytes. The heathland and rock habitats have been damaged by frequent burning and disturbance and have low bryophyte diversity. However, two Red Data Book species were recorded (from burnt heathland and the quarry) which are rare in Co. Dublin. The quarry also supports good examples of the bryophyte dominated Annex I priority habitat 'Petrifying springs with tufa formation'. Overall a typical range of heathland and ruderal species are present, and the species diversity is higher than might be expected given the limited habitat diversity.

5 MONITORING

The following site monitoring is recommended:

- The permanent monitoring quadrats should be resurveyed in full every 3 years, using the same methodology as for the present survey.
- The site should be walked over to identify any new bryophyte habitat that may have formed and any new threats and impacts to bryophyte species and communities should also be recorded and quantified.
- The condition and extent of the population of *Bryum bornholmense* should be assessed.
- The condition and extent of the population of *Campyliadelphus elodes* in the quarry should be assessed.
- The condition of the wetland habitats and petrifying springs in the disused quarry should be assessed using the relevant national monitoring guidelines (e.g. Lyons & Kelly, 2016).
- The data should be analysed in comparison to the baseline collected in this survey, and, when repeat monitoring, data from the previous monitoring period(s). Based on these analyses, a trend of the habitat quality and suitability for bryophytes should be determined, in order to determine whether habitat suitability for bryophytes is increasing or declining.

6 MANAGEMENT

There are no management strategies that would be likely to significantly increase the bryophyte diversity of this site, but by allowing the heath to regenerate, controlling disturbance and bracken, and maintaining a diversity of habitats, it is possible to retain and enhance habitat for the occurrence of a basic suite of heathland and coastal bryophytes.

General management recommendations to enhance the quality of bryophyte habitat at this site are as follows (and shown on Figures 6.1a and 6.1b):

- Reduce frequency of burning. Ensure that repeat burning does not occur in areas that have recently been burnt for a period of 5-10 years, to allow dwarf shrubs to recolonise and the peat surface to stabilise.
- Retain some mature gorse scrub. Removal of some areas of dense gorse scrub may be desirable as part of the overall management of the site, but mature gorse scrub is a potential habitat for a range of epiphytic bryophyte species, in an area where there are few trees to support them.
- Control the growth of dense bracken, as it is currently colonising recently burnt former areas of heath and scrub and does not provide a suitable habitat for bryophyte growth.
- Maintain/ create open areas. The network of smaller paths with moderate disturbance creates additional bryophyte habitat for open soil/ rock species in areas of otherwise dense bracken/ scrub. This should be prioritised in areas of dense bracken/ gorse scrub (Figure 6.1b), but can also be undertaken in areas of heathland away from the cliff slopes.
- Minimise disturbance. Ensure that disturbance to rocky slopes by walkers is minimised and by any future development of paths on the site.

- Grazing. This site would benefit by light to medium grazing by goats and/ or horses as they will reduce the dense heather and gorse and provide additional open habitat. This is particularly important in the areas adjacent to the coast/ cliffs where Bracken has become dominant. Grazing can be year-round for bryophytes, as they do not have 'seasonal growth' in the same way that vascular plants do. However, it may be that seasonal grazing will be recommended to support other species groups (heathland vascular plants/ birds) and this would also suitable for bryophytes.

Figure 6.1a. Potential management options to enhance bryophyte habitats (East Mountain North)

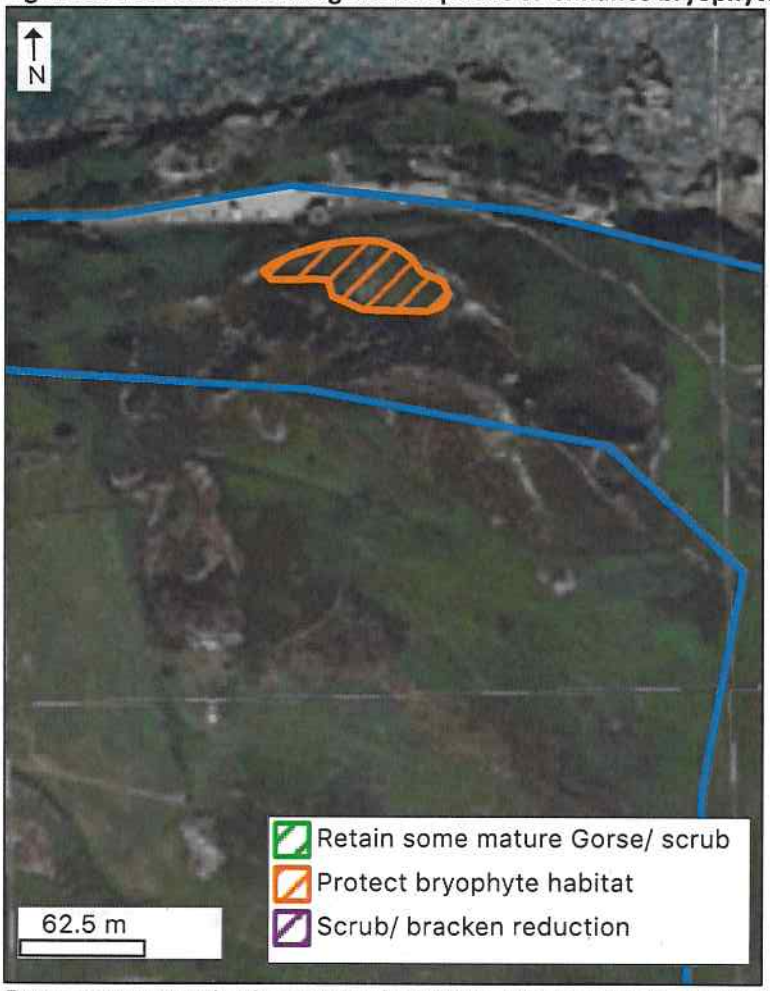


Figure 6.1b. Potential management options to enhance bryophyte habitats (East Mountain South)

REFERENCES

Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014). *Atlas of British and Irish bryophytes*. Volume 2. British Bryological Society (Pisces Publications, Newbury).

Denyer, J.L. & Hodd, R.L. (2019). *Howth and Ireland's Eye Bryophyte Survey*. Unpublished report for Fingal County Council.

Fossitt, J.A. (2000). *A guide to habitats in Ireland.* Heritage Council.

Hodgetts, N. and Lockhart, N. (2013) Rare and scarce bryophytes of Ireland. *Field Bryology* 110:12-26.

Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Lyons, M.D. & Kelly, D.L. (2016). Monitoring guidelines for the assessment of petrifying springs in Ireland. *Irish Wildlife Manuals,* No. 94. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Ireland.

APPENDIX C

SITE REPORT: Red Rock

Rory Hodd (Nimbosa Ecology) and Joanne Denyer

CONTENTS

1 INTRODUCTION

Six sites were surveyed and assessed as part of the 2019 Howth and Ireland's Eye Bryophyte Survey, commissioned by Fingal County Council. This Appendix contains the site report for Red Rock. Refer to the main report (Denyer & Hodd, 2019) for details of the methodology and Excel files for species lists and relevé data.

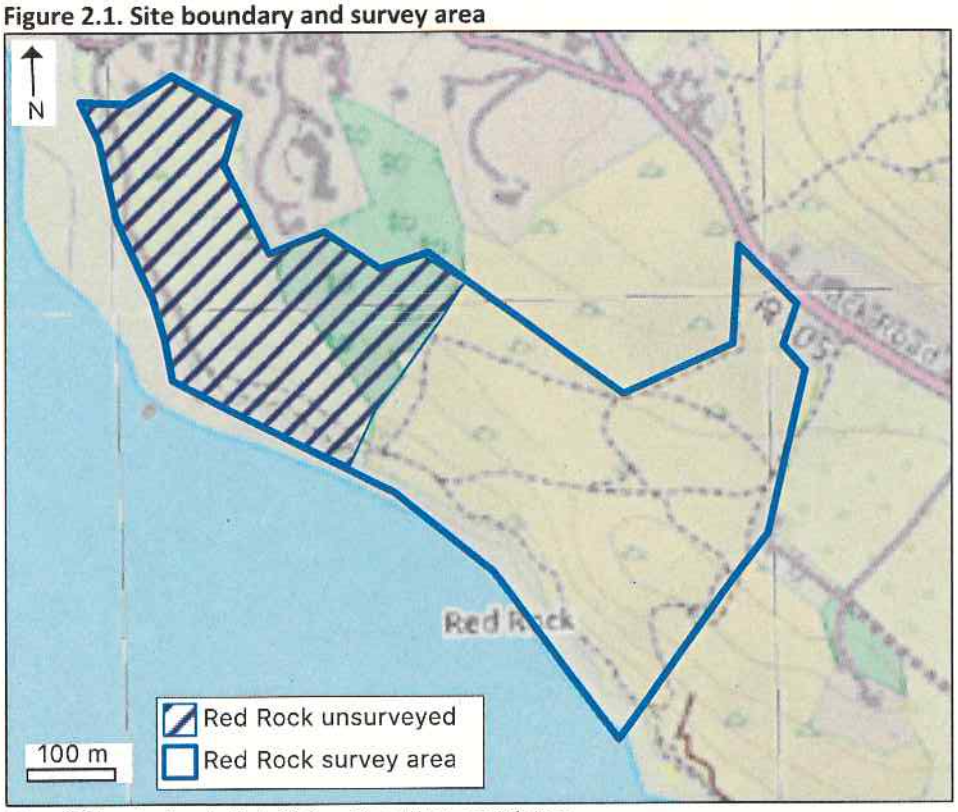
2 SITE AND SURVEY DETAILS

Date from the site summary card and other relevant information is shown in Table 2.1. The site boundary and survey area are shown on Figure 2.1.

Table 2.1. Site and survey details

Site name	Red Rock
Survey date(s)	22/07/2019
Recorder(s)	Rory Hodd
Altitude range (m)	0-60
Fossitt habitats present on site	CM2 Upper saltmarsh CS1 Rocky sea cliffs ER1 Exposed siliceous rock GS3 Dry-humid acid grassland HD1 Dense bracken HH1 Dry siliceous heath WS1 Scrub
Annex I habitats present on site	1330 Atlantic salt meadows 4030 European dry heaths
Relevé numbers	RR1 RR2 RR3 RR4
Site description	This site consists of a rocky hillock, sloping down to the sea, and backed by undulating ground. It is mostly covered by heath, with some patches of dense bracken, scrub (including areas dominated by Elder (*Sambucus nigra*)) and acid grassland. There is a small fringe of coastal habitat along the coastal margin, with maritime rocky habitats and some rudimentary saltmarsh. It is contiguous with Bellingham's Farm, from which it is divided by a broken down fence.
Site notes (e.g. geography, management, damaging operations)	The majority of the heathland has been burnt recently, with little dwarf shrub cover remaining, except in small patches. There is a small area of intact dense heath on top of the hill, which is species-poor, and has probably been previously burnt. There are numerous paths through the site, which leads to very localised trampling, and no grazing animals.
Survey limitations	The western part of the site was not surveyed as this area comprised dense woodland and amenity grassland (not heathland). All other areas within the survey area were visited, although dense bracken areas were not surveyed in detail.

Figure 2.1. Site boundary and survey area



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3 BRYOPHYTE SURVEY RESULTS

3.1 Key bryophyte habitats

The main bryophyte habitat present in this area is the heathland, both burnt and unburnt (Photograph 3.1). Rocky areas (e.g. Photograph 3.2) also provide habitat for a number of bryophyte species, with a slightly richer assemblage closer to the sea. Patches of scrub and scattered small trees provide a habitat for a suite of bryophytes that are unable to grow elsewhere in the area, with an area of Elder scrub providing very good habitat for epiphytic bryophytes, as well as lichens (Photograph 3.3).

