

Ireland

Red List No. 8



THE IUCN RED LIST
OF THREATENED SPECIES™

Bryophytes

Mosses, Liverworts & Hornworts





Ireland Red List No. 8:

Bryophytes

Neil Lockhart¹, Nick Hodgetts² and David Holyoak³

¹ National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, 7 Ely Place,
Dublin 2, Ireland

² Cullin Views, 15 Earlish, Portree, Isle of Skye, IV51 9XL, Scotland, UK

³ Quinta da Cachopa, Barcoila, 6100-014 Cabeçudo, Portugal

Citation:

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.

Cover photos: From top: *Pseudocalliergon trifarium*, *Riccia huebeneriana*, *Plagiochila carringtonii*, *Bryum uliginosum*, *Paludella squarrosa* © Neil Lockhart and David Holyoak

Ireland Red List Series Editors: N. Kingston & F. Marnell

© National Parks and Wildlife Service 2012

ISSN 2009-2016

CONTENTS

EXECUTIVE SUMMARY	2
ACKNOWLEDGEMENTS	3
INTRODUCTION	4
Recording of bryophytes in Ireland	4
Legal Protection	5
METHODS AND DATA SOURCES	10
Irish Checklist/Nomenclature	10
Species coverage	10
Geographical coverage	11
Sources of information	11
Regionally determined settings	11
Setting of assessments	14
SUMMARY OF EVALUATIONS.....	15
Interpretation of the Red List	15
Habitats of Red List taxa	16
Life strategies of Red List taxa	20
Reproductive characteristics of Red List taxa	21
<i>Ex situ</i> conservation	24
Conservation priorities	24
FORMAT OF CHECKLIST	26
Description of the columns	26
RED LIST OF IRISH BRYOPHYTES	28
REFERENCES.....	67
APPENDIX 1: SUMMARY OF THE CRITERIA USED TO EVALUATE TAXA.....	70

EXECUTIVE SUMMARY

This report contains the bryophyte checklist and Red List that was published in *Rare and Threatened Bryophytes of Ireland* (Lockhart *et al.* 2012). It covers the island of Ireland. It considers accepted bryophyte records up to the end of 2010 and lists 835 taxa (including species, subspecies and varieties). Threat assessments, using IUCN categories and criteria (IUCN 2001), are applied to the checklist. A cut-off date of 1970 is chosen to represent the threshold between old and recent records. In summary, 195 taxa (24% of the flora) are Red Listed: 40 Regionally Extinct, 23 Critically Endangered, 43 Endangered, 89 Vulnerable; 97 taxa (12%) are Near Threatened; 37 taxa (4%) are Data Deficient and 495 taxa (59%) are Least Concern. Eleven taxa (1%), thought to be introductions of alien origin, are Not Evaluated against IUCN threat criteria.

A high proportion of Red List taxa are saxicolous, growing directly on rocks, but species characteristic of peatlands, heath (including Northern Hepatic mat communities) and coastal systems are also well represented, reflecting threats to these habitats. Metallophytes, an overlooked group found mostly on disused mine sites, are also prominent on the Red List. There appears to be little correlation between bryophyte life strategy (perennial, colonist, short-lived shuttle, etc.) and threat status. A relatively higher proportion of monoicous taxa are represented on the Red List than would otherwise be expected in the flora as a whole.

ACKNOWLEDGEMENTS

Much of the recent research on bryophytes in Ireland has been funded jointly by the National Parks and Wildlife Service and the Northern Ireland Environment Agency. This funding is gratefully acknowledged, along with the hard work of colleagues in both agencies. Thanks are also due to Dr Andy Bleasdale and Dr Ciaran O’Keeffe for their sustained support at NPWS, and to Richard Weyl at NIEA. We are grateful to Christina Campbell for her help with analysis of datasets. Especial thanks are due to *Red List* series editor, Dr Naomi Kingston, for her advice and input to this report.

This work has been underpinned by loans of herbarium specimens from **BBSUK**, **BEL**, **DBN**, **E** and **NMW** for which the respective curators are thanked, as are those at Truro Museum for assistance in receiving some loans. We have also received much help during visits to study material at **BM** and **S**. Recorders of the British Bryological Society have checked many specimens resulting from fieldwork in Ireland carried out over the past decade, principally Tim Blackstock and Gordon Rothero, but also their successors Sam Bosanquet and Tom Blockeel. Access to data from the Biological Records Centre and CEDaR has also been fundamental to our studies. Nick Stewart provided the detailed notes he prepared during earlier work for a Red Data Book covering Irish bryophytes. Donal Synnott allowed use of his detailed typescript catalogue of Irish liverwort records.

Help is acknowledged from many individuals with specimens and provision of information especially: John Blackburn, Sam Bosanquet, Tom Blockeel, Dr Agneta Burton, Dr Joanne Denyer, Prof. Jeff Duckett, Len Ellis, Richard Fisk, Mary Ghullam, Paul Hackney, Clare Heardman, Dr Lars Hedenäs, Dr Mark Hill, Dr Rory Hodd, Geraldine Holyoak, Dr Matthew Jebb, Dr Daniel Kelly, Heribert Köckinger, Dr Jan Kučera, Willem Labeij, Richard Lansdown, Dr David Long, Howard Matcham, Dr Caroline Mhic Daeid, Rosaline Murphy, Dr Fionnuala O’Neill, Dr Angela Newton, Jean Paton MBE, Dr Niklas Pedersen, Dr Philip Perrin, Roy Perry, Dr Peter Pitkin, Ron Porley, Dr Chris Preston, Patrick Reilly, Dr Fred Rumsey, Dr David Rycroft, Prof. Mark Seaward, Dr Noeleen Smyth, Dr Philip Stanley, Dr Georgina Thurgate, Prof. Jiri Váňa, Sally Whyman, Jo Wilbraham and Mark Wright.

INTRODUCTION

Recording of bryophytes in Ireland

An understanding of the history of bryophyte collecting and recording in Ireland is essential in judging the varying accuracy and completeness of past records and the precision (or otherwise) of recorded localities. The validity of any evidence for decline of particular species is of course largely dependent on the completeness and quality of the older records. Details of the early history of bryophyte recording in Ireland are to be found in Stewart & Corry (1888) and Lett (1915), amongst others. More information on recent recording activity up to the end of 2010, the period covered by this Red List, is summarised by Holyoak (2003) and Lockhart *et al.* (2012).

Preparatory work for a Red Data List of bryophytes for Britain and Ireland was carried out during the early 1990s, with much of the data for Ireland being assembled from herbaria and literature by N.F. Stewart. It became apparent as this work progressed that the data from Ireland on rare species were much less complete than those from Britain, so that Ireland was eventually excluded from the published book (Church *et al.* 2001). In 1998, a draft list of species likely to be included in a Red Data List of Irish bryophytes was assembled by Neil Lockhart (NL), based on hectad counts in the *Atlas of the Bryophytes of Britain and Ireland* (Hill *et al.* 1991–1994). This generally comprised those with 12 or fewer modern (post-1950) hectads, initially 295 taxa, but later increased to 325 taxa. This list was then published as the Provisional Red List (Holyoak 2006a).

The evident need for a better inventory of rare and threatened bryophyte species in Ireland led to collaborative research during 1999–2010 by the National Parks and Wildlife Service (NPWS) in the Republic of Ireland and the Northern Ireland Environment Agency (NIEA) in Northern Ireland. Two of the present authors (DTH and NGH) were commissioned to undertake field surveys, with the third author (NL) co-ordinating much of the research. DTH worked at this annually from 1999–2009, NGH annually from 2001–2009. Each spent a substantial part of each year (up to four months, generally between April and October) on bryological fieldwork in Ireland followed by determination and curation of specimens. DTH also carried out extensive additional research on herbarium material and literature in some years; in the meantime NGH contributed to development of a database of Irish bryophyte records at NPWS. All Irish counties were visited during the fieldwork from 1999–2009, the amount of time spent in each of them being approximately in proportion to their richness in uncommon bryophytes.

Fieldwork by 2005 had done much to modify the Provisional Red List: no fewer than 53 taxa were excluded because they had been under-recorded; 24 others were added as additions to the Irish flora; six more were added as newly recognised taxa; and another six were deleted as misidentifications following herbarium research. Thus 27% of the original list had been changed after six years of work (Holyoak 2006a). Evidence of extensive recent losses of Northern Atlantic hepatic mat habitat had suggested by 2005 that some other species which had more than 12 modern (post-1950) hectad records in 1998 may have become seriously threatened, especially *Bazzania pearsonii*, *Mastigophora woodsii*, *Paraleptodontium recurvifolium* and *Scapania ornithopodioides*. It was apparent that these might qualify as additions to the Red List since they

might by then have had fewer than 12 hectad records in Ireland and those populations that remained might be especially vulnerable. They were therefore added to the list of species that were targeted for survey.

In addition to this funded research, significant contributions have also been made by bryologists on visits to Ireland over the past decade, notably by David Long (e.g. Blackstock & Long 2002; Holyoak & Long 2005), Sam Bosanquet and Chris Preston. In 2005, a British Bryological Society (BBS) field meeting based at Derrygonnelly in Co. Fermanagh was organised by DTH, with fieldwork in Cos Fermanagh, Leitrim and Cavan (Holyoak 2006b). Several interesting new finds during the meeting included two of *Schistidium trichodon* new to Ireland. In 2009, a further BBS field meeting (organised by Sam Bosanquet and Chris Preston) visited parts of Co. Cork and Co. Kerry, again resulting in numerous new records, including *Grimmia anomala* new to Ireland (Bosanquet & Preston 2010). The establishment of a local group of the BBS in Dublin by Joanne Denyer has also encouraged a great deal of recording activity in recent years.

The records that lie behind the Red List assessments in this report cover the period to the end of 2010, and are derived from the same dataset used for the Red List as published in *Rare and Threatened Bryophytes of Ireland* (Lockhart *et al.* 2012). A full reassessment of the Red List status of Irish bryophytes should be undertaken in 2020, in line with IUCN guidance (IUCN 2010). An interim assessment to upgrade species based on new records and add species new to the Irish checklist should be carried out in 2015.

Nevertheless, it would be neglectful not to point out the interesting and important new records made in Ireland since the 2010 assessment. Newly-found colonies of some species, most notably *Meesia triquetra* (by Rory Hodd and Caoimhe Muldoon, Sligo, June 2012), are clearly worthy of conservation and therefore need to be pointed out to conservation authorities and others. The need for further recording in Ireland, and evidence that much still remains to be discovered, is demonstrated by the recent finds of *Entosthodon pulchellus* (by Sam Bosanquet at Holycross Abbey, S. Tipperary) and *Dialytrichia mucronata* (by Tom Blockeel at Lough Derg, N. Tipperary), both new to Ireland, in February 2011; *Syntrichia princeps*, *Encalypta ciliata*, *Pogonatum nanum* and *Hamatocaulis vernicosus* (by NGH at Sallagh Braes, Antrim, September 2011); *Southbya tophacea* (by NL at Island Lake, E. Mayo, October 2011); *Ptilidium pulcherrimum* and *Sematophyllum substrumulosum* (by Sam Bosanquet, Antrim, July 2012); *Lophozia perssonii* (by NGH in Kildare) and *Lophozia longidens* (by David Long in Louth), both new to Ireland, in September 2012.

Legal Protection

A number of bryophytes in Ireland have been afforded legal protection under domestic and European law. Species that are protected in the Republic of Ireland, under the Flora (Protection) Order, 1999, are listed in Table 1.

Table 1. Species listed on the Flora (Protection) Order, 1999

Mosses	Liverworts
<i>Bryum calophyllum</i>	<i>Leiocolea gillmanii</i>
<i>Bryum marratii</i>	<i>Leiocolea rutheana</i>
<i>Catocopium nigratum</i>	<i>Petalophyllum ralfsii</i>
<i>Hamatocaulis vernicosus</i> (as <i>Drepanocladus vernicosus</i>)	<i>Plagiochila heterophylla</i> (as <i>P. atlantica</i>)
<i>Leptobarbula berica</i>	
<i>Orthotrichum pallens</i>	
<i>Orthotrichum sprucei</i>	
<i>Orthotrichum stramineum</i>	
<i>Paludella squarrosa</i>	
<i>Tortula wilsonii</i> (as <i>Pottia wilsonii</i>)	
<i>Tetraplodon angustatus</i>	
<i>Tortella inclinata</i>	
<i>Weissia longifolia</i>	
<i>Weissia rostellata</i>	

Under the terms of the Wildlife Act, 1976, as amended by the Wildlife (Amendment) Act, 2000, it is not allowed, other than with a licence granted by the government, to ‘cut, pick, collect, uproot or otherwise take, injure, damage, or destroy any specimen’ of these species; to ‘purchase, sell, keep for sale, transport for sale or exchange, offer for sale or exchange or be in possession of any such specimen whether alive or dead or the flowers, roots, seeds, spores or any part, product or derivative thereof’; or to ‘wilfully alter, damage, destroy or interfere with the habitat or environment’ of any of these species.

The list, of course, reflects the state of knowledge of the Irish bryophyte flora as it was in 1999, and might look somewhat different if the exercise were to be repeated today. *Hamatocaulis vernicosus* and *Petalophyllum ralfsii* were included because both were listed in European legislation. As in other parts of Europe, this listing has led to a great deal of targeted fieldwork on these two species, and it is now known that neither is nearly as rare as was once thought. This is not to minimise their importance, however. *H. vernicosus* is still a rare and very habitat-specific plant in Ireland. Ireland is of global importance for *P. ralfsii*, and some sites support an estimated several million individuals, almost certainly the greatest concentration of large populations of this species in the world.

The Wildlife (Northern Ireland) Order 1985 generally protects plants against unauthorised removal from the wild, although bryophytes are specially protected under this legislation. The Conservation (Nature Habitats, etc.) Regulations (Northern Ireland) 1995 offers special protection to species protected at a European level; *H. vernicosus* and *P. ralfsii*, both of which have been recorded in Northern Ireland. These plants cannot be intentionally picked, uprooted or destroyed, or offered for sale. The Wildlife and Natural Environment Act (Northern Ireland) 2011 offers protection to a wider group of bryophytes including the mosses *Orthotrichum*

sprucei, *Eurhynchiastrum pulchellum* and *Orthodontium gracile* and the liverworts *Leiocolea heterocolpos* and *Petalophyllum ralfsii*.

In addition, the UK Biodiversity Action Plan (UKBAP) contains subsidiary Action Plans for many rare bryophytes in the UK, including some species that occur in Northern Ireland. UKBAP was introduced in 1995, with further species added in 1999. All the species included by that date have UK Action Plans, and conservation action has taken place for them. UKBAP was reviewed in 2007 (Biodiversity Reporting and Information Group 2007), when the bryophyte list was modified extensively and was based on more objective scientific criteria. Species added in 2007 do not yet have individual Action Plans, and individual countries are responsible for any conservation action that they require. UKBAP species that occur (or have occurred) in Northern Ireland are listed in Table 2.