Photograph 3.1. Small area of dry heath on the summit that has not been recently burnt.

Photo 3.2. Recently burnt dry heath with interspersed rocky outcrops.

Photograph 3.3: Branches in Elder (*Sambucus nigra*) scrub, that support a dense covering of epiphytic bryophyte and lichen species.

3.2 Bryophyte species recorded

A total of 29 moss species and eight liverwort species were recorded at this site. Across the areas of heath impacted by burning, *Ceratodon purpureus, Campylopus introflexus* and *Polytrichum juniperinum* are frequent, with *Dicranum scoparium* dominant in places. Where the heath has been recently burnt, *Funaria hygrometrica* is abundant, alongside *Marchantia polymorpha* subsp. *ruderalis* and *Bryum bornholmense.* In the small areas of heath where burning has not recently taken place, and there is a continuous canopy of dwarf shrubs, the pleurocarpous mosses *Kindbergia praelonga* and *Hypnum jutlandicum* are dominant. Elder scrub at the western end of the site supports a number of epiphytic species, including *Orthotrichum diaphanum, Metzgeria violacea, Ulota bruchii* and *Syntrichia laevipila*. Rocky outcrops on the seaward slopes provide a habitat for the liverworts *Frullania fragilifolia* and *Frullania teneriffae*, both of which are mainly oceanic in distribution, and less frequent on the east coast than the west coast (Blockeel et al., 2014), and, in close proximity to the sea, the coastal specialist moss, *Schistidium maritimum*.

3.3 Notable bryophyte species recorded

Summary details of any notable bryophyte species recorded is shown in Table 3.1. Locations are shown on Figure 3.1.

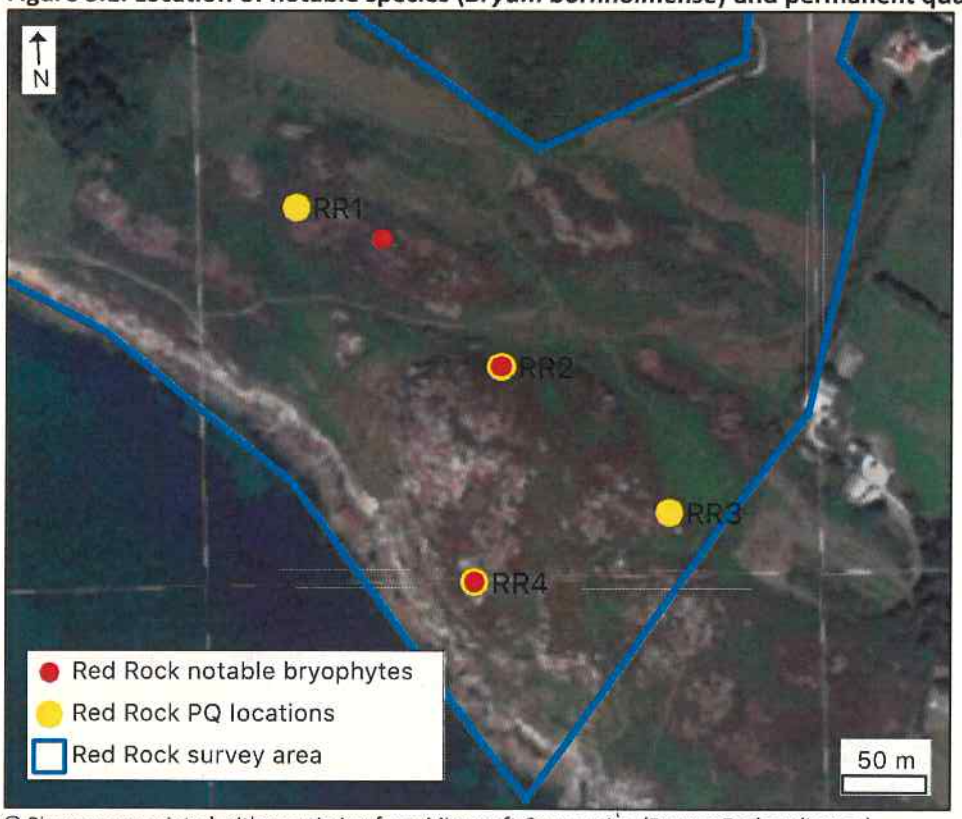
Table 3.1. Notable bryophyte species recorded

Species name	***Bryum bornholmense***
Red Data Book	Near Threatened
FPO	No
New Vice County Record	No
Locally rare (Co. Dublin)	Yes
Other importance/ indicator species	Nationally Scarce

Species name	*Bryum bornholmense*
Grid reference(s) (ITM)	(E) 727160 (N) 737024 (E) 727145 (N) 736895 (E) 727089 (N) 737100
Population notes	This species was widespread across areas of recently burnt bare peat, particularly on the slope facing the sea. Although it was not possible to confirm the identity of the specimens collected here, due to the lack of diagnostic tubers, it is almost certainly this species, which was previously recorded in this area, as well as elsewhere on Howth during this survey.
Photographs (species)	n/a
Photographs (habitat)	

NB Full list and grid references also provided separately in Excel format.

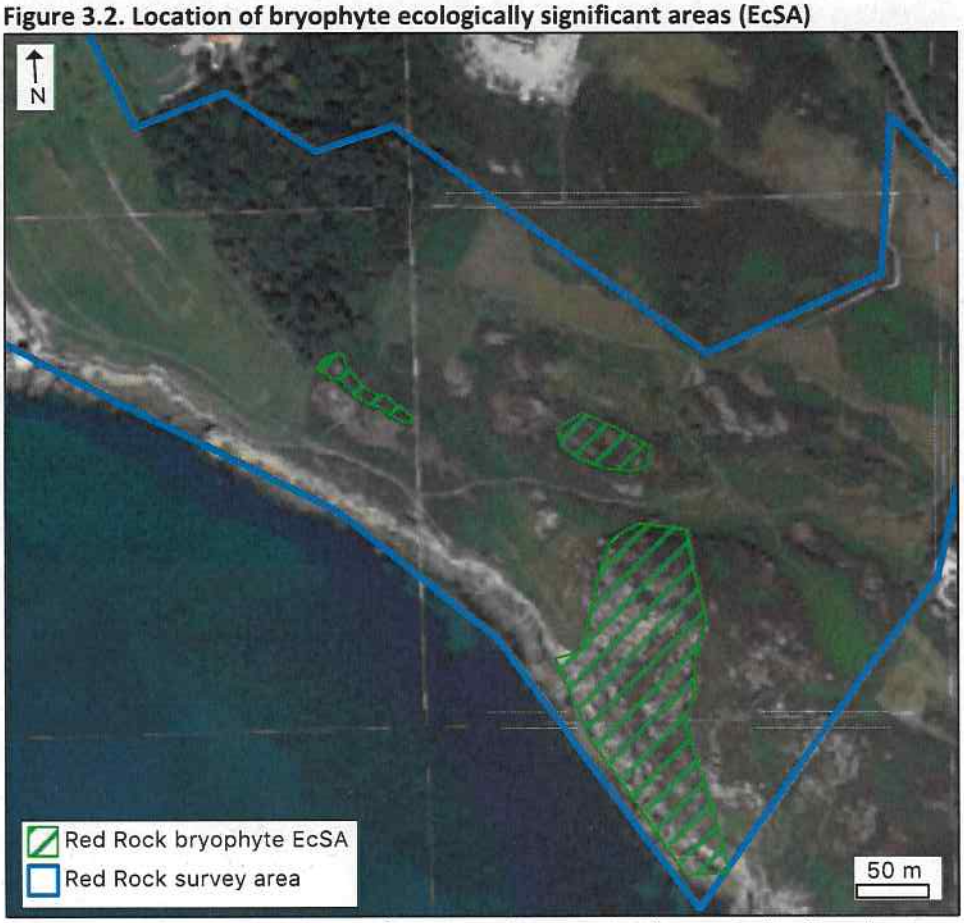
Figure 3.1. Location of notable species (*Bryum bornholmense*) and permanent quadrats



3.4 Bryophyte ecologically significant areas

Bryophyte ecologically significant areas are shown on Figure 3.2. There are no areas of this site with true ecological significance, although the small area of Elder scrub at the western end of the site supports some species that are of limited distribution within the heathland, and the coastal rocks also support some species that are not widespread in the Dublin area. Much of the recently burnt heath area supports the Nationally Scarce (Hodgetts and Lockhart, 2013) and Near Threatened (Lockhart et al., 2012), moss *Bryum bornholmense*, so has some ecological significance, although this species will be lost once the habitat begins to recover from the intense burning.

Figure 3.2. Location of bryophyte ecologically significant areas (EcSA)



3.5 Permanent quadrats

Four permanent quadrats only were undertaken at this site. A summary of the Permanent Quadrat (PQ) data from this site is shown in Table 3.2 and the full data is included in Excel format. The PQ locations are shown on Figure 3.1.

Table 3.2. Permanent Quadrat summary

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
RR1	(E) 727037 (N) 737119	HH1	Revegetating burnt heath	60	4	n/a	
RR2	(E) 727160 (N) 737024	HH1	Very recently burnt heath	75	5	*Bryum bornholmense*	

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
RR3	(E) 727260 (N) 736937	HH1	Not burnt recently	20	2	n/a	
RR4	(E) 727145 (N) 736895	HH1	Very recently burnt, with much bare peat	10	3	*Bryum bornholmense*	

4 SITE ECOLOGICAL IMPORTANCE FOR BRYOPHYTES

This site can be considered to be of Local (higher value) ecological importance for bryophytes. It is not of higher importance despite the presence of the Near Threatened moss *Bryum bornholmense*, the occurrence of which is due to recent burning, and is likely to be transitory. The other bryophytes present mostly common species, although a number of species are restricted to locations in close proximity to the sea and are less common on the east coast than in the west of the country.

5 MONITORING

The following site monitoring is recommended:

- The permanent monitoring quadrats should be resurveyed in full every 3 years, using the same methodology as for the present survey.
- The condition and extent of the population of *Bryum bornholmense* should be assessed.
- The site should be walked over to identify any new bryophyte habitat that may have formed and any new threats and impacts to bryophyte species and communities should also be recorded and quantified
- The data should be analysed in comparison to the baseline collected in this survey, and, when repeat monitoring, data from the previous monitoring period(s). Based on these analyses, a trend of the habitat quality and suitability for bryophytes should be determined, in order to determine whether habitat suitability for bryophytes is increasing or declining.