Table 2. UKBAP species in Northern Ireland

Mosses	Liverwort
<i>Atrichum angustatum</i>	<i>Petalophyllum ralfsii</i>
<i>Bryum marratii</i>	
<i>Bryum uliginosum</i>	
<i>Ephemerum spinulosum</i>	
<i>Eurhynchiastrum pulchellum</i> var. <i>diversifolium</i>	
<i>Orthodontium gracile</i>	
<i>Seligeria oelandica</i>	
<i>Tayloria tenuis</i>	
<i>Tortula cuneifolia</i>	

During the preparation of the Northern Ireland Biodiversity Strategy (EHS 2002) an initial list of Northern Ireland Priority Species requiring conservation action was identified. A more comprehensive list of Northern Ireland Priority Species was later published in March 2004. The latest list was published in March 2010 (Table 3) and includes species over and above those which appear on the main UKBAP list. These are species which require conservation action because of their decline, rarity and importance in either an all-Ireland or a UK context, and were arrived at using the draft Irish Red List. The conservation needs for individual species are being addressed through ASSI designation and management, with species requirements met through more general habitat management and additional survey and research where possible. It is intended that this list will be subject to review on an annual basis.

Selection criteria for Northern Ireland Priority Species bryophyte list are:

1. Listed as a UK Priority Species.
2. Rapid decline (2% per year).
3. Decline (1% year) with Northern Ireland being a stronghold consisting of > 50% Irish population or > 20% UK population/range; or with the Irish or UK population restricted to Northern Ireland.

4. Rare (confined to a small population of one or two sites in Northern Ireland) with Northern Ireland being a stronghold consisting of either > 50% Irish population or > 20% UK population/range; or with the Irish or UK population restricted to Northern Ireland.
5. At least 20% of international population of species or well-recognised subspecies occurring in Northern Ireland.
6. Irish Red Data Book (RDB) species classed as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU).

Table 3. Northern Ireland Priority Species (2010 list)

Mosses	Liverworts and hornworts
<i>Abietinella abietina</i>	<i>Anthoceros agrestis</i>
<i>Aulacomnium androgynum</i>	<i>Calypogeia integristipula</i>
<i>Bartramia ithyphylla</i>	<i>Cephalozia pleniceps</i>
<i>Brachydontium trichodes</i>	<i>Cephaloziella rubella</i>
<i>Bryum intermedium</i>	<i>Cladopodiella francisci</i>
<i>Bryum torquescens</i>	<i>Dumortiera hirsuta</i>
<i>Campylopus subulatus</i>	<i>Geocalyx graveolens</i>
<i>Cinclidium stygium</i>	<i>Gymnomitrium concinnum</i>
<i>Daltonia splachnoides</i>	<i>Leiocolea heterocolpos</i>
<i>Dicranodontium asperulum</i>	<i>Marsupella funckii</i>
<i>Encalypta rhaptocarpa</i>	<i>Marsupella sprucei</i>
<i>Ephemerum spinulosum</i>	<i>Metzgeria pubescens</i>
<i>Eurhynchiastrium pulchellum</i> var. <i>diversifolium</i>	<i>Petalophyllum ralfsii</i>
<i>Hedwigia integrifolia</i>	
<i>Myurella julacea</i>	
<i>Orthodontium gracile</i>	
<i>Orthotrichum sprucei</i>	
<i>Philonotis rigida</i>	
<i>Physcomitrium sphaericum</i>	
<i>Pohlia filum</i>	
<i>Pseudocalliergon lycopodioides</i>	
<i>Racomitrium canescens</i>	
<i>Rhabdoweisia fugax</i>	
<i>Rhytidium rugosum</i>	
<i>Schistidium platyphyllum</i>	
<i>Schistidium trichodon</i>	
<i>Seligeria calcarea</i>	
<i>Seligeria oelandica</i>	
<i>Thuidium recognitum</i>	
<i>Tortella inclinata</i>	
<i>Weissia rutilans</i>	

The European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive), which came into force in 1992, lists two bryophytes that occur in Ireland on Annex II b – *Hamatocaulis vernicosus* and *Petalophyllum ralfsii*. This

requires signatory states to designate Special Areas of Conservation (SACs) for the listed species as part of the Natura 2000 network. The Habitats Directive also provides indirect protection for many other bryophytes in Ireland through SAC designation for habitats, such as woodland and bog species. In addition, Annex V of the Directive deals with exploitation and taking from the wild of certain species. Thus, signatory states are required to monitor *Sphagnum*, as a genus, and *Leucobryum glaucum*, both taxa that are exploited commercially, and take measures to protect them if necessary. A review of wildlife trade in Ireland (Ferriss *et al.* 2007) found that although some trade in Annex V plants was noted, it appeared to be low-level and, with one exception, did not involve plants collected in Ireland.

Other EU legislation also helps to enforce measures that will benefit bryophyte conservation, notably that relating to river basin management (Water Framework Directive), water pollution (Nitrates Directive) and the requirement for environmental impact assessments for developments (EIA Directive). International agreements such as the Convention on Biological Diversity (CBD) can greatly assist bryophyte conservation through the requirement of member parties to publish and implement action plans for species. The National Biodiversity Plan (DAHGI 2002, DAHG 2011) for the Republic of Ireland and the Northern Ireland Biodiversity Strategy (EHS 2002) include recommendations to foster all-island species action programmes, including the production of Red Lists, and both were stimulated in response to CBD.

METHODS AND DATA SOURCES

Irish Checklist/Nomenclature

The scientific names adopted follow the *Census Catalogue of the British Bryological Society* (Hill *et al.* 2008) with a very few minor modifications. Scientific names adopted in other modern literature (including Aleffi 2005, Blockeel & Long 1998, Grolle & Long 2000, Hill *et al.* 1991–1994, Konstantinova & Bakalin 2009, Paton 1999, Schumacker & Váňa 2000, 2005, Smith 1978, 1990, 2004), those from key older works (Dixon 1924, Lett 1915, Macvicar 1926, McArdle 1904) and other important literature are listed as synonyms in Lockhart *et al.* (2012). Abbreviations for authors' names follow Brummitt & Powell (1992). Please refer to Lockhart *et al.* (2012) for full details.

Species coverage

With about 835 taxa (species, subspecies and varieties), Ireland has a rich bryophyte flora and supports nearly 48% of the total European flora (Porley *et al.* 2008). The number of instances of bryophytes being established as probable aliens in the Irish flora is surprisingly small. This is possibly because dispersal of spores is so frequent and widespread that it has allowed most species likely to survive in Ireland to reach the island unaided. Among the alien bryophytes, only two mosses have become widespread (*Campylopus introflexus* and *Orthodontium lineare*) and only the first of these is a really common plant. Another moss, *Atrichum crispum*, is more locally established. Three liverworts have become established very locally in semi-natural habitats (*Lophocolea bispinosa*, *L. semiteres*, *Riccia rhenana*), as have two more mosses (*Calyptrochaeta apiculata* and *Henediella stanfordensis*). Four bryophytes closely associated with tree ferns likewise remain highly localised (the liverwort *Heteroscyphus fissistipus*; the mosses *Calomnion complanatum*, *Dicranoloma menziesii*, *Leptotheca gaudichaudii*). Another moss species, *Hypopterygium immigrans*, was recorded in a greenhouse in Monkstown, Co. Dublin, at the end of the 19th century, but never became naturalised in Ireland and has not been seen since (Lett 1904).

The clearest examples of bryophyte species being of alien origin in Ireland, or elsewhere in western Europe, are with taxa from the southern hemisphere, especially where recent rapid spread has been well documented (for *Campylopus introflexus* by Richards & Smith 1975; for *Orthodontium lineare* by Margadant & Meijer 1950, Hedenäs *et al.* 1989; for *Lophocolea semiteres* by Stieperaere 1994, Paton 1999). Since it is much harder to judge whether species that are native nearer at hand are present in Irish localities as a result of accidental introductions, it has usually been tacitly assumed they are not. Nevertheless, some should not be above suspicion, such as *Grimmia orbicularis* or *Schistidium elegantulum* on bridge walls, *Fissidens fontanus* in lake edges visited by anglers, or *Racomitrium canescens* beside paths in dunes. Pearman (2007) used a series of 10 criteria to judge whether vascular plant species are likely to be native or alien, but these criteria are not all useful with bryophytes (which are not cultivated, and mainly lack subfossil records from archaeological sites). Greater reliance is therefore needed on evidence of patterns and rates of spread, which must be judged from patchy recording activity. 'Presence in semi-

natural habitats' seems a poor criterion since some of the bryophytes known to be aliens have colonised the remotest and least altered natural habitats in Ireland, especially *Campylopus introflexus* (although this is a feature also of New Zealand Willowherb *Epilobium brunnescens*). It is thus often impossible to judge from the conditions in which a bryophyte is found whether it arrived from nearby or far away, aided or unaided.

Uncertainties over native and 'alien' status of bryophytes notwithstanding, they are all listed in this checklist. To exclude a few known aliens as unworthy of consideration while ignoring the doubts attaching to the claims to native status of a larger number of other taxa would be arbitrary and unscientific. Furthermore, at least one established bryophyte that is undoubtedly an alien (*Calomnion complanatum* on tree fern 'trunks') merits attention from conservationists because it is regarded as a threatened species in its native Australian range.

Geographical coverage

The Red List for bryophytes is for the whole island of Ireland, a single list for the biogeographic unit being considered the most practical approach for the application of IUCN criteria. Separate lists of species of conservation concern, or species requiring conservation actions, can be compiled from the all-island Red List by the relevant authorities as necessary, taking into account policy factors that may operate differently within the two jurisdictions.

Sources of information

The main data sources used for the compilation of the Red List are described in some detail in *Rare and Threatened Bryophytes of Ireland* (Lockhart *et al.* 2012). In summary, these were: NPWS database, CEDaR database, National Biodiversity Data Centre (NBDC), UK Biological Records Centre (BRC), herbarium material, field records collected during the course of targeted fieldwork from 1999–2009, mainly by DTH and NGH, and recent field records from Chris Preston, Sam Bosanquet and others.

Regionally determined settings

In applying the IUCN criteria, 1970 has been chosen as the cut-off date to represent the threshold between old and recent records. This was essentially a compromise decision. There were strong arguments for having a 1960 threshold (much fieldwork was done in the 1960s, especially in the north, and should therefore be taken into account); or a 1980 threshold (the data would be more current and the landscape of Ireland has changed a great deal since the 1960s, presumably resulting in changes in the bryophyte flora). Using 1970 resulted in a reasonably large all-island dataset of recent records to which the IUCN criteria could be applied.

The IUCN criteria have been applied to all bryophyte taxa reported to occur in Ireland according to the latest checklist (Hill *et al.* 2008). This includes species and infraspecific taxa. The exceptions, which are not included in the evaluation process, are taxa that have been incorrectly reported from Ireland, or with uncertain status in Ireland, invalid or synonymised taxa and those that are thought to be recent introductions.

The Irish Red List of bryophytes consists of taxa in the categories Regionally Extinct, Critically Endangered, Endangered and Vulnerable. Further details on the categories, criteria and guidelines for their use can be found in IUCN (2001, 2003, 2008, 2010).

In order to apply the IUCN criteria in the context of Irish bryophytes the following taxonomic and regionally specific issues were identified:

- **Criterion A** considers percentage decline, regardless of current range or abundance, and has been used very sparingly. For bryophytes, it is often difficult to decide what constitutes a mature individual, or even if an individual can be defined, and so estimates of the size of bryophyte populations are rarely available. It is also difficult to measure the rate of decline of bryophyte taxa from the available data that do exist, because records have so often been made at different times, in different areas, and there has been little systematic monitoring of populations over time. When considering population decline, the use of generation time is a useful concept for bryophytes as it enables decline over a longer time period than 10 years to be used. Hallingbäck *et al.* (1995) advise using a *maximum* of 25 years for one generation (for species that are not known to reproduce sexually), with a sliding scale of 11–25 years for species that reproduce sexually only infrequently, down to 1–5 years for short-lived ephemeral colonists that reproduce frequently with small, highly mobile spores. In other words, a system of life strategies, such as that devised by During (1992), needs to be adopted in order to obtain a broad estimate of generation time.

Subcriterion A1 has not been used here, as there are no taxa for which there is certainty about whether their decline is reversible, understood and ceased. However, subcriteria A2 and A3 allow inferred or suspected decline, and the inference or suspicion can be based on a decline in habitat. This can sometimes be seen only too clearly. Thus, the very specific oceanic wet heath habitat of *Adelanthus lindenbergianus* and *Scapania ornithopodioides* has clearly declined in some areas, so subcriterion A2c can be used to contribute towards their assessment. *Tomentypnum nitens*, although occurring in too many populations to qualify as Vulnerable under other criteria, is known to have been destroyed at several of its localities, so A2c is also appropriate here. Subcriterion A3c has been used for *Aongstroemia longipes* and *Pohlia filum*, as it seems clear that their habitat will deteriorate in the future through natural succession. Subcriterion A4 has not been used, as it requires decline in both the past and the future, a level of detail too specific for bryophytes at our current state of knowledge.

- **Criterion B** is used to categorise taxa that have a restricted distribution and are also declining. Extent of occurrence was at first used sparingly to determine threat category, but the advent of the α -hull method (IUCN 2006) allowed it to be used more extensively. If this shows a significant reduction in extent of occurrence (i.e. range), when old records (pre-1970) were compared with recent records (1970–2010), then clearly the concept is a useful one for determining threat category. However, bryophytes tend naturally to have very wide ranges, often with wide disjunctions between populations, so the concept of extent of occurrence may be less relevant to them as it is to many other species groups. Consequently, subcriteria B1a and B1b

(extent of occurrence) have been used infrequently and with caution. Subcriterion B1c has not been used at all.

Area of occupancy also presents problems of interpretation in this context. It should be measured, according to the IUCN Guidelines, on grid squares 'which are sufficiently small', and which are of appropriate size for the biological aspects of the taxon. This criterion is perhaps more applicable to a mobile animal holding a territory or a home range that can be measured. For a plant, it is either much more difficult to determine the area needed for its survival, or the area might be tiny in comparison. For simplicity, the area of occupancy of the bryophytes considered in this report has been interpreted in terms of hectads, which is the finest resolution attainable with the existing data. Subcriteria B2a and B2b (area of occupancy) have been used extensively.

- The concepts of extreme fluctuation and fragmentation are listed as additional risk factors by IUCN, but these are seldom applicable to most bryophytes, as many species can fluctuate considerably as part of their natural population dynamics, and their distribution naturally appears to be fragmented. The only exception to this generalisation is found in the specialised bryophyte flora that grows in the draw-down zone of reservoirs and similar habitats. Subcriterion B2c has been used for two reservoir species, *Ephemerum cohaerens* and *E. spinulosum*, where their populations could be at risk and subject to extreme fluctuation if water levels are kept artificially high for too long.
- **Criterion C** requires detailed data on both population size and decline, and has not been used at all, since this level of information is not available for Irish bryophytes.
- **Criterion D** identifies very small or restricted populations and is an expression of rarity, inferring that a taxon is threatened by human activities or stochastic events simply because it is rare, without necessarily having declined. Criterion D has been used very sparingly for assigning taxa to the Critically Endangered or Endangered categories, as there is usually no detailed information on population size. However, it has been used in a few cases where it can reasonably be inferred that a population consists of fewer than 50 mature individuals or fewer than 250 mature individuals (depending, of course, on the interpretation of 'an individual'). Subcriterion D2 has been used more extensively for assigning taxa with less than 5 localities to the Vulnerable category.
- **Criterion E** uses quantitative analyses to consider the probability of extinction in the wild. This has not been used at all, as there have been no population viability analyses published on bryophytes in Ireland.