6 MANAGEMENT

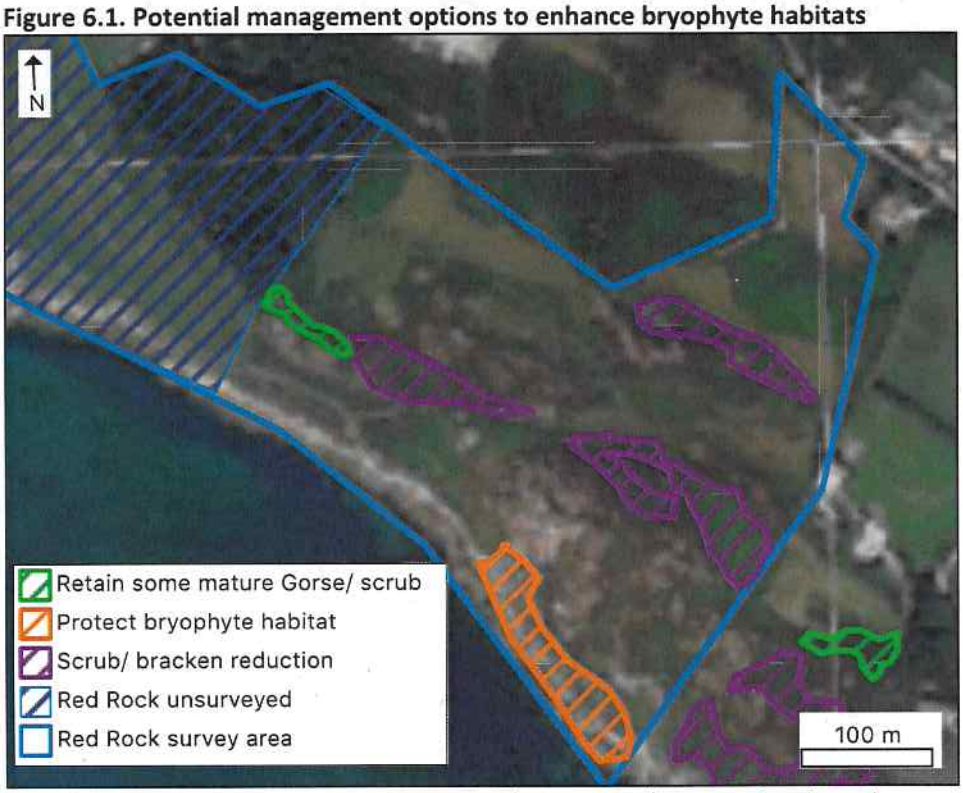
There are few management prescriptions that would be beneficial to both the heathland habitat and the bryophyte communities, particularly the only uncommon species found on the site, *Bryum bornholmense*. In order to retain suitable habitat for *B. bornholmense*, it would be necessary to maintain open, bare peat, to the exclusion of most vascular plants and a healthy vegetation structure. As it currently stands, it is likely that there is much soil erosion and runoff of peat occurring in the recently burnt areas. There are no management strategies that would be likely to significantly increase the bryophyte diversity of this site, but by allowing the heath to regenerate, ensuring that bracken does not become dominant, and maintaining a diversity of habitats, it is possible to retain and enhance habitat for the occurrence of a basic suite of heathland and coastal bryophytes. As this site is contiguous with Bellingham's Farm, these sites should be managed as a single unit, as far as is possible.

General management recommendations to enhance the quality of bryophyte habitat at this site are as follows (and shown on Figure 6.1):

- Reduce frequency of burning. Ensure that repeat burning does not occur in areas that have recently been burnt for a period of 5-10 years, to allow dwarf shrubs to recolonise and the peat surface to stabilise.
- Retain and expand scrub. Ensure that areas of scrub, particularly the area dominated by Elder (*Sambucus nigra*), are retained and, if possible, allowed to expand.
- Control the growth of dense bracken in/ adjacent to heathland areas. Ensure that areas of heavily burnt heath do not transition to dense bracken as this does not provide a suitable habitat for bryophyte growth.
- Maintain small areas of open bare soil, if practicable, to allow the persistence of ruderal bryophytes, in particular *Bryum bornholmense*.
- Minimise disturbance. Ensure that disturbance is minimised to coastal rocks and soil banks, where coastal specialist species grow, by walkers and by any future development of the coastal path.

The key requirement for optimising the suitability of this site for bryophyte communities is to maintain a diversity of habitats, and ensure that excessive burning does not further damage the integrity of the site, and lead to a monospecific sward of dense bracken, or an unstable and biodiversity-poor mix of open bare peat and depauperate dwarf shrubs.

Figure 6.1. Potential management options to enhance bryophyte habitats



REFERENCES

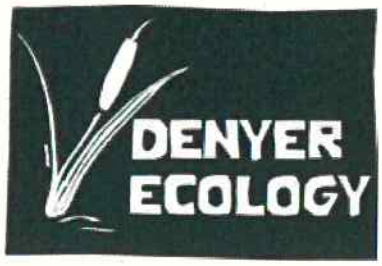
Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014). *Atlas of British and Irish bryophytes*. Volume 1. British Bryological Society (Pisces Publications, Newbury).

Denyer, J.L. & Hodd, R.H. (2019). *Howth and Ireland's Eye Bryophyte Survey*. Unpublished report for Fingal County Council.

Fossitt, J.A. (2000). *A guide to habitats in Ireland*. Heritage Council.

Hodgetts, N. and Lockhart, N. (2013) Rare and scarce bryophytes of Ireland. *Field Bryology* 110:12-26.

Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.



APPENDIX D

SITE REPORT: Shielmartin

Joanne Denyer

CONTENTS

1 INTRODUCTION

Six sites were surveyed and assessed as part of the 2019 Howth and Ireland's Eye Bryophyte Survey, commissioned by Fingal County Council. This Appendix contains the site report for Sheilmartin. Refer to the main report (Denyer & Hodd, 2019) for details of the methodology and Excel files for species lists and relevé data.

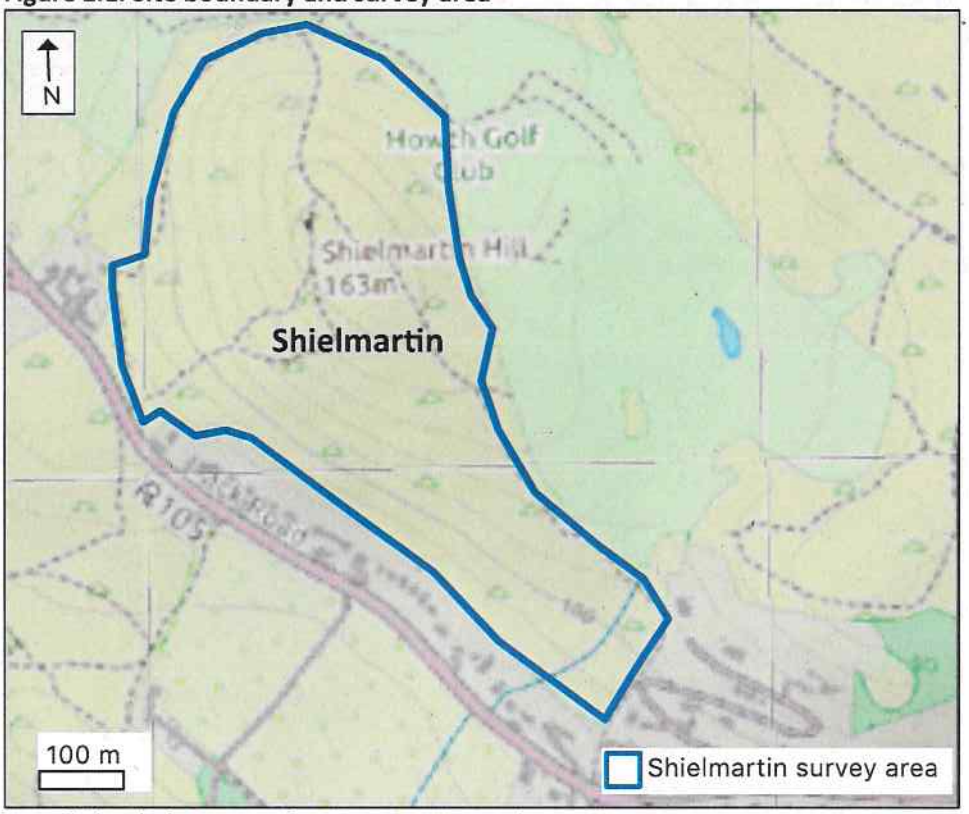
2 SITE AND SURVEY DETAILS

Date from the site summary card and other relevant information is shown in Table 2.1. The site boundary and survey area are shown on Figure 2.1.

Table 2.1. Site and survey details

Site name	Shielmartin
Survey date(s)	06/08/2019
Recorder(s)	Joanne Denyer
Altitude range (m)	80-163m
Fossitt habitats present on site	BL1 Stone walls and other stonework ER1 Exposed siliceous rock ER3 Siliceous scree and loose Rock FW1 Small upland stream HD1 Dense bracken HH1 Dry siliceous heath WS1 Scrub
Annex I habitats present on site	4030 European dry heaths *cf* 8110 Siliceous scree of the montane to snow levels
Relevé numbers	SH1 SH2 SH3 SH4
Site description	This site comprises a hill rising to 163m, There are steep slopes on the south-western side with heathland and dense bracken and gorse scrub and occasional scree and exposed rock. The summit is dominated by exposed rock and soil and the north and north-eastern slopes by dry heathland, dense bracken and occasional large boulders. The lower south-eastern slopes of the hill have had recent gorse clearance undertaken, although areas of mature gorse remain. There is a main path running around the western side of the hill, one crossing the hill north to south and smaller paths to the east.
Site notes (e.g. geography, management, damaging operations)	The heathland does not appear to have been recently burnt. There is some erosion and disturbance of soil by walkers at the summit.
Survey limitations	Most of the survey area was surveyed. There were some areas of dense scrub on the south-western slope that were not accessed but these were not considered to be of high value for bryophytes.

Figure 2.1. Site boundary and survey area



Maps © Thunderforest, Data © OpenStreetMap contributors

3 BRYOPHYTE SURVEY RESULTS

3.1 Key bryophyte habitats

This site is dominated by species-poor mature heathland with some areas of gorse scrub (Photograph 3.1). There are areas of scree on the south-western slope and at the summit (Photograph 3.2) and exposed rock and soil, mainly near the summit (Photograph 3.3). There are rock outcrops and some large boulders (Photograph 3.4), particularly on the northern slopes of the hill.

Photograph 3.1. Species-poor mature heathland with areas of dense gorse scrub

Photograph 3.2. Scree at the summit. Some bryophytes are present with the sheltered in the scree

Photograph 3.3. Exposed rock and soil at summit, showing signs of trampling by walkers

Photograph 3.4. Large boulder on northern side of hill, surrounded by dense bracken and mature dry heathland

3.2 Bryophyte species recorded

A total of 24 mosses and 10 liverworts were recorded from Shielmartin. This is a relatively large number of liverwort species given the limited habitat diversity and overall low number of bryophytes.

The liverworts were recorded as epiphytes, from sheltered north facing boulders, damp exposed peat and in a small stream on the lower slopes. Localised areas of mature heather had a ground flora of heathland species mosses such as *Hypnum jutlandicum* and *Dicranum scoparium*. However, most diversity was recorded from open areas, such as at the edges of paths on damp peaty soil and rocks.

3.3 Notable bryophyte species recorded

Summary details of any notable bryophyte species recorded is shown in Table 3.1. Locations are shown on Figure 3.1.

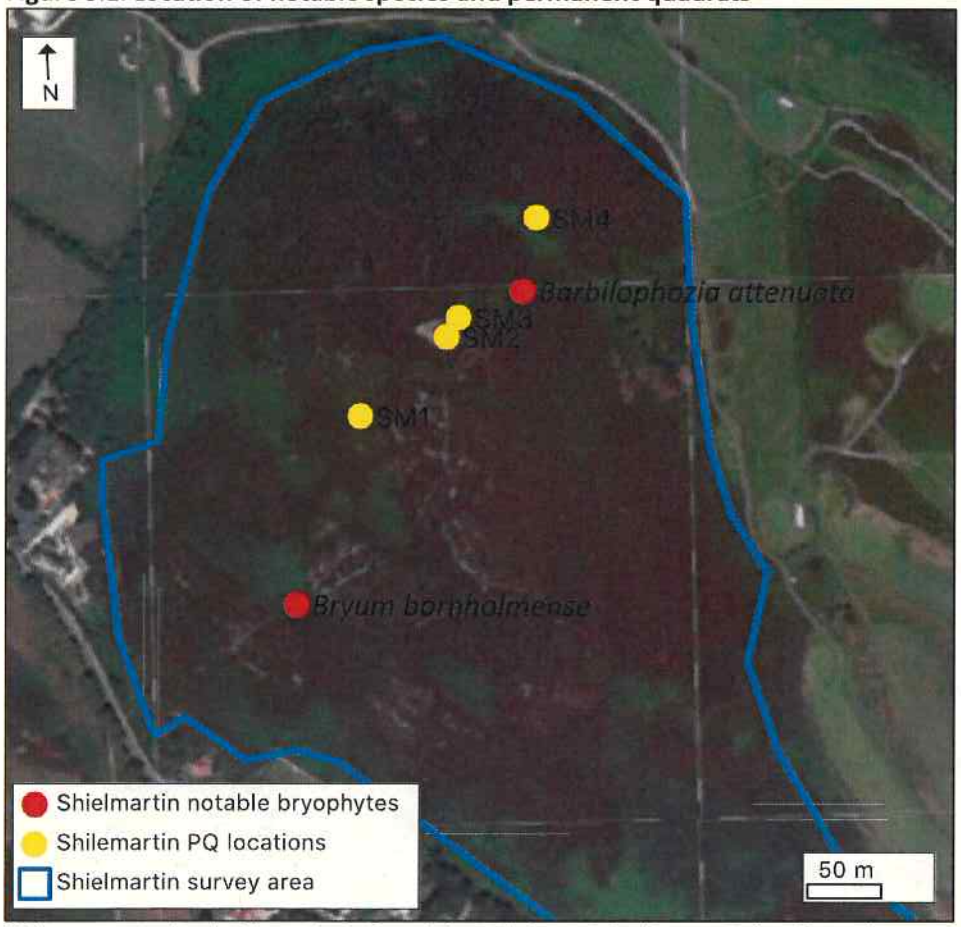
Table 3.1. Notable bryophyte species recorded

Species name	***Bryum bornholmense***
Red Data Book	Near Threatened
FPO	No
New Vice County Record	No
Locally rare (Co. Dublin)	Yes (<5 records and only one other site)
Other importance/ indicator species	Nationally Scarce
Grid reference(s) (ITM)	(E) 727434 (N) 737421
Population notes	Peaty disturbed soil by a path, possibly previously burnt
Photographs (species)	n/a
Photographs (habitat)	
Species name	***Barbilophozia attenuata***
Red Data Book	No
FPO	No
New Vice County Record	No
Locally rare (Co. Dublin)	Yes (<5 records and only one other historic site). Not recorded from Co. Dublin since 1981 (recorded from Howth Demesne). This is the only recent site for this species in Co. Dublin.
Other importance/ indicator species	Indicates humid conditions
Grid reference(s) (ITM)	(N) 727587 (E) 737634
Population notes	North side of a boulder on northern slopes of hill. Locally abundant on one boulder

Photographs (species)	 (Growing in a cushion of the moss *Dicranum scoparium*)
Photographs (habitat)	

NB Full list and grid references also provided separately in Excel format.

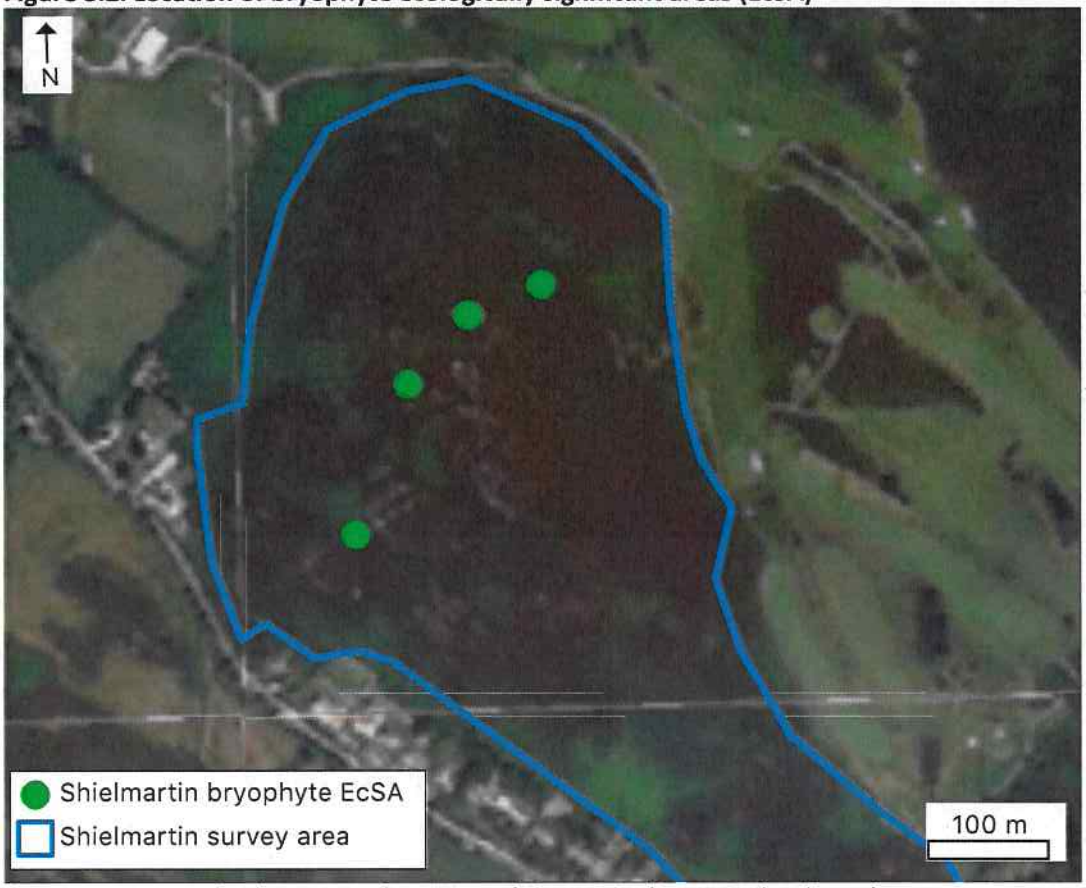
Figure 3.1. Location of notable species and permanent quadrats



3.4 Bryophyte ecologically significant areas

Bryophyte ecologically significant areas are shown on Figure 3.2. These represent the notable species habitat and scree areas. Much of the site is currently low quality habitat for bryophytes. However, the boulders on the northern side of the hill have the potential to support species which require humid conditions (such as the liverwort *Barbilophozia attenuata* and other species that were only found in this habitat). The area of disturbed peaty soil adjacent to the path on the southern side of the hill is of some ecological significance, due to the presence of *Bryum bornholmense*, which is Nationally Scarce (Hodgetts and Lockhart, 2013) and Near Threatened on the Irish Red Data List (Lockhart et al., 2012). However, it is likely that *B. bornholmense* will be lost as the disturbed/ burnt peat revegetates. Some of the mature heathland supported some typical heathland species, but the exposed rocks and soil generally had low cover of bryophytes or were dominated by *Ceratodon purpureus* and *Campylopus introflexus* which was the most common species recorded from the site. The scree areas provided a different habitat, although bryophytes currently have low cover in these areas.

Figure 3.2. Location of bryophyte ecologically significant areas (EcSA)



3.5 Permanent quadrats

Four permanent quadrats only were undertaken at this site. A summary of the Permanent Quadrat (PQ) data from this site is shown in Table 3.2 and the full data is included in Excel format. The PQ locations are shown on Figure 3.1.

Table 3.2. Permanent Quadrat summary

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
SH1	(E) 727478 (N) 737549	ER3	Scree on steep slope	9%	2	n/a	
SH2	(E) 727536 (N) 737603	HH1/ ER3	Scree/ heath at summit	8%	2	n/a	

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
SH3	(E) 727544 (N) 737616	HH1	Mature dry heathland just below summit	81%	5	n/a	
SH4	(E) 727596 (N) 737684	HH1	Mature dry heathland on northern lower slope	85%	1	n/a	

4 SITE ECOLOGICAL IMPORTANCE FOR BRYOPHYTES

This site is considered to be of County ecological importance for bryophytes. The heathland and exposed rock habitats generally have low bryophyte diversity. However, one Red Data Book species was recorded (*Bryum bornholmense*) and one species for which this is the only current recent record in Co. Dublin (*Barbilophozia attenuata*). There was also a relatively high number of liverwort species recorded given the limited habitats present on site. The scree habitat is rare in Co. Dublin and if disturbance were reduced, it may potentially support additional bryophyte species in the future.

5 MONITORING

The following site monitoring is recommended:

- The permanent monitoring quadrats should be resurveyed in full every 3 years, using the same methodology as for the present survey.
- The site should be walked over to identify any new bryophyte habitat that may have formed and any new threats and impacts to bryophyte species and communities should also be recorded and quantified.
- The condition and extent of the population of *Bryum bornholmense* should be assessed.
- The condition and extent of the population of *Barbilophozia attenuata* should be assessed.
- The data should be analysed in comparison to the baseline collected in this survey, and, when repeat monitoring, data from the previous monitoring period(s). Based on these analyses, a trend of the habitat quality and suitability for bryophytes should be determined, in order to determine whether habitat suitability for bryophytes is increasing or declining.

6 MANAGEMENT

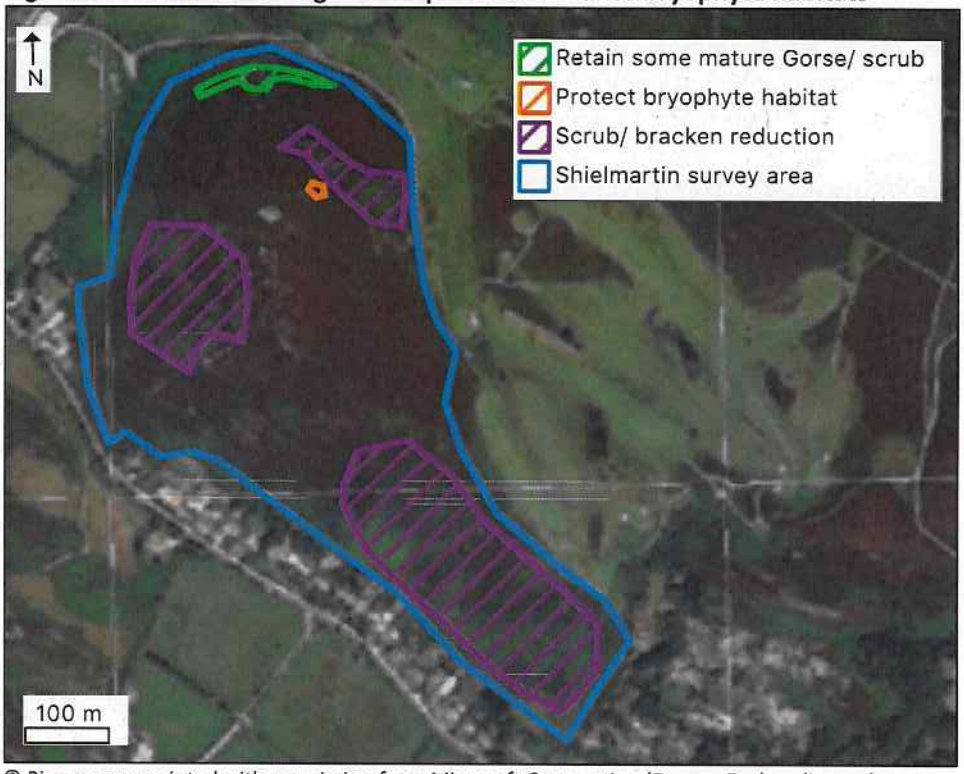
There are no management strategies that would be likely to significantly increase the bryophyte diversity of this site, but by allowing the heath to regenerate, controlling scrub and bracken, and maintaining a diversity of habitats, it is possible to retain and enhance habitat for the occurrence of a basic suite of heathland and coastal bryophytes.