In order to apply the IUCN categories in the context of Irish bryophytes the following regionally specific treatments should be noted:

- **Regionally Extinct (RE).** A taxon is regarded as Regionally Extinct in Ireland if there are no recent (1970–2010) records and all known localities have been visited and surveyed without success. Failure to re-find older records may sometimes just reflect the imprecision of the original locality data or adverse weather conditions during recent survey visits, or simply that certain taxa occur sporadically and are inherently difficult

to find. It is possible therefore that some Regionally Extinct taxa may persist in Ireland, albeit at a relatively low frequency, and might yet turn up at some future date. An effort has been made, however, to distinguish between taxa that have probably genuinely disappeared and those that may still occur, the latter being placed in the Data Deficient category.

- Near Threatened (NT). A taxon is regarded as close to qualifying for a threatened category in Ireland if it occurs in 6–12 hectads (1970–2010) but has not declined; or < 20 hectads (1970–2010) and has declined.
- Data Deficient (DD). A taxon is regarded as Data Deficient in Ireland if it is thought likely that future research will show that a threatened classification is appropriate and that it will be included in the Red List at some stage.
- Least Concern (LC). A taxon is regarded as Least Concern in Ireland if it occurs in > 20 hectads (1970–2010); or 13–19 hectads (1970–2010) and shows no decline.
- Not Evaluated (NE). A taxon is regarded as Not Evaluated in Ireland if it has not been confirmed in the Irish list; if it is treated as a synonym in the latest checklist (Hill *et al.* 2008); or if it is considered to be an introduction and therefore not part of the native Irish flora (see Table 4).

Table 4. Taxa included in the Irish checklist that were Not Evaluated.

Species	Reason for non assessment
Liverworts	
<i>Heteroscyphus fissistipus</i>	Alien introduction
<i>Lophocolea bispinosa</i>	Alien introduction
<i>Lophocolea semiteres</i>	Alien introduction
<i>Riccia rhenana</i>	Probable alien introduction
Mosses	
<i>Atrichum crispum</i>	Probable alien introduction
<i>Calomnion complanatum</i>	Alien introduction
<i>Calyptrochaeta apiculata</i>	Alien introduction
<i>Dicranoloma menziesii</i>	Alien introduction
<i>Henediella stanfordensis</i>	Alien introduction
<i>Hypopterygium immigrans</i>	Alien introduction (probably extinct)
<i>Leptotheca gaudichaudii</i> var. <i>gaudichaudii</i>	Alien introduction

Setting of assessments

The Red List was compiled by NGH, with comments and inputs from DTH and NL. The completed list was then circulated for consideration and acceptance to Richard Weyl (NIEA) and to the Conservation and Recording Committee of the British Bryological Society, and was subsequently finalised in December 2010.

SUMMARY OF EVALUATIONS

The number of taxa in each threat category is summarised in Table 5 and in the pie chart below.

Table 5. Summary of the number of taxa in each threat category in Ireland.

	RE	CR	EN	VU	NT	DD	LC	NE	Total
Liverworts	5	4	13	25	28	9	151	4	239
Mosses	35	19	30	64	69	28	344	7	596
Total	40	23	43	89	97	37	495	11	835

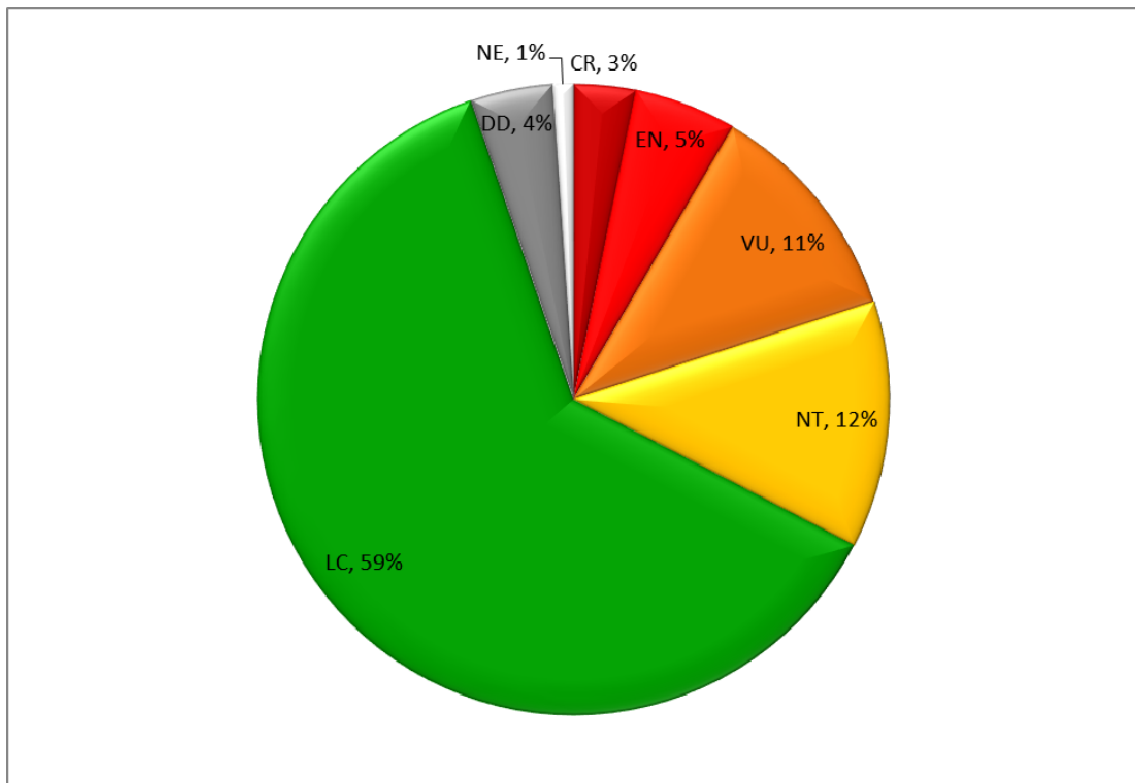


Figure 1. The percentage of bryophyte taxa in each of the IUCN categories in this assessment.

Interpretation of the Red List

There are a large number of taxa that are considered Regionally Extinct; five liverworts and 35 mosses. An effort has been made to distinguish between taxa that have probably genuinely disappeared and those that may still occur, the latter being placed in the Data Deficient category. Nevertheless, it is possible that a number of Regionally Extinct taxa do still occur in Ireland, perhaps at a very low frequency, but have not been detected because of the generally low level of field recording in Ireland over recent decades.

Some Regionally Extinct taxa may have been temporary colonists in Ireland, although in the absence of data this is obviously only a speculative inference. These include: *Grimmia crinita*, a thermophilous species found mainly in Mediterranean countries, where it grows on calcareous

sandstone and weathered mortar-covered walls; *Buxbaumia aphylla*, a colonist of soil and rotting wood that is rare and often ephemeral in its occurrence elsewhere in Europe; and *Bryum turbinatum*, a short-lived colonist of damp sandy or gravelly soils. These species may have been transient in Ireland, coming in from outside as spores, establishing themselves on a small patch of suitable habitat, then disappearing possibly without forming a permanent population.

The disappearance of some other taxa is closely linked to the loss of their habitat in Ireland and their listing as Regionally Extinct can be made with a greater degree of certainty. The community of mosses that used to grow on mud-capped walls, which includes *Aloina rigida*, *Microbryum curvicolium*, *Pterygoneurum ovatum*, *P. lamellatum* and *Tortula vahliana*, has almost certainly disappeared in Ireland, although some of these could recolonise in chalk or gravel pits from the chance arrival and establishment of spores. The loss of *Dicranum undulatum* from midland raised bogs is almost certainly due to damage to its habitat by industrial-scale peat extraction. Species of rotting wood, such as *Anastrophyllum hellerianum* and *Calypogeia suecica*, may have been lost due to a decline in the availability of suitable niches, reflecting changes in woodland management practices, but these species might have been overlooked, despite recent efforts to refine them.

The reasons for the apparent disappearance of other taxa in the Regionally Extinct list remain mysterious. They are mostly plants that were always rare in Ireland, and therefore prone to stochastic events such as the destruction of small populations at individual sites or over-collecting by botanists. These include several taxa that have only ever been recorded on a single occasion from Ireland: *Myurium hochstetteri*, *Pohlia proligera*, *Rhytidiadelphus subpinnatus*, *Tortula protobryoides*, *Eurhynchiastrum pulchellum* var. *diversifolium*, and a group from Benbulbin and Gleniff, Cos Sligo and Leitrim: *Barbilophozia kunzeana*, *Conardia compacta* and *Didymodon icmadophilus*. But why should *Bartramia halleriana* or *Targionia hypophylla*, both recorded from several localities and neither of them unique to obviously threatened habitats, have become extinct? Does long-term climate change have a part to play here? And why are there fewer liverworts than would be expected in the Regionally Extinct list, compared to the number of mosses? There is much we simply do not know.

Habitats of Red List taxa

Many of the taxa on the Red List are threatened because of changes in habitat conditions. The internationally important Northern Atlantic hepatic mat community of upland corries in the west has been severely affected by the impacts of overstocking with sheep; riverine species have been affected by canalisation of watercourses, channel maintenance and pollution locally, and many of the Irish bogs have been very severely damaged or destroyed by drainage, afforestation and peat extraction. How these changes are reflected in the Red List can be seen by examining the principal habitats and substrates in which the taxa are usually found. Table 6 is a simplified representation, combining both the substrate on which a taxon occurs, such as rock, rotting wood or soil, with the major habitat types, such as dune, fen or woodland. Whereas substrates may be relatively unimportant for most vascular plants, most of which are rooted in soil, they are much more relevant to the ecology of a poikilohydrous group such as the

bryophytes. More detail on bryophyte habitats is provided by Hill *et al.* (2007), who list Ellenberg indicator values and EUNIS habitat classes for all bryophyte taxa.

Table 6. Habitats of the Red List taxa. Note that several taxa are characteristic of more than one habitat, so the totals do not correspond with the numbers by threat category listed in Table 5.

Habitat	RE	CR	EN	VU	Total
Non-calcareous rock (upland)	4	5	5	11	25
Calcareous rock (upland)	8	4	2	10	24
Bare ground	4	1	3	10	18
Calcareous rock (other)	3	1	2	9	15
Riverine	2	1	3	7	13
Dunes	0	0	7	4	11
Oceanic peatland/rocks	1	1	3	6	11
Fen	1	1	2	6	10
Calcareous soil/mud wall tops	6	1	1	1	9
Metalliferous	0	2	3	4	9
Woodland	1	1	1	6	9
Epiphytic	2	2	3	1	8
Bog	2	0	0	5	7
Coastal turf	1	2	2	2	7
Non-calcareous rock (other)	1	1	1	4	7
Non-calcareous soil/banks	1	0	1	5	7
Peaty banks	1	1	3	1	6
Arctic-alpine	1	0	1	2	4
Rotting wood	2	0	1	1	4
Reservoir margins	0	0	1	2	3
Wet ground	1	0	1	0	2
Organic detritus	1	0	0	0	1

A high proportion of the Red List taxa are saxicolous, growing directly on rocks. Of these, many are naturally rare montane plants; their potential habitat is very limited in extent, and many of the best places for them are protected through SAC, NHA, ASSI or National Park designations. This does not mean that they are not threatened, however. Some of the populations are so small that they might easily be extirpated by a single event. *Gymnomitrium corallioides*, for example, may already have been eliminated in Kerry by botanical collection; *Encalypta ciliata* and *Cynodontium jenneri* could easily succumb if conifers happened to be planted on their sites (both of which are just outside protected areas); *Leiocolea heterocolpos* could be severely compromised if careless path and boardwalk maintenance work were to dislodge it from its substrate. Many more upland saxicolous plants are placed in the sub-Red List category Near Threatened: rare and susceptible, but not really subject to any specific threats (other than, perhaps, climate change), and therefore not appropriately placed in any of the Red List categories.

General physical damage and nutrient enrichment from overstocking is also a significant threat to most of the upland taxa. Those that occur in rock crevices are relatively protected by their sheltered situation, as can be seen at Annacoona, Co. Sligo, but their spread and ultimate

viability as healthy populations must be severely restricted by the activities of sheep. Much more serious is the effect that overstocking has had on the non-saxicolous taxa, notably those in the Northern Atlantic hepatic mat community. Their habitat has been more or less damaged throughout Ireland, but almost completely destroyed in Connemara, where the cover of heather-dominated heath has been removed entirely in many places.

Lowland saxicolous taxa can be even more threatened than those in the uplands, simply because there is more development pressure to contend with, including housing projects and quarrying. Perhaps surprisingly, then, there are relatively few lowland saxicolous taxa on the Red List. A possible explanation is that many of these plants find a secondary habitat on walls and can persist even in the absence of natural rock outcrops. Old walls are now a threatened habitat in their own right and Irish populations of species such as *Grimmia orbicularis* are entirely dependent on walls.

A high proportion of the most threatened bryophytes grow in ruderal habitats, but it is not immediately obvious why this should be the case. Firstly, a high proportion of all bryophytes grow in ruderal habitats, so it is likely that some of these will be threatened; secondly, it may be that the nature of 'bare ground' has changed, and that most bare ground is no longer suitable for some bryophytes. Thus, formerly widespread bare ground, such as second-year stubble in arable fields or skeletal turf in species-rich limestone grassland, is now relatively rare in Ireland, whereas extremely short-lived bare ground that quickly becomes colonised by vigorous and nutrient-demanding plants is quite common. The latter is widely promoted by a combination of frequent disturbance and nutrient enrichment, both features of the modern countryside, and is usually the substrate for only a small number of common bryophytes, such as *Bryum argenteum*, *B. dichotomum*, *Ceratodon purpureus*, *Funaria hygrometrica* and common species of *Barbula* and *Didymodon*. Rare (or, in Ireland, Regionally Extinct) species such as *Acaulon muticum*, *Microbryum curvicolium* and *Tortula protobryoides* are presumably unable to compete successfully against the more vigorous species except in very specific conditions which are, by and large, not yet fully understood.

Several bog bryophytes have declined because their habitat has been destroyed, or severely damaged, through exploitation for agriculture, forestry and energy resources. One of the most beautiful, *Dicranum undulatum*, is apparently extinct, and many of the tiny liverworts (*Cephalozia* spp., *Cephaloziella* spp.) that are confined to the wettest parts of raised bogs are well represented on the Red List. Fen bryophytes are also well represented, with several taxa severely threatened and reduced to just small populations (*Paludella squarrosa*, *Leiocolea rutheana* var. *rutheana*, *Pseudocalliergon trifarium*). Fossil remains of bryophytes preserved in peat show that fen habitat has declined in extent over a long period since the late-glacial in Ireland (Dickson 1973). The last remaining fragments of fen, along with their specialised bryophytes, are a high priority for conservation.

The prominence of coastal taxa in the Red List reflects both the loss of bryophyte habitat in coastal dune systems, often due to leisure developments (including golf courses), and the ongoing threats posed by inappropriate grazing regimes (both overgrazing and undergrazing), water abstraction and drainage, coastal protection works and over-stabilisation. Several species

of *Bryum*, notably *B. calophyllum*, *B. intermedium*, *B. uliginosum* and *B. warneum*, are especially sensitive to changes in habitat conditions and their survival will also depend on the maintenance of dynamic dune and machair systems.

Maritime clifftop grassland was overlooked as an important habitat for bryophytes in Ireland until relatively recently. Extensive survey on southern coasts has revealed that *Tortula viridifolia* is widespread in this habitat, but that a number of others are much rarer and probably in decline, including *T. atrovirens* and *Scleropodium touretii*, and that *Tortula cuneifolia* may even have disappeared. This is a habitat that has become threatened almost without being noticed, as agricultural land has squeezed it into an ever-narrowing band at the top of sea cliffs. The tiny strips that remain are vulnerable to nutrient enrichment, especially from dog faeces, and scrub encroachment through undergrazing. The best sites need to be taken into conservation management, and bryophyte conservation requirements should be integrated into wider conservation plans for the coastline.