General management recommendations to enhance the quality of bryophyte habitat at this site are as follows (and shown on Figure 6.1):

- Protect the boulders on the northern side of the hill. It is important that these do not have the vegetation around them burnt or removed as they provide a humid rocky habitat rare on this site (and the others sites surveyed on Howth for this survey).
- Prevent frequent burning. The site does not appear to have been subject to much recent burning and this should be maintained if possible. Ensure that repeat burning does not occur in areas that have recently been burnt for a period of 5-10 years, to allow dwarf shrubs to recolonise and the peat surface to stabilise.
- Retain some gorse scrub, particularly on the lower, northern parts of the site. Continued removal of some areas of dense gorse scrub may be desirable as part of the overall management of the site (particularly in the south-western part of the site). However, mature gorse scrub is a potential habitat for a range of epiphytic bryophyte species, in an area where there are few trees to support them.
- Maintain/ create open areas. A network of smaller (unsurfaced) paths with moderate disturbance creates additional bryophyte habitat for open soil/ rock species in areas of otherwise dense bracken/ scrub. This can be in any areas of heathland, gorse or bracken which have not been identified as otherwise ecologically sensitive. For instance, the creation of a path running south-west to north-east across the site would create additional open habitat whilst providing additional amenity access.
- Control the growth of dense bracken, as it is currently colonising some areas of heath and and does not provide a suitable habitat for bryophyte growth.

- Minimise disturbance. Ensure that disturbance to rocky slopes by walkers and by any future development of paths on the site is minimised.
- Grazing. This site would benefit by light to medium grazing by goats and/ or horses as they will reduce the dense heather and gorse and provide additional open habitat. Grazing can be year-round for bryophytes, as they do not have 'seasonal growth' in the same way that vascular plants do. However, it may be that seasonal grazing will be recommended to support other species groups (heathland vascular plants/ birds) and this would also suitable for bryophytes.

Figure 6.1. Potential management options to enhance bryophyte habitats



REFERENCES

Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014). *Atlas of British and Irish bryophytes*. Volume 2. British Bryological Society (Pisces Publications, Newbury).

Denyer, J.L. & Hodd, R.L. (2019). *Howth and Ireland's Eye Bryophyte Survey*. Unpublished report for Fingal County Council.

Fossitt, J.A. (2000). *A guide to habitats in Ireland*. Heritage Council.

Hodgetts, N. and Lockhart, N. (2013) Rare and scarce bryophytes of Ireland. *Field Bryology* 110:12-26.

Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

APPENDIX E

SITE REPORT: Summit

Joanne Denyer

CONTENTS

1 INTRODUCTION

Six sites were surveyed and assessed as part of the 2019 Howth and Ireland's Eye Bryophyte Survey, commissioned by Fingal County Council. This Appendix contains the site report for the Summit area (including the Ben of Howth). Refer to the main report (Denyer & Hodd, 2019) for details of the methodology and Excel files for species lists and relevé data.

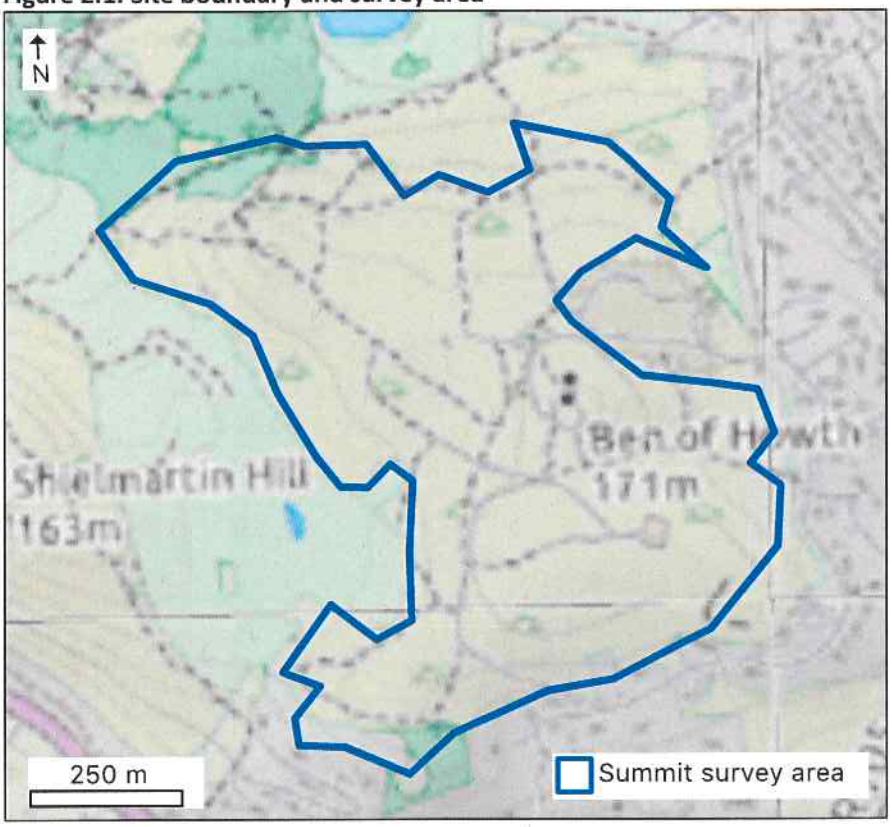
2 SITE AND SURVEY DETAILS

Date from the site summary card and other relevant information is shown in Table 2.1. The site boundary and survey area are shown on Figure 2.1.

Table 2.1. Site and survey details

Site name	Summit
Survey date(s)	02/07/2019
Recorder(s)	Joanne Denyer & Rory Hodd
Altitude range (m)	130-171m
Fossitt habitats present on site	BL1 Stone walls and other stonework BL3 Buildings and artificial surfaces ED2 Spoil and bare ground ER1 Exposed siliceous rock FW1 Small upland stream HD1 Dense bracken HH1 Dry siliceous heath PF2 Poor fen and flush WS1 Scrub WS3 Ornamental/non-native shrub
Annex I habitats present on site	4030 European dry heaths
Relevé numbers	SU1 SU2 SU3 SU4
Site description	This site comprises exposed rocky slopes with low vegetation cover; heathland on flat or gently sloping ground and areas of dense Bracken (*Pteridium aquilinum*) and/ or Gorse (*Ulex europaeus*). The highest point is the Ben of Howth (171m) where there is a mast and associated road/ areas of concrete. There is a quarry (Greenhallows Quarries) in the north-east part of the hill and a golf course in the hollow to the west. There are a number of paths crossing the site (both gravelled and unsurfaced).
Site notes (e.g. geography, management, damaging operations)	There are large areas of relatively species poor heath which has probably been burnt regularly. Most of the rocky slopes also appeared to have been recently burnt. There has been some dumping of cuttings/ garden waste and rubble.
Survey limitations	Most of the survey area was surveyed. There were some areas of dense scrub that were not accessed, but these are unlikely to be of high value for bryophytes. A small area with a house was fenced off and was not accessed.

Figure 2.1. Site boundary and survey area



3 BRYOPHYTE SURVEY RESULTS

3.1 Key bryophyte habitats

This site is dominated by species-poor mature heathland with gorse scrub (Photograph 3.1) and recently burnt, regenerating heathland (Photograph 3.2). Siliceous rock outcrops are frequent but have also been recently burnt and have low diversity (Photograph 3.3). There is a small area of poor fen with Common Cottongrass (*Eriophorum angustifolium*) on the main plateau (Photograph 3.4), there may be a spring arising in this area. *Rhododendron ponticum* scrub is occasional but did not support many bryophyte species. However, there are areas of concrete and dumped rubble (e.g. Photograph 3.5), which provide habitat for bryophytes which require base-rich conditions and these areas had a moderate bryophyte diversity.

Photograph 3.1. Species-poor mature heathland with areas of dense gorse scrub

Photograph 3.2. Burnt, regenerating heathland with low diversity and locally high cover of non-native moss *Campylopus introflexus*.

Photograph 3.3. Recently burnt siliceous rock outcrops

Photograph 3.4. Area of poor fen with Common Cottongrass on main plateau, possibly the location of a spring.

Photograph 3.5. Dumped rubble near the quarry area provides additional habitat for bryophytes requiring base-rich conditions not present on the rest of the site.

3.2 Bryophyte species recorded

A total of 41 mosses and 6 liverworts were recorded from Summit, which is relatively diverse given the narrow range of habitats present. Many of these species were only recorded from the base-rich concrete and dumped rubble habitats. Recently burnt heath was dominated by the non-native moss *Campylopus introflexus* with *Ceratodon purpureus.* Localised areas of mature heather had a ground flora of heathland species such as *Hypnum jutlandicum.* Wetland species were rare and include the moss *Bryum pseudotriquetrum* which was recorded from the poor fen/ spring area and the liverwort *Scapania undulata* which was present in a small stream on the north-eastern side of the hill.

3.3 Notable bryophyte species recorded

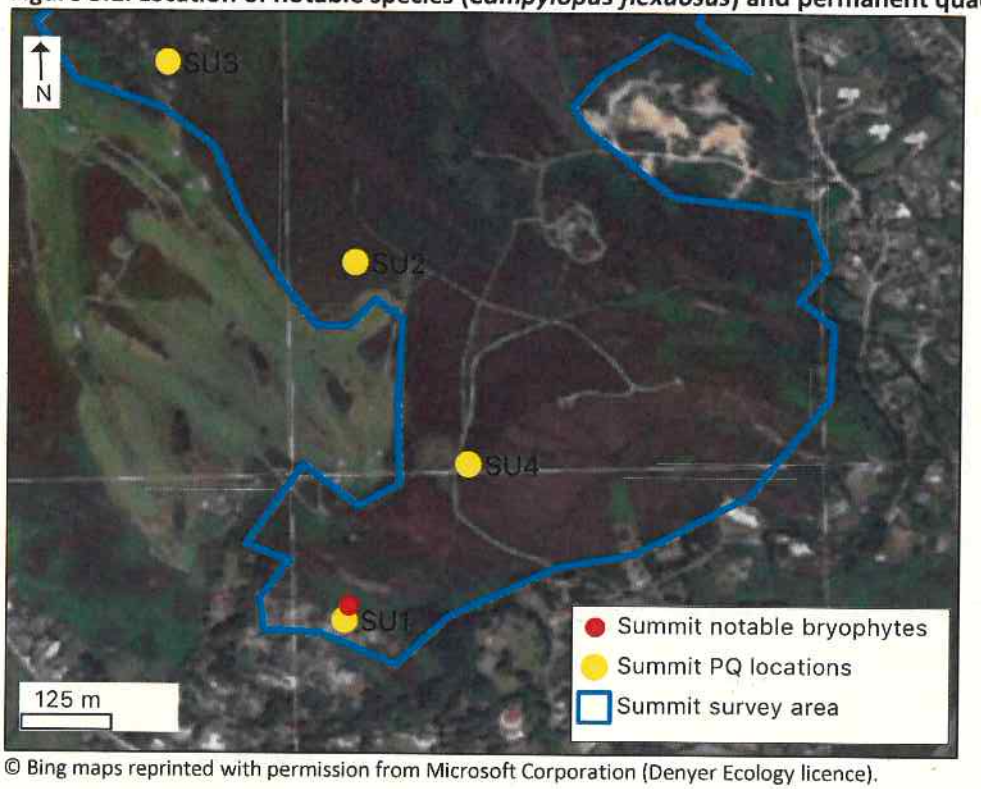
Summary details of any notable bryophyte species recorded is shown in Table 3.1. Locations are shown on Figure 3.1.

Table 3.1. Notable bryophyte species recorded

Species name	*Campylopus flexuosus*
Red Data Book	No
FPO	No
New Vice County Record	Yes (de-bracket*) – specimen lodged in DBN**
Locally rare (Co. Dublin)	Occasional (<10 records for Dublin)
Other importance/ indicator species	n/a
Grid reference(s) (ITM)	(N) 728152 (E) 737105
Population notes	Occasional in open heathy areas. Specimen collected from a boulder near a path.
Photographs (species)	n/a
Photographs (habitat)	n/a

NB Full list and grid references also provided separately in Excel format.
*Bracketed species are those for which there are no previous records post-1960. A species is 'de-bracketed' when a post-1960 specimen is sent to the relevant BBS recorder to update the species.
**Dublin Botanic Gardens (National Botanic Gardens, Glasnevin)

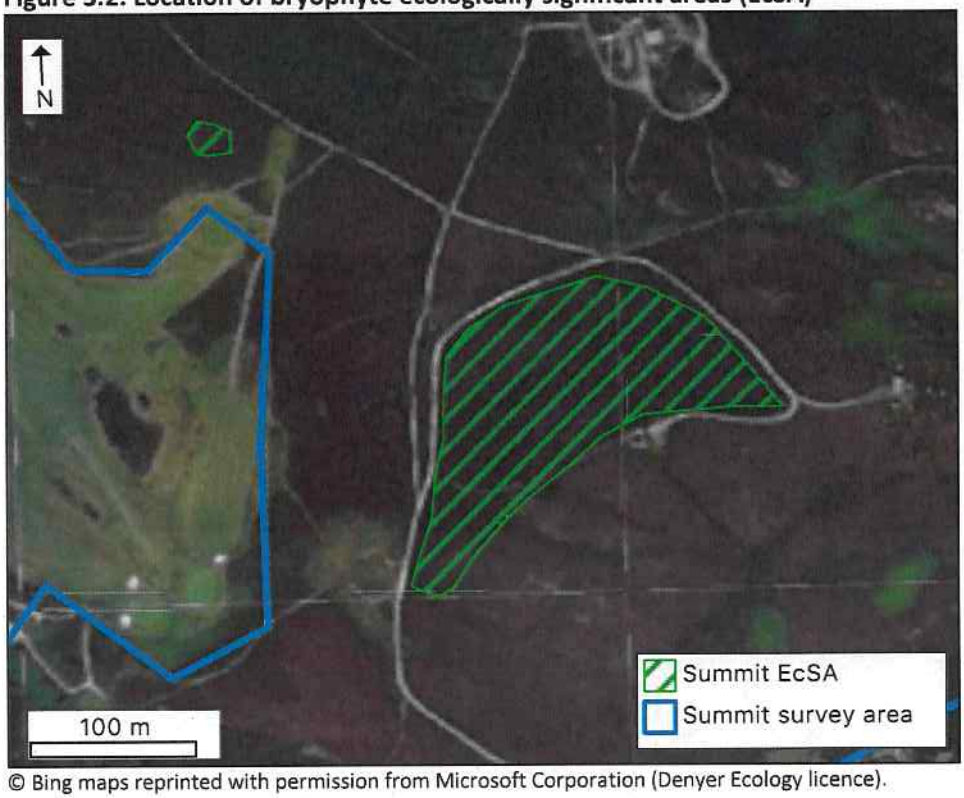
Figure 3.1. Location of notable species (*Campylopus flexuosus*) and permanent quadrats



3.4 Bryophyte ecologically significant areas

Bryophyte ecologically significant areas are shown on Figure 3.2. Much of the site is currently low quality habitat for bryophytes. Areas with the highest diversity or providing additional bryophyte habitat are the poor fen/ spring area; dumped concrete and rubble and occasional mature scrub. There is some mature heathland in the area of PQ SU4, and on parts of the lower south-eastern slopes, which have a high cover of typical heathland species.

Figure 3.2. Location of bryophyte ecologically significant areas (EcSA)



3.5 Permanent quadrats

Four permanent quadrats only were undertaken at this site. A summary of the Permanent Quadrat (PQ) data from this site is shown in Table 3.2 and the full data is included in Excel format. The PQ locations are shown on Figure 3.1.

Table 3.2. Permanent Quadrat summary

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
SU1	(E) 728146 (N) 737086	HH1	Recently burnt dry heath/ rocky slope	11%	2	n/a	
SU2	(E) 728157 (N) 737581	HH1	Regenerating dry heath	83%	2	n/a	

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
SU3	(E) 727895 (N) 737857	ER1	Previously burnt exposed rock	5%	3	n/a	
SU4	(E) 728317 (N) 737303	HH1	Mature dry heathland	85%	2	n/a	

4 SITE ECOLOGICAL IMPORTANCE FOR BRYOPHYTES

This site is considered to be of Local (higher value) ecological importance for bryophytes. The heathland and rock habitats have been damaged by frequent burning and have low bryophyte diversity. However, a typical range of heathland and ruderal species are present and the species diversity is higher than might be expected given the management history.

5 MONITORING

The following site monitoring is recommended:

- The permanent monitoring quadrats should be resurveyed in full every 3 years, using the same methodology as for the present survey.
- The site should be walked over to identify any new bryophyte habitat that may have formed and any new threats and impacts to bryophyte species and communities should also be recorded and quantified
- The data should be analysed in comparison to the baseline collected in this survey, and, when repeat monitoring, data from the previous monitoring period(s). Based on these analyses, a trend of the habitat quality and suitability for bryophytes should be determined, in order to determine whether habitat suitability for bryophytes is increasing or declining.

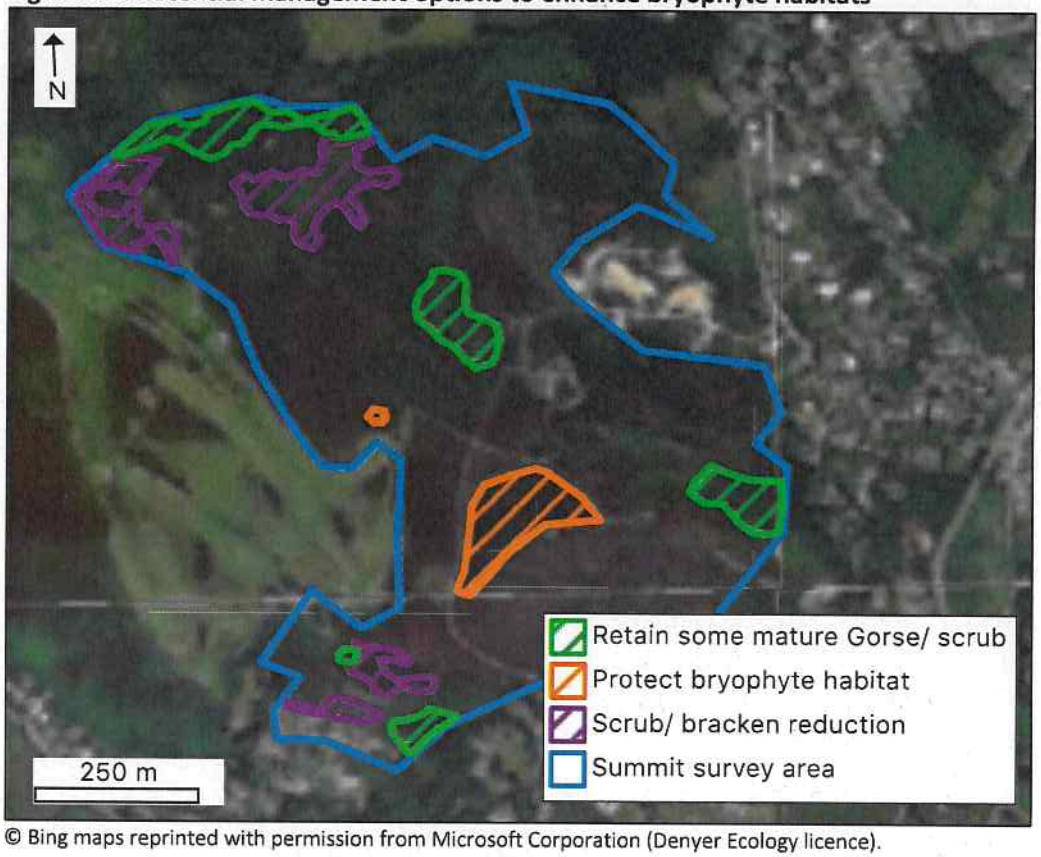
6 MANAGEMENT

There are no management strategies that would be likely to significantly increase the bryophyte diversity of this site, but by allowing the heath to regenerate, controlling scrub and bracken, and maintaining a diversity of habitats, it is possible to retain and enhance habitat for the occurrence of a basic suite of heathland and coastal bryophytes.

General management recommendations to enhance the quality of bryophyte habitat at this site are as follows (and shown on Figure 6.1):

- Reduce frequency of burning. Ensure that repeat burning does not occur in areas that have recently been burnt for a period of 5-10 years, to allow dwarf shrubs to recolonise and the peat surface to stabilise.
- Retain some gorse scrub. Burning of some areas of dense gorse scrub may be desirable as part of the overall management of the site, but mature gorse scrub is a potential habitat for a range of epiphytic bryophyte species, in an area where there are few trees to support them.
- Control the growth of dense bracken, as it is currently colonising recently burnt former areas of heath and scrub and does not provide a suitable habitat for bryophyte growth.
- Maintain/ create open areas. The network of smaller (unsurfaced) paths with moderate disturbance creates additional bryophyte habitat for open soil/ rock species in areas of otherwise dense bracken/ scrub. This can be in any areas of heathland, gorse or bracken which have not been identified as otherwise ecologically sensitive.
- Minimise disturbance. Ensure that disturbance to rocky slopes by walkers is minimised and by any future development of paths on the site.
- Grazing. This site would benefit by light to medium grazing by goats and/ or horses as they will reduce the dense heather and gorse and provide additional open habitat. Grazing can be year-round for bryophytes, as they do not have 'seasonal growth' in the same way that vascular plants do. However, it may be that seasonal grazing will be recommended to support other species groups (heathland vascular plants/ birds) and this would also suitable for bryophytes.

Figure 6.1. Potential management options to enhance bryophyte habitats



REFERENCES

Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014). *Atlas of British and Irish bryophytes.* Volume 2. British Bryological Society (Pisces Publications, Newbury).

Denyer, J.L. & Hodd, R.L. (2019). *Howth and Ireland's Eye Bryophyte Survey*. Unpublished report for Fingal County Council.