The distribution of metallophyte bryophytes in Ireland was also poorly understood until recently, but several old mine workings are now known to be important habitats for several of these globally threatened taxa, notably *Ditrichum cornubicum*, *D. plumbicola*, *Cephaloziella massalongi* and *C. nicholsonii*. The challenge here lies in integrating the bryophyte conservation requirements with the preservation of industrial archaeology at old mine sites. Such sites are important for their social and industrial history, but also as hotspots of biodiversity, and should be presented as such in any future restoration works.

Quite a large number of Red List taxa can be put in a category that can broadly be defined as riverine. A few of these are upland plants of mountain streams (*Hygrohypnum duriusculum*, *Bryum riparium*), but most occur in the lowlands and are under varying degrees of threat from drainage, canalisation, inappropriate riverbank management, pollution and conifer afforestation. Changes to flow regimes, especially by arterial drainage of the main lowland river systems over recent decades, and the subsequent loss of suitable niches and substrates for bryophytes, has undoubtedly had an impact on riverine bryophytes. Species such as *Orthotrichum sprucei*, which occur on silt-encrusted tree trunks, roots and rocks, require regular inundation through flooding. Ephemeral bryophytes such as *Ephemerum crassinervium* subsp. *rutheanum* also depend on the availability of temporarily exposed and regularly flooded substrates on riverbanks (and lake shores). Several species of *Fissidens* are represented on the Red List because they require small niches by rivers that can only be provided if the riverbank structure is allowed to develop naturally. Management with minimal intervention is suitable for these plants, allowing a natural riverbank vegetation structure to develop, with tangles of riverside trees and swamp woodland, wet vegetated banks and plenty of rocks.

Although there are few bryophytes in the Red List that are strictly woodland plants, there are several that grow as epiphytes on trees and others that grow mainly on dead, rotting timber. The rare epiphytes are largely plants of woodland edges or isolated trees that require good illumination to thrive, such as *Orthotrichum pallens* and *O. stramineum*. Although most of these plants are capable of dispersing efficiently through the production of spores, they are often very substrate-specific and individual plants are short-lived, so they require a continuity of suitable

habitat spread over as large an area as possible. Wayside trees and clumps of elder are good substrates, and these are often removed without a second thought if they obstruct projects such as housing developments or road-widening.

Species of the oceanic west feature in the Red List, but perhaps not as greatly as might be expected. Many of these species, while globally rare, are relatively frequent in parts of western Ireland, and relatively secure in remote ravines or on mountains. This is not always the case, however, and some of the oceanic species, such as *Acrobolbus wilsonii*, *Lejeunea mandonii* and *Plagiochila heterophylla*, are so rare and grow in such small quantity that they have to be regarded as threatened.

Life strategies of Red List taxa

It is important to take the differing life strategies of the Red List taxa into account when considering how to conserve them, although other aspects of population biology (e.g. competition and niche breadth) and habitat characters are also clearly relevant. During (1992) devised a classification system of bryophyte life strategies based on sexual reproductive performance, spore size and longevity of individuals. The categories of bryophyte life strategy he coined are:

- *Fugitives*: annual taxa producing many small (< 20 µm) spores
- *Colonists*: short-lived taxa producing many small (< 20 µm) spores
- *Perennial stayers*: long-lived taxa producing many small (< 20 µm) spores
- *Annual shuttles*: annual taxa producing few large (> 20 µm) spores
- *Short-lived shuttles*: short-lived taxa producing few large (> 20 µm) spores
- *Long-lived shuttles*: long-lived taxa producing few large (> 20 µm) spores
- *Dominants*: potentially very long-lived taxa producing few large (> 20 µm) spores

Fugitives and colonists tend to be highly mobile taxa, coming and going as habitat becomes available in different places. Perennial stayers tend to be competitive, stress-tolerant taxa that nevertheless may have the potential to colonise elsewhere. Shuttle taxa tend to reoccur at or near the same place, as suitable conditions recur regularly (e.g. arable weeds, reservoir bryophytes, etc.).

The system developed by During (1992) provides a convenient framework for analyses, although one of the principal conclusions of Longton (1997) was that 'the strategies should be regarded as nodes within a continuous array of reticulate variation rather than as discrete entities'. Using this system, and developing it by adding asexual reproductive performance and size of asexual propagules, all taxa on the Irish bryophyte list have been allocated a life strategy (Table 7). No attempt has been made here to apply statistical analyses to this dataset, and the system is still somewhat oversimplified, but it is sufficient to give a crude indication of bryophyte life strategies and their relationships to threat status. The table shows that although a slightly higher proportion of Red List taxa have perennial, colonist and short-lived shuttle strategies, the percentage figures are overall quite similar for Red List taxa and for the flora as a whole, suggesting that there is little correlation between bryophyte life strategy and threat status. The Regionally Extinct list contains a higher proportion of colonist and annual shuttle

taxa than the flora as a whole, but this might just reflect the relatively high number of taxa with these life strategies that may have been affected by the demise of mud-capped wall habitat in Ireland.

Table 7. Life strategies of Irish bryophytes. Note that many taxa have been allocated more than one life strategy: these taxa are capable of behaving in different ways in different conditions. The total percentages in each column do not always add up to exactly 100 because of the effects of rounding up or down. Raw data for this table were taken from BRYOATT (Hill *et al.* 2007).

Life strategy	% of all taxa on Irish list	% of Red List, NT & DD taxa	% of Red List taxa	RE	CR	EN	VU
Perennial	18.9	22.5	22.6	17.5	21.7	27.9	22.5
Colonist	12.4	14.6	15.4	22.5	8.7	20.9	11.2
Short-lived shuttle	11.4	11.9	13.8	10.0	21.7	18.6	11.2
Long-lived shuttle	10.0	11.6	9.2	12.5	0	7.0	11.2
Colonist/perennial	13.3	10.3	6.2	2.5	8.7	2.3	9.0
Short-lived shuttle/long-lived shuttle	4.8	6.1	8.7	5.0	13.0	11.6	7.9
Short-lived shuttle/colonist	5.4	5.5	6.2	5.0	8.7	2.3	7.9
Annual shuttle	2.5	4.3	3.6	10.0	0	2.3	2.2
Annual shuttle/short-lived shuttle	4.8	4.0	4.1	2.5	8.7	4.7	3.4
Fugitive/annual shuttle	0.1	0.3	0.5	2.5	0	0	0
Long-lived shuttle/dominant	3.7	3.0	2.6	2.5	0	0	4.5
Long-lived shuttle/perennial	2.5	1.8	3.1	0	8.7	0	4.5
Fugitive/colonist	1.2	1.2	1.0	2.5	0	0	1.1
Short-lived shuttle/long-lived shuttle/colonist	0.5	0.9	1.5	2.5	0	2.3	1.1
Colonist/short-lived shuttle/perennial	0.5	0.9	0	0	0	0	0
Short-lived shuttle/perennial	0.1	0.3	0.5	0	0	0	1.1
Colonist/long-lived shuttle	3.2	0.3	0	0	0	0	0
Colonist/long-lived shuttle/perennial	1.0	0.3	0.5	2.5	0	0	0
Fugitive/colonist/annual shuttle/short-lived shuttle	1.7	0	0	0	0	0	0
Fugitive	0.6	0.6	0.5	0	0	0	1.1

* - Red List includes RE, CR, EN & VU taxa

Reproductive characteristics of Red List taxa

Sexual reproduction is also an important feature for bryophyte survival since it produces both diaspores for dispersal in time and space, and genetic variation (Longton 1994, Söderström & During 2005). Although statistical analyses have not yet been applied to the Irish dataset, a summary list of the sexual reproductive characteristics of Irish bryophytes (Table 8) suggests that a relatively higher proportion of monoicous taxa may be on the Red List than would otherwise be expected in the flora as a whole. Longton (1992) and Laaka-Lindberg *et al.* (2000)

observed a similar trend for monoicous taxa in relation to rarity; a higher proportion of monoicous taxa are rare in the British bryophyte flora compared to dioicous taxa. They also noted that monoicous taxa tend to produce sporophytes more often than dioicous taxa, and that rarity and failure to produce sporophytes are strongly associated, both in Britain (Longton 1992, Laaka-Lindberg *et al.* 2000) and at a world level (Longton & Schuster 1983). These latter traits are also hinted at in Table 8, where the Red List has a slightly higher proportion of taxa that produce sporophytes abundantly, a characteristic that may be linked to the high proportion of monoicous taxa on the Red List, and a higher proportion of taxa that are not known to produce sporophytes at all.

The relationship between threat status and rarity is complex, but the similarity between the reproductive characteristics of Red List taxa and rare taxa is partly to be expected, given that a high proportion of all threatened taxa are also rare. Söderström and During (2005) observed that not all rare species are threatened and that natural rarity should be distinguished from human-induced rarity, with species that are rare for the latter reason being regarded as threatened. They hypothesised that most naturally rare species are habitat limited, but that at least some naturally rare species may be dispersal limited, particularly those characterised by a long-lived bank of large spores or asexual propagules in the soil.

Table 8. Sexual reproductive characteristics of Irish bryophytes. The total percentages do not always add up to exactly 100 because of the effects of rounding up or down. The raw data for this table were taken from BRYOATT (Hill *et al.* 2007).

	% of all taxa on Irish list	% of Red List, NT & DD taxa	% of Red List taxa	RE	CR	EN	VU
Dioicous	58.9	50.5	50.8	52.5	52.2	51.2	49.4
Monoicous	37.1	45.0	46.2	45.0	47.8	41.9	48.3
Monoicous or dioicous	2.8	3.3	2.1	2.5	0	2.3	2.2
Sexuality not known	1.0	1.5	1.0	0	0	4.7	0
Sporophytes abundant	25.1	29.2	30.8	35.0	43.5	27.9	27.0
Sporophytes frequent	19.5	15.8	12.3	15.0	4.3	14.0	12.4
Sporophytes occasional	14.1	7.6	6.7	5.0	8.7	11.6	4.5
Sporophytes rare	25.5	25.8	24.1	17.5	21.7	27.9	25.8
Sporophytes unknown in Ireland	15.6	21.9	26.7	27.5	21.7	18.6	31.5

* - Red List includes RE, CR, EN & VU taxa

Different life strategies and reproductive behaviour in bryophytes may require different sorts of conservation action. Fugitive and colonist taxa are likely to exist as metapopulations (Gilpin &

Hanski 1991), with individual populations short-lived, producing sporophytes and moving on to new habitat elsewhere (Söderström & Herben 1997). Thus, many of these taxa rely on a continual turnover of habitat over the whole, or part, of their potential geographical distribution (or 'extent of occurrence'). Protected areas may not be the best way to address the conservation of these plants, unless such areas are at a landscape scale.

The ability of bryophytes to colonise through spore dispersal is limited by their diminutive size and even those taxa with relatively small spores tend to deposit many of them close to the parent plant (Miles & Longton 1987, Söderström & Jonsson 1989). Epiphytic species of *Orthotrichum*, for example, form short-lived tufts and produce small spores regularly and are therefore defined as colonists. Many spores, despite their small size, almost certainly land very close to the parent plants and develop into new plants on the same tree; other spores are blown further afield, but have a better chance of establishing new plants if there is a substantial local area of suitable substrate (e.g. willows in swamp woodland). The further away from the parent plant the spores travel, the less likelihood there is of finding suitable habitat. Taxa that rely almost entirely on long-distance spore dispersal (e.g. *Funaria hygrometrica*) have to produce vast quantities of spores and be capable of establishing and growing in habitats that are widespread and common.

Shuttle taxa invest a lot of energy in reproductive effort but a high proportion of their propagules, being relatively large, tend to fall close to the parent plants. These taxa therefore require a constant or reappearing habitat within a small area, and the designation of protected areas may be very suitable for their conservation, provided they are managed in such a way as to ensure continuity of habitat or continuity of the processes that lead to the habitat reappearing regularly.

Arable weed taxa comprise an interesting subset of the flora in that most of them are annual or short-lived, and capable of behaving as annual or short-lived shuttle taxa (reproducing locally through relatively large gemmae, bulbils or rhizoidal tubers), and also producing spores regularly, allowing them to move away and colonise elsewhere. The various reproductive structures produced by these plants are also probably quite long-lived, surviving as diaspore banks in the soil (Bisang 1996, During 1997). On the face of it, therefore, the rare arable weeds would appear to be the best-equipped to survive with little or no targeted conservation effort, and indeed all the plants with this multiple life strategy fall into the Least Concern category. On the other hand, their survival depends on the right sort of arable field management. Too little disturbance of the soil and more competitive taxa take over; too much and they cannot complete their life cycles. The ideal management for these plants is the sort of arable farming that permits overwintering stubble, and leaves 'conservation headlands' and uncultivated field margins (Porley 2008).

Perennial stayers and dominants are the taxa most suited to the 'nature reserve treatment', as they require a habitat that is more or less stable, in terms of both its quality and extent. The most obvious examples of these are the large liverworts of the Northern Atlantic hepatic mat community, which seldom, if ever, produce either spores or vegetative propagules and must rely on the relatively inefficient process of fragmentation for their dispersal. Protection and

management of the best sites for this internationally important community is highly appropriate. Most of the sites are in remote NE-facing corries in the mountains, so all that might need to be done is to leave them alone and not impose excessive grazing regimes. Many of the sites are now protected for habitat reasons by SAC designations.

Ex situ conservation

The most effective means of conserving the bryophyte flora is *in situ*; retaining and managing areas of habitat so that the populations can survive, breed and disperse. *Ex situ* conservation involves taking plants out of their natural habitat and trying to grow them in garden, greenhouse or laboratory conditions. It is considered a useful adjunct to *in situ* conservation, but in no way an alternative to it. It can include, for example, breeding and 'bulking up' rare taxa for eventual reintroduction, long-term storage of cryogenically frozen plants and spores as a backstop against their disappearance in the wild, and providing a reservoir of genetic material for species that have become extinct in the wild. *Ex situ* conservation undoubtedly raises some profound practical and philosophical questions. What is the point of conserving plants divorced from their natural habitat? Is it possible to preserve in an *ex situ* population the full range of genetic variation that might be required in future? How do you grow bryophytes?

The *ex situ* conservation of rare Irish bryophytes is under investigation at the National Botanic Gardens, Glasnevin, Dublin, in partnership with the Royal Botanic Gardens, Kew, London, where much pioneering work has taken place, and a number of co-workers in continental Europe. It may well prove to be an important tool in the conservation of the Irish bryophyte flora.

Conservation priorities

Traditionally, conservation effort has been directed towards species and habitats that are rare and threatened on a country basis. This is perfectly understandable, and in many ways both sensible and effective. The Red List is a tool for determining which species are threatened in a specific geographical area, in this case bryophytes in Ireland. However, it is only one of several tools that can be employed for assessing where most conservation effort should be directed, and should not be used in isolation. While *Barbilophozia barbata* may be Critically Endangered in Ireland, there is plenty of it in Britain and continental Europe. To what extent does it actually matter if this species, which is probably at the edge of its range here, becomes Regionally Extinct in Ireland? On the other hand, *Campylopus setifolius*, which is Least Concern in Ireland, is considered a rare European endemic. As well as conserving species that are rare and threatened in Ireland, there is an international responsibility to conserve those species and habitats which may not be particularly rare or threatened in Ireland, but for which Ireland has a large proportion of the global resource.