Fossitt, J.A. (2000). *A guide to habitats in Ireland.* Heritage Council.

Hodgetts, N. and Lockhart, N. (2013) Rare and scarce bryophytes of Ireland. *Field Bryology* 110:12-26.

Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

APPENDIX F

SITE REPORT: Ireland's Eye

Rory Hodd (Nimbosa Ecology) and Joanne Denyer

CONTENTS

1 INTRODUCTION

Six sites were surveyed and assessed as part of the 2019 Howth and Ireland's Eye Bryophyte Survey, commissioned by Fingal County Council. This Appendix contains the site report for Ireland's Eye. Refer to the main report (Denyer & Hodd, 2019) for details of the methodology and Excel files for species lists and relevé data.

2 SITE AND SURVEY DETAILS

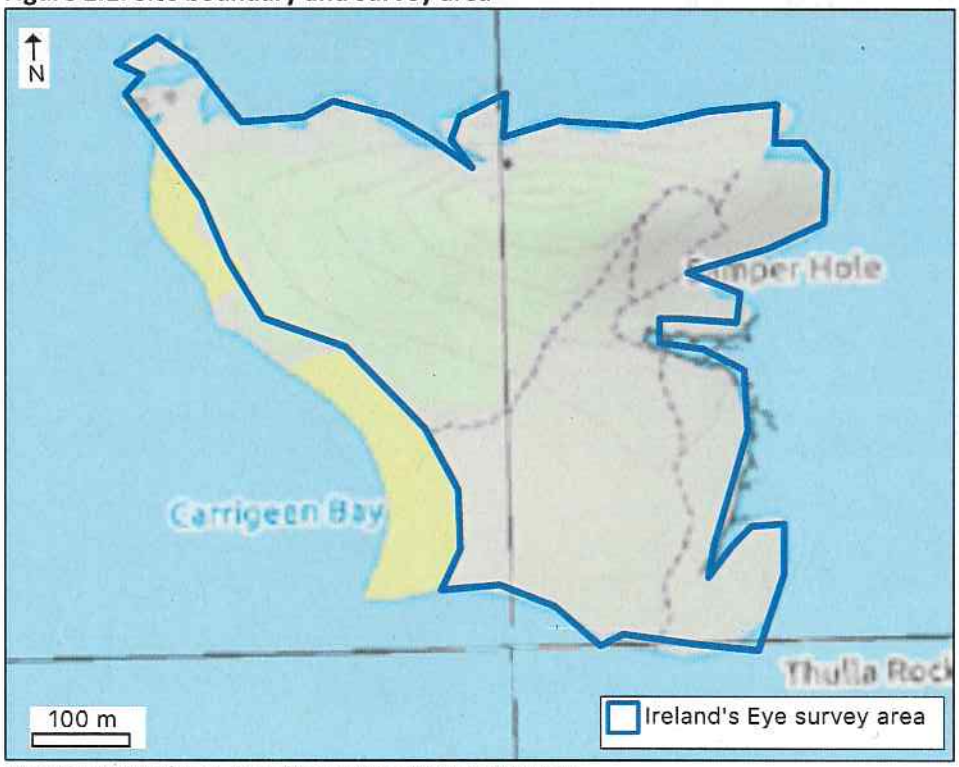
Date from the site summary card and other relevant information is shown in Table 2.1. The site boundary and survey area are shown on Figure 2.1.

Table 2.1. Site and survey details

Site name	**Ireland's Eye**
Survey date(s)	22/08/2019
Recorder(s)	Joanne Denyer and Rory Hodd
Altitude range (m)	0-70
Fossitt habitats present on site	CD1 Embryonic dunes CD2 Marram dunes CM2 Upper saltmarsh CS1 Rocky sea cliffs ER1 Exposed siliceous rock GS3 Dry-humid acid grassland HD1 Dense bracken WS1 Scrub
Annex I habitats present on site	1210 Annual vegetation of drift lines 1230 Vegetated sea cliffs of Atlantic and Baltic coasts 1330 Atlantic salt meadows 2110 Embryonic shifting dunes 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
Relevé numbers	IE1 IE2 IE3 IE4
Site description	Ireland's Eye is a small island located north of Howth, which rises to an altitude of 69m at its highest point. The island slopes up from the south to tall sea cliffs on the northern and eastern sides of the island. The majority of the island is covered by rough grassland and dense bracken, interspersed with small cliffs and rocky outcrops, mainly in the higher, northern, area of the island, as well as small areas of scrub, that are nestled in the shelter of the rocky outcrops. There is a sandy beach along the western coast of the island, which is backed by a narrow strip of embryonic and shifting dunes.
Site notes (e.g. geography, management, damaging operations)	The main human impact on this island is from visitors, who land at the northern end and follow a network of paths to the ruined church, beach and summit of the island. Much of the island has been subject to fires, eliminates most of the gorse scrub, as well as any heath that may have been present. The high numbers of breeding seabirds has led to localised eutrophication in places. There was a large fire on Ireland's Eye in 2015.

Site name	Ireland's Eye
Survey limitations	The sea cliffs were not surveyed, due to both the dangerous nature of the terrain and to avoid disturbance of the colonies of seabirds. However, it would not be expected that any additional bryophyte species would be found on the sea cliffs that were not found elsewhere on the island.

Figure 2.1. Site boundary and survey area



Maps © Thunderforest, Data © OpenStreetMap contributors

3 BRYOPHYTE SURVEY RESULTS

3.1 Key bryophyte habitats

The most widespread bryophyte habitat on Ireland's eye is rocky outcrops, on vertical rockfaces, particularly where moist or shaded, and on thin soil over and around rocks (Photograph 3.1), that may have been covered by dwarf shrubs prior to burning. Patches of scrub, particularly those dominated by elder (*Sambucus nigra*) also support a number of bryophyte species, that would not be present on the island, if not for the presence of the scrub (Photograph 3.2). Sandy ground and the small area of dune at the back of the beach provides habitat for a handful of species. Compacted soil along the paths also acts as a substrate for some bryophyte species.

Photograph 3.1. View along the western side of Ireland's eye, showing rocky outcrops and sand dune habitats, both of which support assemblages of bryophytes.

Photograph 3.2. Area of Elder (*Sambucus nigra*) scrub, sheltered by rocky bluff.

3.2 Bryophyte species recorded

In total, 28 mosses and three liverworts were recorded on Ireland's Eye. The commonest species across the island, on bare peat and soil and in cracks in rocks are *Campylopus introflexus, Ceratodon purpureus* and *Hypnum resupinatum*. A range of *Bryum* species were recorded on bare soil, including *B. argenteum, B. bornholmense* and *B. capillare*. A species that was found to be unexpectedly

abundant on bare soil was *Syntrichia ruralis* var. *ruralis*, which would not normally be expected to be a prominent component of such habitat. A number of species were recorded from rocks, in very close proximity to the beach, that also would not be expected in such habitat. These species include *Tortula muralis, Grimmia pulvinata, Frullania dilatata* and *Orthotrichum diaphanum*. The last of these is also the dominant bryophyte on the branches of elder (*Sambucus nigra*) trees further inland, a more typical habitat for this species. The greatest surprise was to find the moss *Syntrichia papillosa* growing on exposed rocks below the summit of the island. This moss usually grows as an epiphyte on sheltered trees and does not appear to have been recorded growing on coastal rocks in Ireland or Britain previously (Blockeel et al., 2014). Humid rocky crevices contained a further number of species not found elsewhere on the island, including *Metzgeria furcata, Frullania fragilifolia, Plagiothecium nemorale, Mnium hornum* and *Cirriphyllum crassinervium*. The limited areas of dune habitat support the dune specialist species *Brachythecium albicans* and *Syntrichia ruralis* var. *ruraliformis*, while species characteristic of coastal rocks, aside from the oddities mentioned above, were *Trichostomum brachydontium* and *Schistidium maritimum*.

3.3 Notable bryophyte species recorded

Summary details of any notable bryophyte species recorded is shown in Table 3.1. Locations are shown on Figure 3.1.

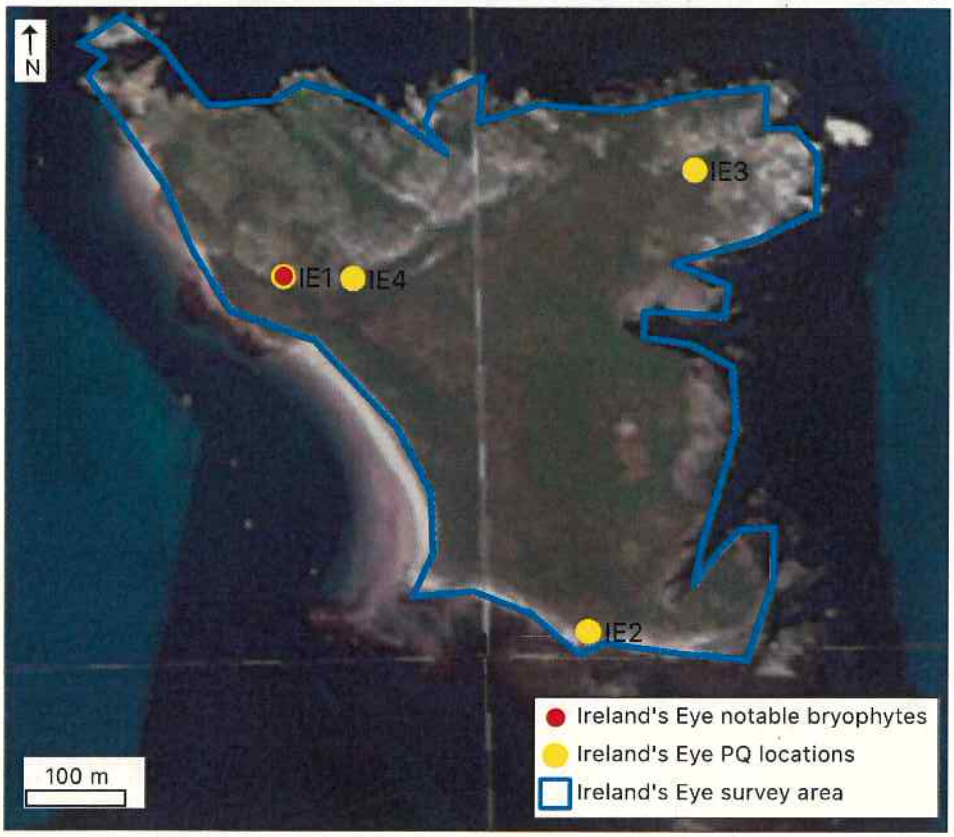
Table 3.1. Notable bryophyte species recorded

Species name	***Bryum bornholmense***
Red Data Book	Near Threatened
FPO	No
New Vice County Record	No
Locally rare (Co. Dublin)	Yes
Other importance/ indicator species	Nationally Scarce (Hodgetts and Lockhart, 2013)
Grid reference(s)	(E) 728499 (N) 741330
Population notes	This species was found in one location, on shallow soil in association with other small mosses.
Photographs (species)	

Species name	*Bryum bornholmense*
Photographs (habitat)	

NB Full list and grid references also provided separately in Excel format.