We must certainly try to take care of, say, *Paludella squarrosa*, a plant that is relatively common in Scandinavia, because its presence here may have wider phylogeographical significance; it might be genetically distinct from its continental cousins, and it is indicative of, and integral to, a very special and diverse part of Ireland's natural heritage. However, effort and resources

should also be put into the conservation of features that are relatively common here but extremely rare globally. These are nearly all habitats and plant communities that occur in Ireland because of its oceanic position and for which Ireland has a special responsibility to conserve: the Atlantic communities of large liverworts in wet heath in the hills; the remaining stands of Atlantic woodland; the now damaged and restricted remnants of the midland bogs; the dune slack and machair communities of the west coast; the unique bryophyte assemblages to be found in the Dartry Mountains. All of these habitats and plant communities are under pressure and threat from human influences.

To summarise, to determine conservation priorities, it is necessary to employ as much information as possible. One source is the regional Red List; others may include international Red Lists, information about species and habitat distribution globally, and information about global threats and trends to species and habitats. Conservation efforts for bryophytes should aim to address those species that are already declining and scarce, as well as those assemblages of species that are more common but for which Ireland holds a special responsibility.

FORMAT OF CHECKLIST

This section gives brief notes on all the Irish bryophytes (with the exception of those taxa identified in Table 4). More detailed information on Red List (RE, CR, EN or VU), NT and DD taxa, especially relating to identification, distribution in Ireland, protected sites, ecology and biology, is given in Lockhart *et al.* (2012).

Description of the columns

Group: Hornwort (H), liverwort (L) or moss (M).

Taxon name: Accepted taxon name, mostly follows British Bryological Society *Census Catalogue* (Hill *et al.* 2008). Additions are marked under 'Notes'.

Scientific authority: Mostly follows British Bryological Society *Census Catalogue* (Hill *et al.* 2008). Additions are marked under 'Notes'.

Threat Category (Ireland): Follows IUCN 2001. Further information about the application of the categories and criteria in the regional context are described above.

Criteria: Follows IUCN 2001, 2003, 2008, 2010. Further information about the application of the categories and criteria in the regional context are described above. Key: RE – Regionally Extinct; EN – Endangered; VU – Vulnerable; NT – Near Threatened; LC – Least Concern; DD – Data Deficient; NE – Not Evaluated.

Threat Status (Europe): If a taxon is given a status on the ECCB website <http://www.bio.ntnu.no/users/soder/ECCB/RDBTaxon.php> (Feb 2010), it is marked with an asterisk (*); otherwise threat status is according to the published *Red Data Book of European Bryophytes* (ECCB 1995), which used the old IUCN threat criteria (IUCN 1978). The European Red List is now well out of date, and this applies even to species given a status on the website. It is in urgent need of revision. Some species have not been evaluated in Europe, including recently described species, recently synonymised species and introduced species. Varieties have not been evaluated in Europe (or taxa that were considered varieties in 1995). Those species (the great majority) that have not been assigned a threat status in Europe are assumed to be Least Concern. 'Endemic' means endemic to Europe and Macaronesia.

Special Responsibility: The proportion of the global population of species in Ireland is unknown in most, if not all cases. There are no endemic bryophyte species to Ireland, but some are thought to have their main centre of distribution here. Taxa for which Ireland may have special responsibility are noted, and are defined here as those considered threatened or endemic in Europe (ECCB 1995); or Red Listed, Near Threatened or Data Deficient in Ireland with Oceanic/Hyperoceanic distributions in Europe (Hill *et al.* 2007); or with occurrence in Ireland but not in Britain (Hill *et al.* 2007).

Notes: Notes that may be relevant to interpreting global distribution (and significance of Irish populations) are given where appropriate. 'NI only' distribution refers to distribution within Ireland. Additions to the names used in Hill *et al.* 2008 are also marked here as "Not in CC".

Current Protection Status in Ireland: Lists legal status: Flora (Protection) Order, 1999; Priority Species Northern Ireland; UKBAP species; EU Habitats Directive Annex II or V, with the number of SAC designated for the species in square brackets.

Research Needed: An attempt has been made to link the categories listed by IUCN (<http://www.iucnredlist.org/technical-documents/classification-schemes/research-needed-classification-scheme-ver2>) to those identified in *Rare and Threatened Bryophytes of Ireland* (Lockhart *et al.* 2012).

Conservation Actions Needed: An attempt has been made to link the categories listed by IUCN (<http://www.iucnredlist.org/technical-documents/classification-schemes/conservation-actions-classification-scheme-ver2>) to those identified in *Rare and Threatened Bryophytes of Ireland* (Lockhart *et al.* 2012).

RED LIST OF IRISH BRYOPHYTES

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
H	<i>Anthoceros agrestis</i>	Paton	VU	D2	LC			Priority NI	1.2 Population size, distribution & trends	
H	<i>Anthoceros punctatus</i>	L.	LC							
H	<i>Phaeoceros laevis</i>	(L.) Prosk.	LC							
L	<i>Acrobolbus wilsonii</i>	Nees	VU	D1	NT*. Endemic	Yes				
L	<i>Adelanthus decipiens</i>	(Hook.) Mitt.	LC							
L	<i>Adelanthus lindenbergianus</i>	(Lehm.) Mitt.	VU	A2c, B2a, biii, iv	VU*	Yes	Globally disjunct		3.1 Population trends	2.3 Habitat & natural process restoration; 4.3 Awareness & communications
L	<i>Anastrepta orcadensis</i>	(Hook.) Schiffn.	LC							
L	<i>Anastrophyllum hellerianum</i>	(Nees ex Lindenb.) R.M.Schust.	RE		NT*	Yes, if re-found				
L	<i>Anastrophyllum minutum</i>	(Schreb.) R.M.Schust.	LC							
L	<i>Aneura mirabilis</i>	(Malmb.) Wickett & Goffinet	VU	B2a, bii, iii, iv	LC				1.2 Population size, distribution & trends	1.1 Sites/area protection
L	<i>Aneura pinguis</i>	(L.) Dumort.	LC							
L	<i>Anthelia julacea</i>	(L.) Dumort.	LC							
L	<i>Anthelia juratzkana</i>	(Limpr.) Trevis.	NT		LC					
L	<i>Aphanolejeunea microscopica</i>	(Taylor) A.Evans	LC							
L	<i>Barbilophozia atlantica</i>	(Kaal.) Loeske	EN	B2a, bii, iv, v	LC					4.3 Awareness & communications
L	<i>Barbilophozia attenuata</i>	(Mart.) Loeske	LC							
L	<i>Barbilophozia barbata</i>	(Schmidel ex Schreb.) Loeske	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC					
L	<i>Barbilophozia floerkei</i>	(F.Weber & D.Mohr) Loeske	LC							
L	<i>Barbilophozia kunzeana</i>	(Huebener) Gams	RE		LC					
L	<i>Bazzania pearsonii</i>	Steph.	VU	B2a, bii, iii, iv	Rare	Yes	Globally disjunct		3.1 Population trends	2.3 Habitat & natural process restoration; 4.3 Awareness & communications

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Bazzania tricrenata</i>	(Wahlenb.) Lindb.	LC							
L	<i>Bazzania trilobata</i>	(L.) Gray	LC							
L	<i>Blasia pusilla</i>	L.	LC							
L	<i>Blepharostoma trichophyllum</i>	(L.) Dumort.	LC							
L	<i>Calypogeia arguta</i>	Nees & Mont.	LC							
L	<i>Calypogeia azurea</i>	Stotler & Crotz	LC							
L	<i>Calypogeia fissa</i>	(L.) Raddi	LC							
L	<i>Calypogeia integristipula</i>	Steph.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC		NI only	Priority NI	3.1 Population trends	
L	<i>Calypogeia muelleriana</i>	(Schiffn.) Müll.Frib.	LC							
L	<i>Calypogeia neesiana</i>	(C.Massal. & Carestia) Müll.Frib.	LC							
L	<i>Calypogeia sphagnicola</i>	(Arnell & J.Perss.) Müll.Frib.	LC							
L	<i>Calypogeia suecica</i>	(Arnell & J.Perss.) Müll.Frib.	RE		LC				1.2 Population size, distribution & trends	2.3 Habitat & natural process restoration
L	<i>Cephalozia bicuspidata</i>	(L.) Dumort.	LC							
L	<i>Cephalozia catenulata</i>	(Huebener) Lindb.	LC							
L	<i>Cephalozia connivens</i>	(Dicks.) Lindb.	LC							
L	<i>Cephalozia crassifolia</i>	Lindenb. & Gottsche	EN	B2a, bii, iv	VU*	Yes	In Ireland, but not in Britain		3.1 Population trends	4.3 Awareness & communications
L	<i>Cephalozia leucantha</i>	Spruce	LC							
L	<i>Cephalozia loitlesbergeri</i>	Schiffn.	VU	B2a, biii	LC					2.3 Habitat & natural process restoration
L	<i>Cephalozia lunulifolia</i>	(Dumort.) Dumort.	LC							
L	<i>Cephalozia macrostachya</i> var. <i>macrostachya</i>	Kaal.	LC		LC					
L	<i>Cephalozia macrostachya</i> var. <i>spiniflora</i>	(Schiffn.) Müll.Frib.	DD		LC					1.1 Sites/area protection; 2.3 Habitat & natural process restoration
L	<i>Cephalozia pleniceps</i>	(Austin) Lindb.	VU	B2a, bii, iv	LC			Priority NI		2.3 Habitat & natural process restoration
L	<i>Cephaloziella divaricata</i>	(Sm.) Schiffn.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Cephaloziella elachista</i>	(J.B.Jack ex Gottsche & Rabenh.) Schiffn.	DD		Insufficiently Known	Yes			1.2 Population size, distribution & trends	
L	<i>Cephaloziella hampeana</i>	(Nees) Schiffn.	LC							
L	<i>Cephaloziella integerrima</i>	(Lindb.) Warnst.	VU	D2	LC				3.1 Population trends	1.2 Resource & habitat protection
L	<i>Cephaloziella massalongi</i>	(Spruce) Müll.Frib.	VU	D2	Rare	Yes			3.1 Population trends	2.1. Site/area management; 3.4 Ex-situ conservation; 4.3 Awareness & communications
L	<i>Cephaloziella nicholsonii</i>	Douin	VU	B2a, biii	Rare. Endemic	Yes			3.1 Population trends	2.1. Site/area management; 3.4 Ex-situ conservation; 4.3 Awareness & communications
L	<i>Cephaloziella rubella</i>	(Nees) Warnst.	VU	D2	LC			Priority NI		
L	<i>Cephaloziella spinigera</i>	(Lindb.) Warnst.	DD		LC					
L	<i>Cephaloziella stellulifera</i>	(Spruce) Schiffn.	NT		LC					
L	<i>Cephaloziella turneri</i>	(Hook.) Müll.Frib.	VU	D2	LC	Yes				
L	<i>Chiloscyphus pallescens</i>	(Ehrh. ex Hoffm.) Dumort.	LC							
L	<i>Chiloscyphus polyanthos</i>	(L.) Dumort.	LC							
L	<i>Cladopodiella fluitans</i>	(Nees) H.Buch	LC							
L	<i>Cladopodiella francisci</i>	(Hook.) H.Buch ex Jörg.	VU	D2	LC			Priority NI	3.1 Population trends	
L	<i>Cololejeunea calcarea</i>	(Lib.) Schiffn.	LC							
L	<i>Cololejeunea minutissima</i>	(Sm.) Schiffn.	LC							
L	<i>Cololejeunea rossettiana</i>	(C.Massal.) Schiffn.	LC							
L	<i>Colura calyptrifolia</i>	(Hook.) Dumort.	LC							
L	<i>Conocephalum conicum</i>	(L.) Dumort.	LC							
L	<i>Conocephalum salebrosum</i>	Szweyk. et al.	LC							
L	<i>Diplophyllum albicans</i>	(L.) Dumort.	LC							
L	<i>Diplophyllum obtusifolium</i>	(Hook.) Dumort.	NT		LC					
L	<i>Douinia ovata</i>	(Dicks.) H.Buch	NT		LC	Yes				

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Drepanolejeunea hamatifolia</i>	(Hook.) Schiffn.	LC							
L	<i>Dumortiera hirsuta</i>	(Sw.) Nees	NT		Rare	Yes		UKBAP; Priority NI	1.2 Population size, distribution & trends; 3.1 Population trends	
L	<i>Eremonotus myriocarpus</i>	(Carrington) Pearson	NT		LC					
L	<i>Fossombronina angulosa</i>	(Dicks.) Raddi	LC							
L	<i>Fossombronina caespitififormis</i> subsp. <i>multispira</i>	(Schiffn.) J.R.Bray & Cargill	DD		LC	Yes			1.1 Taxonomy; 1.2 Population size, distribution & trends	
L	<i>Fossombronina fimbriata</i>	Paton	VU	D2	Rare. Endemic	Yes			1.2 Population size, distribution & trends; 3.1 Population trends	
L	<i>Fossombronina foveolata</i>	Lindb.	LC							
L	<i>Fossombronina incurva</i>	Lindb.	LC							
L	<i>Fossombronina maritima</i>	(Paton) Paton	NT		LC	Yes				
L	<i>Fossombronina pusilla</i>	(L.) Nees	LC							
L	<i>Fossombronina wondraczekii</i>	(Corda) Lindb.	LC							
L	<i>Frullania dilatata</i>	(L.) Dumort.	LC							
L	<i>Frullania fragilifolia</i>	(Taylor) Gottsche <i>et al.</i>	LC							
L	<i>Frullania microphylla</i> var. <i>microphylla</i>	(Gottsche) Pearson	LC							
L	<i>Frullania tamarisci</i>	(L.) Dumort.	LC							
L	<i>Frullania teneriffae</i>	(F.Weber) Nees	LC							
L	<i>Geocalyx graveolens</i>	(Schrad.) Nees	EN	D	LC			Priority NI	3.1 Population trends	4.3 Awareness & communications
L	<i>Gymnocolea inflata</i>	(Huds.) Dumort.	LC							
L	<i>Gymnomitrium concinatum</i>	(Lightf.) Corda	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC			Priority NI	3.1 Population trends	
L	<i>Gymnomitrium corallioides</i>	Nees	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC				1.2 Population size, distribution & trends; 3.1 Population trends	4.3 Awareness & communications

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Gymnomitrium crenulatum</i>	Gottsche ex Carrington	LC							
L	<i>Gymnomitrium obtusum</i>	Lindb.	NT		LC				1.2 Population size, distribution & trends	
L	<i>Haplomitrium hookeri</i>	(Sm.) Nees	LC		Rare	Yes				
L	<i>Harpalejeunea mollerii</i>	(Steph.) Grolle	LC							
L	<i>Harpanthus scutatus</i>	(F.Weber & D.Mohr) Spruce	LC							
L	<i>Herbertus aduncus</i> subsp. <i>hutchinsiae</i>	(Gottsche) R.M.Schust.	LC							
L	<i>Heteroscyphus fissistipus</i>	(Hook.f. & Taylor) Schiffn.	NE							
L	<i>Hygrobrella laxifolia</i>	(Hook.) Spruce	LC							
L	<i>Jubula hutchinsiae</i> subsp. <i>hutchinsiae</i>	(Hook.) Dumort.	LC							
L	<i>Jungermannia atrovirens</i>	Dumort.	LC							
L	<i>Jungermannia exsertifolia</i> subsp. <i>cordifolia</i>	(Dumort.) Váňa	LC							
L	<i>Jungermannia pumila</i>	With.	LC							
L	<i>Kurzia pauciflora</i>	(Dicks.) Grolle	LC							
L	<i>Kurzia sylvatica</i>	(A.Evans) Grolle	NT		LC					
L	<i>Kurzia trichoclados</i>	(Müll.Frib.) Grolle	LC							
L	<i>Leiocolea badensis</i>	(Gottsche) Jörg.	LC							
L	<i>Leiocolea bantriensis</i>	(Hook.) Jörg.	NT		LC				3.1 Population trends	
L	<i>Leiocolea collaris</i>	(Nees) Schljakov	LC							
L	<i>Leiocolea fitzgeraldiae</i>	Paton & A.R.Perry	NT		LC. Endemic	Yes	Endemic to Britain & Ireland		3.1 Population trends	
L	<i>Leiocolea gillmanii</i>	(Austin) A.Evans	VU	D2	LC	?		FPO		1.2 Resource & habitat protection; 3.4 Ex-situ conservation; 4.3 Awareness & communications
L	<i>Leiocolea heterocolpos</i>	(Thed. ex C.Hartm.) H.Buch	CR	B2a, biii	LC		NI only	Priority NI	3.1 Population trends	4.3 Awareness & communications

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Leiocolea rutheana</i> var. <i>rutheana</i>	(Limpr.) Müll.Frib.	EN	B2a, biii, D	LC		Boreal relict	FPO	3.1 Population trends	1.2 Resource & habitat protection; 3.4 Ex-situ conservation; 4.3 Awareness & communications
L	<i>Leiocolea turbinata</i>	(Raddi) H.Buch	LC							
L	<i>Lejeunea cavifolia</i>	(Ehrh.) Lindb.	LC							
L	<i>Lejeunea eckloniana</i>	Lindenb.	NT		LC	Yes			3.1 Population trends	
L	<i>Lejeunea flava</i> subsp. <i>moorei</i>	(Lindb.) R.M.Schust.	VU	B2a, bii, iv	Rare. Endemic	Yes	In Ireland, but not in Britain		1.2 Population size, distribution & trends	
L	<i>Lejeunea hibernica</i>	Bischl. <i>et al.</i> ex Grolle	NT		Rare. Endemic	Yes	In Ireland, but not in Britain		3.1 Population trends	
L	<i>Lejeunea lamacerina</i>	(Steph.) Schiffn.	LC							
L	<i>Lejeunea mandonii</i>	(Steph.) Müll.Frib.	EN	B2a, bii, iv	Rare. Endemic	Yes			1.2 Population size, distribution & trends; 3.1 Population trends	1.2 Resource & habitat protection; 4.3 Awareness & communications
L	<i>Lejeunea patens</i>	Lindb.	LC							
L	<i>Lepidozia cupressina</i>	(Sw.) Lindenb.	LC							
L	<i>Lepidozia pearsonii</i>	Spruce	LC							
L	<i>Lepidozia reptans</i>	(L.) Dumort.	LC							
L	<i>Leptoscyphus cuneifolius</i>	(Hook.) Mitt.	LC							
L	<i>Lophocolea bidentata</i>	(L.) Dumort.	LC							
L	<i>Lophocolea bispinosa</i>	(Hook.f. & Taylor) Gottsche <i>et al.</i>	NE							
L	<i>Lophocolea fragrans</i>	(Moris & De Not.) Gottsche <i>et al.</i>	LC							
L	<i>Lophocolea heterophylla</i>	(Schrad.) Dumort.	LC							
L	<i>Lophocolea semiteres</i>	(Lehm.) Mitt.	NE							
L	<i>Lophozia bicrenata</i>	(Schmidel ex Hoffm.) Dumort.	LC							
L	<i>Lophozia excisa</i>	(Dicks.) Dumort.	LC							
L	<i>Lophozia incisa</i>	(Schrad.) Dumort.	LC							
L	<i>Lophozia opacifolia</i>	Culm. ex Meyl.	VU	D2	LC				3.1 Population trends	1.2 Resource & habitat protection

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Lophozia sudetica</i>	(Nees ex Huebener) Grolle	LC							
L	<i>Lophozia ventricosa</i>	(Dicks.) Dumort.	LC							
L	<i>Lophozia wenzelii</i>	(Nees) Steph.	DD		NE				1.1 Taxonomy	
L	<i>Lunularia cruciata</i>	(L.) Lindb.	LC							
L	<i>Marchantia polymorpha</i> subsp. <i>montivagans</i>	Bischl. & Boisselier	EN	D	LC				1.2 Population size, distribution & trends; 3.1 Population trends	4.3 Awareness & communications
L	<i>Marchantia polymorpha</i> subsp. <i>polymorpha</i>	L.	LC							
L	<i>Marchantia polymorpha</i> subsp. <i>ruderalis</i>	Bischl. & Boisselier	LC							
L	<i>Marchesinia mackaii</i>	(Hook.) Gray	LC							
L	<i>Marsupella adusta</i>	(Nees emend. Limpr.) Spruce	NT		LC					
L	<i>Marsupella emarginata</i> var. <i>aquatica</i>	(Lindenb.) Dumort.	LC							
L	<i>Marsupella emarginata</i> var. <i>emarginata</i>	(Ehrh.) Dumort.	LC							
L	<i>Marsupella emarginata</i> var. <i>pearsonii</i>	(Schiffn.) M.F.V. Corley	LC							
L	<i>Marsupella funckii</i>	(F. Weber & D. Mohr) Dumort.	NT		LC			Priority NI	3.1 Population trends	
L	<i>Marsupella sphacelata</i>	(Gieseke ex Lindenb.) Dumort.	VU	B1a, bi, ii, iv, B2a, bi, ii, iv	LC				3.1 Population trends	1.2 Resource & habitat protection
L	<i>Marsupella sprucei</i>	(Limpr.) Bernet	VU	B2a, bii, biv	LC			Priority NI		
L	<i>Mastigophora woodsii</i>	(Hook.) Nees	NT		Rare	Yes	Globally disjunct		3.1 Population trends	2.3 Habitat & natural process restoration
L	<i>Metzgeria conjugata</i>	Lindb.	LC							
L	<i>Metzgeria consanguinea</i>	Schiffn.	LC							
L	<i>Metzgeria furcata</i>	(L.) Dumort.	LC							
L	<i>Metzgeria leptoneura</i>	Spruce	NT		LC	Yes				
L	<i>Metzgeria pubescens</i>	(Schrank) Raddi	VU	D2	LC		NI only	Priority NI		
L	<i>Metzgeria violacea</i>	(Ach.) Dumort.	LC							
L	<i>Microlejeunea ulicina</i>	(Taylor) A. Evans	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Moerckia flotoviana</i>	(Nees) Schiffn.	LC							
L	<i>Moerckia hibernica</i>	(Hook.) Gottsche	DD		LC				1.1 Taxonomy; 1.2 Population size, distribution & trends	
L	<i>Mylia anomala</i>	(Hook.) Gray	LC							
L	<i>Mylia taylorii</i>	(Hook.) Gray	LC							
L	<i>Nardia compressa</i>	(Hook.) Gray	LC							
L	<i>Nardia geoscyphus</i>	(De Not.) Lindb.	NT		LC					
L	<i>Nardia scalaris</i>	Gray	LC							
L	<i>Nowellia curvifolia</i>	(Dicks.) Mitt.	LC							
L	<i>Odontoschisma denudatum</i>	(Mart.) Dumort.	LC							
L	<i>Odontoschisma elongatum</i>	(Lindb.) A.Evans	NT		LC					
L	<i>Odontoschisma sphagni</i>	(Dicks.) Dumort.	LC							
L	<i>Pallavicinia lyellii</i>	(Hook.) Carruth.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	VU*	Yes			1.2 Population size, distribution & trends	1.1 Sites/area protection; 1.2 Resource & habitat protection; 3.4 Ex-situ conservation; 4.3 Awareness & communications
L	<i>Pedinophyllum interruptum</i>	(Nees) Kaal.	LC							
L	<i>Pellia endiviifolia</i>	(Dicks.) Dumort.	LC							
L	<i>Pellia epiphylla</i>	(L.) Corda	LC							
L	<i>Pellia neesiana</i>	(Gottsche) Limpr.	LC							
L	<i>Petalophyllum ralfsii</i>	(Wilson) Nees & Gottsche	LC		VU*	Yes		FPO; WCA; Bern App. 1; Hab. Dir. Annex 2 [21 SACs]; UKBAP; Priority NI	1.1 Taxonomy; 2.1 Species Action/Recovery Plan; 3.1 Population trends	3.4 Ex-situ conservation; 4.3 Awareness & communications
L	<i>Plagiochila asplenioides</i>	(L. emend. Taylor) Dumort.	LC							
L	<i>Plagiochila bifaria</i>	(Sw.) Lindenb.	LC							
L	<i>Plagiochila britannica</i>	Paton	LC		LC. Endemic	Yes				

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Plagiochila carringtonii</i>	(Balf.) Grolle	EN	B2a, biii	Rare. Endemic (subsp. <i>carringtonii</i>)	Yes			1.2 Population size, distribution & trends; 3.1 Population trends	2.3 Habitat & natural process restoration; 4.3 Awareness & communications
L	<i>Plagiochila exigua</i>	Taylor	LC							
L	<i>Plagiochila heterophylla</i>	Lindenb. ex Lehm.	EN	B2a, bii, iv	Rare	Yes		FPO	3.1 Population trends	1.1 Sites/area protection; 4.3 Awareness & communications
L	<i>Plagiochila porelloides</i>	(Torr. ex Nees) Lindenb.	LC							
L	<i>Plagiochila punctata</i>	(Taylor) Taylor	LC							
L	<i>Plagiochila spinulosa</i>	(Dicks.) Dumort.	LC							
L	<i>Pleurozia purpurea</i>	Lindb.	LC							
L	<i>Porella arboris-vitae</i>	(With.) Grolle	LC							
L	<i>Porella cordaeana</i>	(Huebener) Moore	NT		LC					
L	<i>Porella obtusata</i>	(Taylor) Trevis.	LC							
L	<i>Porella pinnata</i>	L.	LC							
L	<i>Porella platyphylla</i>	(L.) Pfeiff.	LC							
L	<i>Preissia quadrata</i>	(Scop.) Nees	LC							
L	<i>Ptilidium ciliare</i>	(L.) Hampe	LC							
L	<i>Ptilidium pulcherrimum</i>	(Weber) Vainio	RE		LC		Re-found in 2012			
L	<i>Radula aquilegia</i>	(Hook.f. & Taylor) Gottsche <i>et al.</i>	LC							
L	<i>Radula carringtonii</i>	J.B.Jack	NT		Rare	Yes			3.1 Population trends	
L	<i>Radula complanata</i>	(L.) Dumort.	LC							
L	<i>Radula holtii</i>	Spruce	NT		Rare. Endemic	Yes			1.2 Population size, distribution & trends; 3.1 Population trends	
L	<i>Radula lindenbergiana</i>	Gottsche ex C.Hartm.	LC							
L	<i>Radula voluta</i>	Taylor ex Gottsche <i>et al.</i>	LC		Rare	Yes				
L	<i>Reboulia hemisphaerica</i>	(L.) Raddi	LC							
L	<i>Riccardia chamedryfolia</i>	(With.) Grolle	LC							
L	<i>Riccardia incurvata</i>	Lindb.	LC							
L	<i>Riccardia latifrons</i>	(Lindb.) Lindb.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Riccardia multifida</i>	(L.) Gray	LC							
L	<i>Riccardia palmata</i>	(Hedw.) Carruth.	LC							
L	<i>Riccia beyrichiana</i>	Hampe ex Lehm.	LC							
L	<i>Riccia cavernosa</i>	Hoffm.	LC							
L	<i>Riccia crozalsii</i>	Levier	EN	D	LC	Yes			3.1 Population trends	2.1. Site/area management; 4.3 Awareness & communications
L	<i>Riccia fluitans</i>	L.	LC							
L	<i>Riccia glauca</i>	L.	LC							
L	<i>Riccia huebeneriana</i>	Lindenb.	DD		Rare	Yes			3.1 Population trends	2.1. Site/area management
L	<i>Riccia rhenana</i>	Lorb. ex Müll.Frib.	NE							
L	<i>Riccia sorocarpa</i>	Bisch.	LC							
L	<i>Riccia subbifurca</i>	Warnst. ex Croz.	LC							
L	<i>Riccocarpos natans</i>	(L.) Corda	NT		LC					
L	<i>Saccogyna viticulosa</i>	(L.) Dumort.	LC							
L	<i>Scapania aequiloba</i>	(Schwägr.) Dumort.	LC							
L	<i>Scapania aspera</i>	Bernet & M.Bernet	LC							
L	<i>Scapania compacta</i>	(A.Roth) Dumort.	LC							
L	<i>Scapania curta</i>	(Mart.) Dumort.	VU	D2	LC				3.1 Population trends	2.1. Site/area management; 4.3 Awareness & communications
L	<i>Scapania cuspiduligera</i>	(Nees) Müll.Frib.	VU	D2	LC					1.2 Resource & habitat protection
L	<i>Scapania gracilis</i>	Lindb.	LC							
L	<i>Scapania gymnostomophila</i>	Kaal.	VU	D2	LC					1.2 Resource & habitat protection
L	<i>Scapania irrigua</i>	(Nees) Nees	LC							
L	<i>Scapania lingulata</i>	H.Buch	DD		LC				1.2 Population size, distribution & trends	2.3 Habitat & natural process restoration
L	<i>Scapania nemorea</i>	(L.) Grolle	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
L	<i>Scapania nimbosa</i>	Taylor	EN	B2a, bii, iii, iv	Rare	Yes	Globally disjunct		3.1 Population trends	2.3 Habitat & natural process restoration; 4.3 Awareness & communications
L	<i>Scapania ornithopodioides</i>	(With.) Waddell	VU	A2c	LC	Yes	Globally disjunct		3.1 Population trends	2.3 Habitat & natural process restoration
L	<i>Scapania scandica</i>	(Arnell & H.Buch) Macvicar	LC							
L	<i>Scapania subalpina</i>	(Nees ex Lindenb.) Dumort.	DD		LC				1.2 Population size, distribution & trends	
L	<i>Scapania umbrosa</i>	(Schrad.) Dumort.	LC							
L	<i>Scapania undulata</i>	(L.) Dumort.	LC							
L	<i>Solenostoma gracillimum</i>	(Sm.) R.M.Schust.	LC							
L	<i>Solenostoma hyalinum</i>	(Lyell) Mitt.	LC							
L	<i>Solenostoma obovatum</i>	(Nees) C.Massal.	LC							
L	<i>Solenostoma paroicum</i>	(Schiffn.) R.M.Schust.	NT		NT*. Endemic	Yes			1.2 Population size, distribution & trends; 3.1 Population trends	
L	<i>Solenostoma sphaerocarpum</i>	(Hook.) Steph.	NT		LC					
L	<i>Solenostoma subellipticum</i>	(Lindb. ex Kaal.) R.M.Schust.	NT		LC					
L	<i>Southbya tophacea</i>	(Spruce) Spruce	CR	B1a, bii, iv, B2a, bii, iv	LC	Yes	Most northerly locality in the world		1.2 Population size, distribution & trends	2.1. Site/area management; 4.3 Awareness & communications
L	<i>Sphenolobopsis pearsonii</i>	(Spruce) R.M.Schust.	NT		Rare	Yes				
L	<i>Targionia hypophylla</i>	L.	RE		LC					
L	<i>Telaranea europaea</i>	Engel & G.L.S.Merr.	NT		Rare. Endemic	Yes				
L	<i>Trichocolea tomentella</i>	(Ehrh.) Dumort.	LC							
L	<i>Tritomaria exsecta</i>	(Schmidel) Loeske	VU	B2a, bii, iv	LC					1.2 Resource & habitat protection
L	<i>Tritomaria exsectiformis</i>	(Breidl.) Loeske	LC							
L	<i>Tritomaria quinquedentata</i>	(Huds.) H.Buch	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Abietinella abietina</i> var. <i>abietina</i>	(Hedw.) M.Fleisch.	EN	B2a, biii, iv	LC [<i>A. abietina</i>]			Priority NI		
M	<i>Abietinella abietina</i> var. <i>hystricosa</i>	(Mitt.) Sakurai	NT		LC [<i>A. abietina</i>]					
M	<i>Acaulon muticum</i>	(Hedw.) Müll.Hal.	RE		LC				1.2 Population size, distribution & trends	
M	<i>Aloina aloides</i>	(Koch ex Schultz) Kindb.	LC							
M	<i>Aloina ambigua</i>	(Bruch & Schimp.) Limpr.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv, D	LC					
M	<i>Aloina rigida</i>	(Hedw.) Limpr.	RE		LC					
M	<i>Amblyodon dealbatus</i>	(Hedw.) P.Beauv.	LC							
M	<i>Amblystegium confervoides</i>	(Brid.) Schimp.	NT		LC				1.1 Taxonomy	
M	<i>Amblystegium serpens</i> var. <i>salinum</i>	Carrington	LC							
M	<i>Amblystegium serpens</i> var. <i>serpens</i>	(Hedw.) Schimp.	LC							
M	<i>Amphidium lapponicum</i>	(Hedw.) Schimp.	VU	D2	LC					
M	<i>Amphidium mougeotii</i>	(Schimp.) Schimp.	LC							
M	<i>Andreaea alpina</i>	Hedw.	LC							
M	<i>Andreaea megistospora</i>	B.M.Murray	VU	B1a, bi, ii, iv, B2a, bi, ii, iv	Rare	Yes				
M	<i>Andreaea rothii</i> subsp. <i>falcata</i>	(Schimp.) Lindb.	LC							
M	<i>Andreaea rothii</i> subsp. <i>rothii</i>	F.Weber & D.Mohr	LC							
M	<i>Andreaea rupestris</i> var. <i>rupestris</i>	Hedw.	LC							
M	<i>Anoetangium aestivum</i>	(Hedw.) Mitt.	LC							
M	<i>Anomobryum concinatum</i>	(Spruce) Lindb.	LC							
M	<i>Anomobryum julaceum</i>	(Schrud. ex P.Gaertn. et al.) Schimp.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Anomodon viticulosus</i>	(Hedw.) Hook. & Taylor	LC							
M	<i>Antitrichia curtispindula</i>	(Hedw.) Brid.	NT		LC				1.1 Taxonomy	
M	<i>Aongstroemia longipes</i>	(Sommerf.) Bruch & Schimp.	CR	A3c	LC				1.2 Population size, distribution & trends	1.1 Sites/area protection; 2.1. Site/area management; 2.2 Invasive/problematic species control
M	<i>Aphanorrhegma patens</i>	(Hedw.) Lindb.	LC							
M	<i>Archidium alternifolium</i>	(Hedw.) Mitt.	LC							
M	<i>Arctoa fulvella</i>	(Dicks.) Bruch & Schimp.	VU	B2a, bii, iv, D2	LC				3.1 Population trends	1.2 Resource & habitat protection
M	<i>Atrichum angustatum</i>	(Brid.) Bruch & Schimp.	RE		LC		NI only	UKBAP	1.2 Population size, distribution & trends	
M	<i>Atrichum crispum</i>	(James) Sull.	NE							
M	<i>Atrichum tenellum</i>	(Röhl.) Bruch & Schimp.	NT		LC					
M	<i>Atrichum undulatum</i> var. <i>undulatum</i>	(Hedw.) P.Beauv.	LC							
M	<i>Aulacomnium androgynum</i>	(Hedw.) Schwägr.	VU	B2a, bii, iv	LC			Priority NI		
M	<i>Aulacomnium palustre</i>	(Hedw.) Schwägr.	LC							
M	<i>Barbula convoluta</i> var. <i>convoluta</i>	Hedw.	LC							
M	<i>Barbula convoluta</i> var. <i>sardoa</i>	Schimp.	LC							
M	<i>Barbula unguiculata</i>	Hedw.	LC							
M	<i>Bartramia halleriana</i>	Hedw.	RE		LC				1.2 Population size, distribution & trends	
M	<i>Bartramia ithyphylla</i>	Brid.	VU	B2a, bii, iv	LC			Priority NI		
M	<i>Bartramia pomiformis</i>	Hedw.	LC							
M	<i>Blindia acuta</i>	(Hedw.) Bruch & Schimp.	LC							
M	<i>Brachydontium trichodes</i>	(F.Weber) Milde	EN	B2a, bi, ii, iv	Rare	Yes		Priority NI	1.2 Population size, distribution & trends	2.1. Site/area management