Figure 3.1. Location of notable species (*Bryum bornholmense*) and permanent quadrats

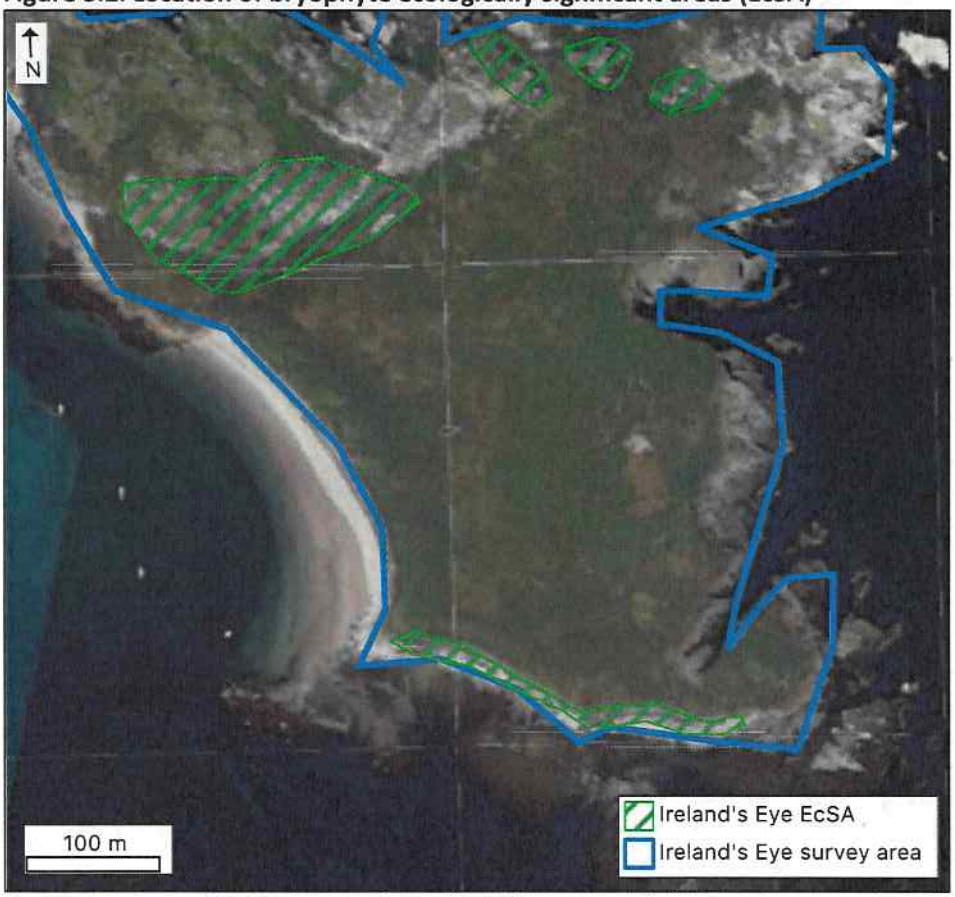


3.4 Bryophyte ecologically significant areas

Bryophyte ecologically significant areas are shown on Figure 3.2. The most ecologically significant areas for bryophytes are the rocky outcrops and associated open soil patches to the south of the

summit, which support the majority of bryophyte species found on the island, including *Bryum bornholmense*, which is Nationally Scarce (Hodgetts and Lockhart, 2013) and Near Threatened on the Irish Red Data List (Lockhart et al., 2012), as well as the coastal rocks, sand and soil at the back of the beaches on the western and southern sides of the island, which also host a notable assemblage of bryophytes.

Figure 3.2. Location of bryophyte ecologically significant areas (EcSA)

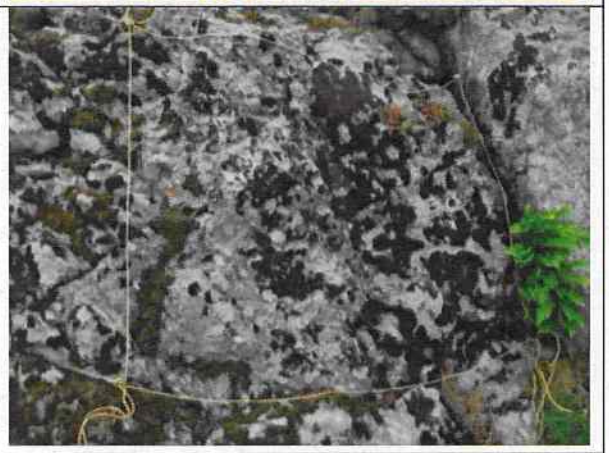


3.5 Permanent quadrats

Two permanent quadrats only were undertaken at this site, as there was limited bryophyte habitat present. A summary of the Permanent Quadrat (PQ) data from this site is shown in Table 3.2 and the full data is included in Excel format. The PQ locations are shown on Figure 3.1.

Table 3.2. Permanent Quadrat summary

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
IE1	(E) 728499 (N) 741330	ER1	South-facing turf on rocks	12	7	*Bryum bornholmense*	
IE2	(E) 728803 (N) 740977		Sandy/rocky bank just above high tide mark	25	8		

Relevé no.	Grid ref. (ITM)	Habitat type	Habitat notes	Bryophyte cover	No. of bryophytes	Notable species	Photograph
IE3	(E) 728906 (N) 741437	ER1	Rocky outcrop on slope	22	6		
IE4	(E) 728569 (N) 741328	ER1	Vertical rock face	40	6		

4 SITE ECOLOGICAL IMPORTANCE FOR BRYOPHYTES

This site can be considered as being of County Ecological Importance, as, although there is not a large number of species present, the species assemblage is unusual, and not typical. Also, as there are few offshore islands in County Dublin, this is a limited habitat type within the county

5 MONITORING

The following site monitoring is recommended:

- The permanent monitoring quadrats should be resurveyed in full every 3 years, using the same methodology as for the present survey.
- The condition and extent of the population of *Bryum bornholmense* should be assessed.
- The site should be walked over to identify any new bryophyte habitat that may have formed and any new threats and impacts to bryophyte species and communities should also be recorded and quantified
- The data should be analysed in comparison to the baseline collected in this survey, and, when repeat monitoring, data from the previous monitoring period(s). Based on these analyses, a trend of the habitat quality and suitability for bryophytes should be determined, in order to determine whether habitat suitability for bryophytes is increasing or declining.

6 MANAGEMENT

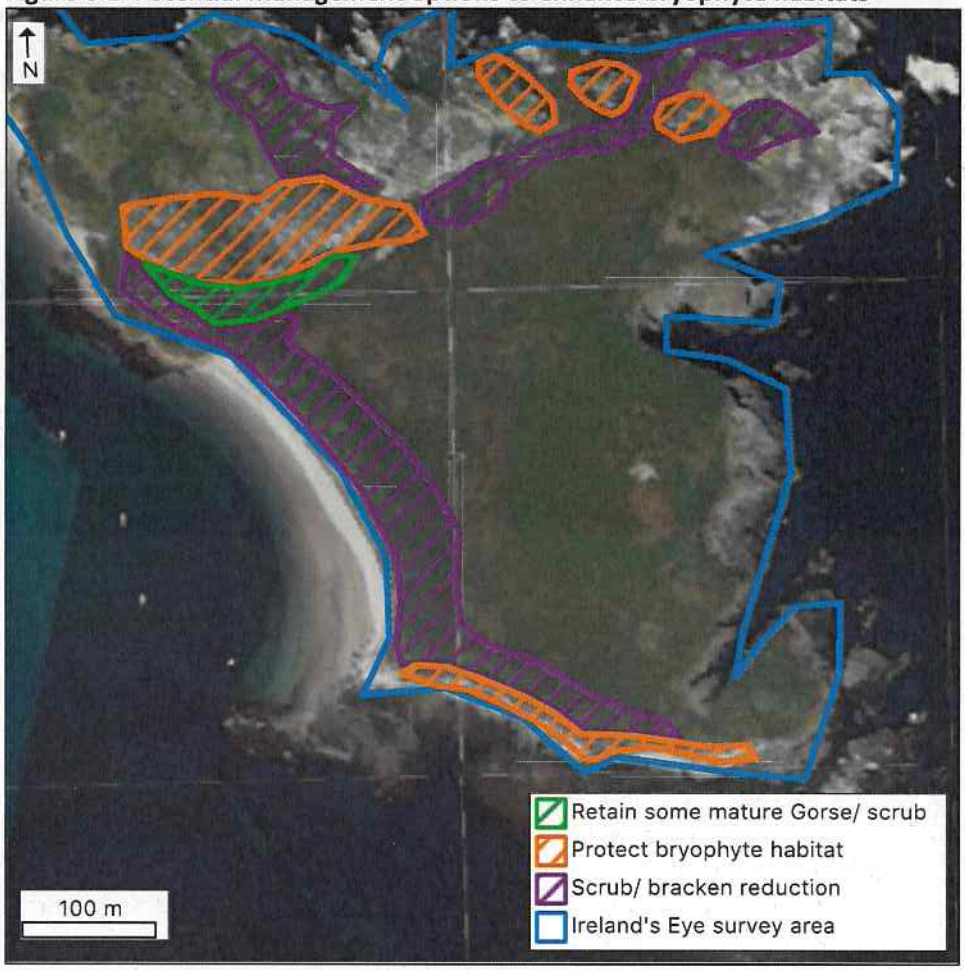
The key management strategy to benefit bryophytes on Ireland's Eye is to ensure that rocky habitats do not become overgrown with vegetation, and that a variety of habitats continue to be present. Openness should be maintained naturally to a certain extent, due to the exposure of the island to the influence of the sea, but attention should be paid to the advance of dense bracken in areas that have been burnt in the past five years. Although it is desirable to maintain some openness, growth of scrub and trees should not be discouraged, as they provide a further important bryophyte habitat.

General management recommendations to enhance the quality of bryophyte habitat at this site are as follows (and shown on Figure 6.1):

- Avoid further burning of the vegetation, to allow what scrub is present to recover and expand.
- Retain existing areas of scrub. Ensure that areas of scrub, particularly the area dominated by elder (*Sambucus nigra*), are retained and encouraged to increase in extent.
- Control the spread of dense bracken. Ensure that dense bracken does not expand into currently open areas, and potentially control and reduce the current area of bracken, as dense bracken does not provide habitat for all but a couple of bryophyte species.
- Maintain small areas of open bare soil, if practicable, to allow the persistence of ruderal bryophytes, in particular *Bryum bornholmense*.
- Minimise disturbance. Ensure that disturbance (e.g. by walkers and by any future development of the path system) is minimised in areas of coastal rocks and soil banks, and ground at the back of the beach, where coastal specialist species grow.
- Grazing. This site would benefit by light to medium grazing by goats and/ or horses as they will reduce the dense heather and gorse and provide additional open habitat. Grazing can be year-round for bryophytes, as they do not have 'seasonal growth' in the same way that vascular plants do. However, it may be that seasonal grazing will be recommended to support other species groups (heathland vascular plants/ birds) and this would also suitable for bryophytes.

The key requirement for optimising the suitability of this site for bryophyte communities is to maintain a diversity of habitats, and ensure that damage caused by burning, expansion of dense bracken areas, or the impact of tourism-related activities do not negatively impact the integrity of the bryophyte assemblages present.

Figure 6.1. Potential management options to enhance bryophyte habitats



REFERENCES

Blockeel, T.L., Bosanquet, S.D.S. Bosanquet, Hill, M.O. and Preston, C.D. (2014). *Atlas of British and Irish bryophytes.* Volume 2. British Bryological Society (Pisces Publications, Newbury).

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Hodgetts, N. and Lockhart, N. (2013) Rare and scarce bryophytes of Ireland. *Field Bryology* 110:12-26.

Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.