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Brachytheciastrum velutinum</i>	(Hedw.) Ignatov & Huttunen	EN	B2a, bi, ii, iv	LC					
M	<i>Brachythecium albicans</i>	(Hedw.) Schimp.	LC							
M	<i>Brachythecium glareosum</i>	(Bruch ex Spruce) Schimp.	LC							
M	<i>Brachythecium mildeanum</i>	(Schimp.) Schimp.	LC							
M	<i>Brachythecium rivulare</i>	Schimp.	LC							
M	<i>Brachythecium rutabulum</i>	(Hedw.) Schimp.	LC							
M	<i>Breutelia chrysocoma</i>	(Hedw.) Lindb.	LC							
M	<i>Bryoerythrophyllum ferruginascens</i>	(Stirt.) Giacom.	LC							
M	<i>Bryoerythrophyllum recurvirostrum</i>	(Hedw.) P.C.Chen	LC							
M	<i>Bryum algovicum</i> var. <i>rutheanum</i>	(Warnst.) Crundw.	LC							
M	<i>Bryum alpinum</i>	Huds. ex With.	LC							
M	<i>Bryum archangelicum</i>	Bruch & Schimp.	LC							
M	<i>Bryum argenteum</i>	Hedw.	LC							
M	<i>Bryum bornholmense</i>	Wink. & R.Ruthe	NT		LC					
M	<i>Bryum caespiticium</i>	Hedw.	VU	D2	LC					
M	<i>Bryum calophyllum</i>	R.Br.	EN	B2a, biii	Rare	Yes		FPO		2.1. Site/area management; 4.3 Awareness & communications
M	<i>Bryum capillare</i>	Hedw.	LC							
M	<i>Bryum creberrimum</i>	Taylor	DD		LC					
M	<i>Bryum dichotomum</i>	Hedw.	LC							
M	<i>Bryum donianum</i>	Grev.	LC							
M	<i>Bryum dyffrynense</i>	Holyoak	NT		NE. Endemic	Yes				
M	<i>Bryum elegans</i>	Nees	VU	D2	LC					
M	<i>Bryum gemmiferum</i>	R.Wilczek & Demaret	LC							
M	<i>Bryum gemmiparum</i>	De Not.	VU	D2	LC	Yes				
M	<i>Bryum intermedium</i>	(Brid.) Blandow	EN	B2a, bii, iv	LC			Priority NI		2.1. Site/area management
M	<i>Bryum klinggraeffii</i>	Schimp.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Bryum knowltonii</i>	Barnes	EN	D	LC					4.3 Awareness & communications
M	<i>Bryum marratii</i>	Hook.f. & Wilson	LC		Regionally Threatened	Yes		FPO; UKBAP		4.3 Awareness & communications
M	<i>Bryum moravicum</i>	Podp.	CR	B1a, bii, iv, B2a, ii, iv	LC					4.3 Awareness & communications
M	<i>Bryum pallens</i>	Sw. ex anon.	LC							
M	<i>Bryum pallescens</i>	Schleich. ex Schwägr.	LC							
M	<i>Bryum pseudotriquetrum</i> var. <i>bimum</i>	(Schreb.) Lilj.	LC							
M	<i>Bryum pseudotriquetrum</i> var. <i>pseudotriquetrum</i>	(Hedw.) P.Gaertn. et al.	LC							
M	<i>Bryum radiculosum</i>	Brid.	LC							
M	<i>Bryum riparium</i>	I.Hagen	EN	B2a, bii, iv	Rare	Yes				
M	<i>Bryum rubens</i>	Mitt.	LC							
M	<i>Bryum ruderale</i>	Crundw. & Nyholm	LC							
M	<i>Bryum salinum</i>	I.Hagen ex Limpr.	CR	B1a, bi, ii, iv, B2a, bi, ii, iv, D	LC					4.3 Awareness & communications
M	<i>Bryum sauteri</i>	Bruch & Schimp.	LC							
M	<i>Bryum subapiculatum</i>	Hampe	LC							
M	<i>Bryum tenuisetum</i>	Limpr.	DD		Insufficiently Known	Yes				
M	<i>Bryum torquescens</i>	Bruch & Schimp.	VU	B2a, bi, ii, iv	LC	Yes		Priority NI		
M	<i>Bryum turbinatum</i>	(Hedw.) Turner	RE		LC					
M	<i>Bryum uliginosum</i>	(Brid.) Bruch & Schimp.	EN	B2a, bii, iv	Regionally Threatened	Yes		UKBAP	3.1 Population trends	2.1. Site/area management; 3.4 Ex-situ conservation; 4.3 Awareness & communications
M	<i>Bryum violaceum</i>	Crundw. & Nyholm	LC							
M	<i>Bryum warneum</i>	(Röhl.) Brid.	EN	B2a, bii, iii, iv	Rare	Yes				2.1. Site/area management; 4.3 Awareness & communications

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Buxbaumia aphylla</i>	Hedw.	RE		Regionally Threatened	Yes, if re-found				
M	<i>Calliergon cordifolium</i>	(Hedw.) Kindb.	LC							
M	<i>Calliergon giganteum</i>	(Schimp.) Kindb.	LC							
M	<i>Calliergonella cuspidata</i>	(Hedw.) Loeske	LC							
M	<i>Calliergonella lindbergii</i>	(Mitt.) Hedenäs	LC							
M	<i>Calomnion complanatum</i>	(Hook.f. & Wilson) Lindb.	NE							
M	<i>Calyptrochaeta apiculata</i>	(Hook.f. & Wilson) Vitt	NE							
M	<i>Campyliadelphus chrysophyllus</i>	(Brid.) R.S.Chopra	LC							
M	<i>Campyliadelphus elodes</i>	(Lindb.) Kanda	NT		Regionally Threatened	Yes				
M	<i>Campylium protensum</i>	(Brid.) Kindb.	LC							
M	<i>Campylium stellatum</i>	(Hedw.) Lange & C.E.O.Jensen	LC							
M	<i>Campylopus atrovirens</i> var. <i>atrovirens</i>	De Not.	LC							
M	<i>Campylopus atrovirens</i> var. <i>falcatus</i>	Braithw.	NT		NE	Yes				
M	<i>Campylopus brevipilus</i>	Bruch & Schimp.	LC							
M	<i>Campylopus flexuosus</i>	(Hedw.) Brid.	LC							
M	<i>Campylopus fragilis</i>	(Brid.) Bruch & Schimp.	LC							
M	<i>Campylopus gracilis</i>	(Mitt.) A.Jaeger	LC							
M	<i>Campylopus introflexus</i>	(Hedw.) Brid.	LC							
M	<i>Campylopus pilifer</i>	Brid.	LC							
M	<i>Campylopus pyriformis</i>	(Schultz) Brid.	LC							
M	<i>Campylopus schimperi</i>	Milde	RE		LC					
M	<i>Campylopus setifolius</i>	Wilson	LC		Rare	Yes				
M	<i>Campylopus shawii</i>	Wilson	NT		Rare	Yes				
M	<i>Campylopus subulatus</i>	Schimp. ex Milde	VU	B2a, bii, iv	LC			Priority NI	3.1 Population trends	
M	<i>Campylostelium saxicola</i>	(F.Weber & D.Mohr) Bruch & Schimp.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	Rare	Yes			1.2 Population size, distribution & trends	

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Catoscopium nigratum</i>	(Hedw.) Brid.	NT		LC			FPO		3.4 Ex-situ conservation
M	<i>Ceratodon purpureus</i>	(Hedw.) Brid.	LC							
M	<i>Cinclidium stygium</i>	Sw.	VU	B2a, biii	LC			Priority NI		
M	<i>Cinclidotus fontinaloides</i>	(Hedw.) P.Beauv.	LC							
M	<i>Cinclidotus riparius</i>	(Host ex Brid.) Arn.	DD		LC				1.2 Population size, distribution & trends	
M	<i>Cirriphyllum crassinervium</i>	(Taylor) Loeske & M.Fleisch.	LC							
M	<i>Cirriphyllum piliferum</i>	(Hedw.) Grout	LC							
M	<i>Climacium dendroides</i>	(Hedw.) F.Weber & D.Mohr	LC							
M	<i>Conardia compacta</i>	(Drumm. ex Müll.Hal.) H.Rob.	RE		LC					
M	<i>Cratoneuron filicinum</i>	(Hedw.) Spruce	LC							
M	<i>Cryphaea heteromalla</i>	(Hedw.) D.Mohr	LC							
M	<i>Ctenidium molluscum</i> var. <i>condensatum</i>	(Schimp.) E.Britton	LC							
M	<i>Ctenidium molluscum</i> var. <i>molluscum</i>	(Hedw.) Mitt.	LC							
M	<i>Ctenidium molluscum</i> var. <i>robustum</i>	Boulay	RE		NE		NI only			
M	<i>Cyclodictyon laetevirens</i>	(Hook. & Taylor) Mitt.	NT		Rare	Yes	Ireland has most of European population.			
M	<i>Cynodontium bruntonii</i>	(Sm.) Bruch & Schimp.	LC							
M	<i>Cynodontium jenneri</i>	(Schimp.) Stirt.	VU	D2	LC				1.2 Population size, distribution & trends	1.1 Sites/area protection; 1.2 Resource & habitat protection
M	<i>Daltonia splachnoides</i>	(Sm.) Hook. & Taylor	LC		NT*	Yes		UKBAP; Priority NI		
M	<i>Dichodontium flavescens</i>	(Dicks.) Lindb.	LC							
M	<i>Dichodontium palustre</i>	(Dicks.) M.Stech	LC							
M	<i>Dichodontium pellucidum</i>	(Hedw.) Schimp.	LC							
M	<i>Dicranella cerviculata</i>	(Hedw.) Schimp.	NT		LC					

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Dicranella crispa</i>	(Hedw.) Schimp.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC					1.1 Sites/area protection; 1.2 Resource & habitat protection
M	<i>Dicranella grevilleana</i>	(Brid.) Schimp.	NT		LC					
M	<i>Dicranella heteromalla</i>	(Hedw.) Schimp.	LC							
M	<i>Dicranella rufescens</i>	(Dicks.) Schimp.	LC							
M	<i>Dicranella schreberiana</i>	(Hedw.) Dixon	LC							
M	<i>Dicranella staphylina</i>	H.Whitehouse	LC							
M	<i>Dicranella subulata</i>	(Hedw.) Schimp.	LC							
M	<i>Dicranella varia</i>	(Hedw.) Schimp.	LC							
M	<i>Dicranodontium asperulum</i>	(Mitt.) Broth.	VU	D2	Insufficiently Known	Yes		Priority NI		
M	<i>Dicranodontium denudatum</i>	(Brid.) E.Britton	LC							
M	<i>Dicranodontium uncinatum</i>	(Harv.) A.Jaeger	VU	B1a, bi, ii, iii, iv, B2a, bi, ii, iii, iv	LC		Globally disjunct		3.1 Population trends	
M	<i>Dicranoloma menziesii</i>	(Taylor) Renauld	NE				Not in CC			
M	<i>Dicranoweisia cirrata</i>	(Hedw.) Lindb.	LC							
M	<i>Dicranum bonjeanii</i>	De Not.	LC							
M	<i>Dicranum fuscescens</i>	Sm.	LC							
M	<i>Dicranum majus</i>	Sm.	LC							
M	<i>Dicranum scoparium</i>	Hedw.	LC							
M	<i>Dicranum scottianum</i>	Turner ex R.Scott	LC							
M	<i>Dicranum undulatum</i>	Schrad. ex Brid.	RE		LC					
M	<i>Didymodon acutus</i>	(Brid.) K.Saito	EN	B2a, bii, iii, iv	LC				3.1 Population trends	1.2 Resource & habitat protection; 4.3 Awareness & communications
M	<i>Didymodon fallax</i>	(Hedw.) R.H.Zander	LC							
M	<i>Didymodon ferrugineus</i>	(Schimp. ex Besch.) M.O.Hill	LC							
M	<i>Didymodon icmadophilus</i>	(Schimp. ex Müll.Hal.) K.Saito	RE		LC				1.1 Taxonomy	
M	<i>Didymodon insulanus</i>	(De Not.) M.O.Hill	LC							
M	<i>Didymodon luridus</i>	Hornsch.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Didymodon maximus</i>	(Syed & Crundw.) M.O.Hill	NT		Rare	Yes	In Ireland, but not rest of Europe. Globally rare.		1.1 Taxonomy	
M	<i>Didymodon nicholsonii</i>	Culm.	LC							
M	<i>Didymodon rigidulus</i>	Hedw.	LC							
M	<i>Didymodon sinuosus</i>	(Mitt.) Delogne	LC							
M	<i>Didymodon spadiceus</i>	(Mitt.) Limpr.	LC							
M	<i>Didymodon tomaculosus</i>	(Blockeel) M.F.V.Corley	VU	D2	Insufficiently Known. Endemic	Yes			1.2 Population size, distribution & trends	
M	<i>Didymodon tophaceus</i>	(Brid.) Lisa	LC							
M	<i>Didymodon umbrosus</i>	(Müll.Hal.) R.H.Zander	VU	D2	Rare	Yes				
M	<i>Didymodon vinealis</i>	(Brid.) R.H.Zander	LC							
M	<i>Diphyscium foliosum</i>	(Hedw.) D.Mohr	LC							
M	<i>Discelium nudum</i>	(Dicks.) Brid.	NT		Regionally Threatened	Yes				1.2 Resource & habitat protection
M	<i>Distichium capillaceum</i>	(Hedw.) Bruch & Schimp.	LC							
M	<i>Distichium inclinatum</i>	(Hedw.) Bruch & Schimp.	LC							
M	<i>Ditrichum cornubicum</i>	Paton	CR	D	EN*. Endemic	Yes	IUCN World Red List, EN (bi 2c)(http://www.artd.ata.slu.se/guest/SSC/Bryo/WorldBryo.htm)		3.1 Population trends	2.1. Site/area management; 3.4 Ex-situ conservation; 4.3 Awareness & communications
M	<i>Ditrichum flexicaule</i>	(Schwägr.) Hampe	DD		NE					
M	<i>Ditrichum gracile</i>	(Mitt.) Kuntze	LC							
M	<i>Ditrichum heteromallum</i>	(Hedw.) E.Britton	LC							
M	<i>Ditrichum lineare</i>	(Sw.) Lindb.	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC				1.2 Population size, distribution & trends	
M	<i>Ditrichum plumbicola</i>	Crundw.	EN	D	NT*. Endemic	Yes				1.1 Sites/area protection; 4.3 Awareness & communications
M	<i>Ditrichum pusillum</i>	(Hedw.) Hampe	DD		LC					

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Ditrichum zonatum</i>	(Brid.) Kindb.	EN	B2a, bii, iv	LC					
M	<i>Drepanocladus aduncus</i>	(Hedw.) Warnst.	LC							
M	<i>Drepanocladus polygamus</i>	(Schimp.) Hedenäs	LC							
M	<i>Drepanocladus sendtneri</i>	(Schimp. ex H.Müll.) Warnst.	NT		Regionally Threatened	Yes				
M	<i>Encalypta alpina</i>	Sm.	VU	D2	LC				3.1 Population trends	2.3 Habitat & natural process restoration
M	<i>Encalypta ciliata</i>	Hedw.	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC				3.1 Population trends	1.1 Sites/area protection; 1.2 Resource & habitat protection; 4.3 Awareness & communications
M	<i>Encalypta rhamnoides</i>	Schwägr.	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC			Priority NI		
M	<i>Encalypta streptocarpa</i>	Hedw.	LC							
M	<i>Encalypta vulgaris</i>	Hedw.	NT		LC					
M	<i>Entodon concinnus</i>	(De Not.) Paris	LC							
M	<i>Entosthodon attenuatus</i>	(Dicks.) Bryhn	LC							
M	<i>Entosthodon fascicularis</i>	(Hedw.) Müll.Hal.	NT		LC					
M	<i>Entosthodon muhlenbergii</i>	(Turner) Fife	RE		LC		Re-found in 2012		1.2 Population size, distribution & trends; 3.1 Population trends	
M	<i>Entosthodon obtusus</i>	(Hedw.) Lindb.	LC							
M	<i>Ephemerum cohaerens</i>	(Hedw.) Hampe	VU	B2a, ciii, iv	CR*	Yes				
M	<i>Ephemerum crassinervium</i> subsp. <i>rutheanum</i>	(Schimp. In Ruthe) Holyoak	NT		NE. Endemic	Yes	Not in CC			
M	<i>Ephemerum crassinervium</i> subsp. <i>sessile</i>	(Bruch) Holyoak	NT		Rare	Yes	Not in CC			
M	<i>Ephemerum minutissimum</i>	Lindb.	LC							
M	<i>Ephemerum recurvifolium</i>	(Dicks.) Boulay	DD		Rare	Yes			1.2 Population size, distribution & trends	
M	<i>Ephemerum serratum</i>	(Hedw.) Hampe	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Ephemerum spinulosum</i>	Bruch & Schimp. ex Schimp.	EN	B2a, ciii, iv	NE	Yes	In Ireland, but not in Britain	UKBAP; Priority NI		2.1. Site/area management; 4.3 Awareness & communications
M	<i>Epipterygium tozeri</i>	(Grev.) Lindb.	LC							
M	<i>Eucladium verticillatum</i>	(With.) Bruch & Schimp.	LC							
M	<i>Eurhynchiastrum pulchellum</i> var. <i>diversifolium</i>	(Schimp.) Ochyra & Żarnowiec	RE		LC		NI only	UKBAP; Priority NI	1.2 Population size, distribution & trends	
M	<i>Eurhynchium striatum</i>	(Hedw.) Schimp.	LC							
M	<i>Fissidens adianthoides</i>	Hedw.	LC							
M	<i>Fissidens bryoides</i> var. <i>bryoides</i>	Hedw.	LC							
M	<i>Fissidens bryoides</i> var. <i>caespitans</i>	Schimp.	LC							
M	<i>Fissidens celticus</i>	Paton	LC							
M	<i>Fissidens crassipes</i>	Wilson ex Bruch & Schimp.	LC							
M	<i>Fissidens crispus</i>	Mont.	DD		LC	Yes			1.2 Population size, distribution & trends	
M	<i>Fissidens curvatus</i>	Hornsch.	RE		Insufficiently Known	Yes, if re-found			1.2 Population size, distribution & trends	
M	<i>Fissidens dubius</i>	P.Beauv.	LC							
M	<i>Fissidens exilis</i>	Hedw.	VU	B2a, bii, iv	LC					
M	<i>Fissidens fontanus</i>	(Bach.Pyl.) Steud.	VU	D2	LC				1.2 Population size, distribution & trends	
M	<i>Fissidens gracilifolius</i>	Brugg.-Nann. & Nyholm	LC							
M	<i>Fissidens incurvus</i>	Starke ex Röhl.	LC							
M	<i>Fissidens monguillonii</i>	Thér.	NT		Rare	Yes				1.2 Resource & habitat protection
M	<i>Fissidens osmundoides</i>	Hedw.	LC							
M	<i>Fissidens polyphyllus</i>	Wilson ex Bruch & Schimp.	VU	D2	LC	Yes			3.1 Population trends	1.2 Resource & habitat protection; 4.3 Awareness & communications

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Fissidens pusillus</i>	(Wilson) Milde	LC							
M	<i>Fissidens rivularis</i>	(Spruce) Schimp.	VU	D2	LC	Yes			3.1 Population trends	1.2 Resource & habitat protection; 4.3 Awareness & communications
M	<i>Fissidens rufulus</i>	Bruch & Schimp.	EN	B1a, bi, ii, iii, iv, B2a, bi, ii, iii, iv	LC					1.2 Resource & habitat protection; 4.3 Awareness & communications
M	<i>Fissidens serrulatus</i>	Brid.	VU	D2	LC	Yes			3.1 Population trends	1.2 Resource & habitat protection; 4.3 Awareness & communications
M	<i>Fissidens taxifolius</i> var. <i>pallidicaulis</i>	(Mitt.) Corb.	LC							
M	<i>Fissidens taxifolius</i> var. <i>taxifolius</i>	Hedw.	LC							
M	<i>Fissidens viridulus</i>	(Sw. ex anon.) Wahlenb.	LC							
M	<i>Fontinalis antipyretica</i> var. <i>antipyretica</i>	Hedw.	LC							
M	<i>Fontinalis antipyretica</i> var. <i>cymbifolia</i>	W.E.Nicholson	DD		NE				1.1 Taxonomy	
M	<i>Fontinalis antipyretica</i> var. <i>gracilis</i>	(Lindb.) Schimp.	NT		NE				1.1 Taxonomy	
M	<i>Fontinalis squamosa</i> var. <i>squamosa</i>	Hedw.	LC							
M	<i>Funaria hygrometrica</i>	Hedw.	LC							
M	<i>Glyphomitrium daviesii</i>	(Dicks.) Brid.	LC		Rare. Endemic	Yes				
M	<i>Grimmia anomala</i>	Hampe ex Schimp.	EN	D	LC		Not in CC		1.2 Population size, distribution & trends	
M	<i>Grimmia atrata</i>	Miel. ex Hornsch.	EN	D	Rare	Yes				4.3 Awareness & communications
M	<i>Grimmia crinita</i>	Brid.	RE		LC					
M	<i>Grimmia decipiens</i>	(Schultz) Lindb.	NT		LC					
M	<i>Grimmia dissimulata</i>	E.Maier	VU	D2	LC					
M	<i>Grimmia donniana</i>	Sm.	NT		LC					
M	<i>Grimmia funalis</i>	(Schwägr.) Bruch & Schimp.	NT		LC					

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Grimmia hartmanii</i>	Schimp.	LC							
M	<i>Grimmia laevigata</i>	(Brid.) Brid.	RE		LC				1.2 Population size, distribution & trends	
M	<i>Grimmia lisae</i>	De Not.	LC		Rare	Yes				
M	<i>Grimmia longirostris</i>	Hook.	RE		LC					
M	<i>Grimmia muehlenbeckii</i>	Schimp.	DD		LC				1.2 Population size, distribution & trends	
M	<i>Grimmia orbicularis</i>	Bruch ex Wilson	VU	B2a, bii, iv	LC					4.3 Awareness & communications
M	<i>Grimmia pulvinata</i>	(Hedw.) Sm.	LC							
M	<i>Grimmia ramondii</i>	(Lam. & DC.) Margad.	NT		LC				3.1 Population trends	
M	<i>Grimmia torquata</i>	Drumm.	NT		LC					
M	<i>Grimmia trichophylla</i>	Grev.	LC							
M	<i>Gymnostomum aeruginosum</i>	Sm.	LC							
M	<i>Gymnostomum calcareum</i>	Nees & Hornsch.	LC							
M	<i>Gymnostomum viridulum</i>	Brid.	LC							
M	<i>Gyroweisia tenuis</i>	(Hedw.) Schimp.	LC							
M	<i>Hageniella micans</i>	(Mitt.) B.C.Tan & Y.Jia	NT		Regionally Threatened	Yes				
M	<i>Hamatocaulis vernicosus</i>	(Mitt.) Hedenäs	NT		VU*	Yes		FPO; Bern App. 1; Hab. Dir. Annex 2 [8 SACs]	1.1 Taxonomy; 2.1 Species Action/Recovery Plan; 3.1 Population trends	3.4 Ex-situ conservation; 4.3 Awareness & communications
M	<i>Hedwigia ciliata</i> var. <i>ciliata</i>	(Hedw.) P.Beauv.	VU	D2	LC					
M	<i>Hedwigia integrifolia</i>	P.Beauv.	VU	B2a, bii, iv	Rare	Yes		Priority NI		
M	<i>Hedwigia stellata</i>	Hedenäs	LC							
M	<i>Hennediella heimii</i>	(Hedw.) R.H.Zander	LC							
M	<i>Hennediella stanfordensis</i>	(Steere) Blockeel	NE							
M	<i>Heterocladium heteropterum</i> var. <i>flaccidum</i>	Schimp.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Heterocladium heteropterum</i> var. <i>heteropterum</i>	Schimp.	LC							
M	<i>Heterocladium wulfsbergii</i>	I.Hagen	NT		Apparently threatened but presenting taxonomic problems	Yes				
M	<i>Homalia trichomanoides</i>	(Hedw.) Brid.	LC							
M	<i>Homalothecium lutescens</i>	(Hedw.) H.Rob.	LC							
M	<i>Homalothecium sericeum</i>	(Hedw.) Schimp.	LC							
M	<i>Hookeria lucens</i>	(Hedw.) Sm.	LC							
M	<i>Hygroamblystegium fluviatile</i>	(Hedw.) Loeske	NT		LC				1.1 Taxonomy	
M	<i>Hygroamblystegium humile</i>	(P.Beauv.) Vanderp. et al.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC					
M	<i>Hygroamblystegium tenax</i>	(Hedw.) Jenn.	LC							
M	<i>Hygroamblystegium varium</i>	(Hedw.) Mönk.	NT		LC				1.1 Taxonomy	
M	<i>Hygrohypnum duriusculum</i>	(De Not.) D.W.Jamieson	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC					4.3 Awareness & communications
M	<i>Hygrohypnum eugyrium</i>	(Schimp.) Broth.	LC							
M	<i>Hygrohypnum luridum</i>	(Hedw.) Jenn.	LC							
M	<i>Hygrohypnum ochraceum</i>	(Turner ex Wilson) Loeske	LC							
M	<i>Hylacomiastrum umbratum</i>	(Hedw.) M.Fleisch.	NT		LC					
M	<i>Hylacomium splendens</i>	(Hedw.) Schimp.	LC							
M	<i>Hymenostylium recurvirostrum</i> var. <i>insigne</i>	(Dixon) E.B.Bartram	NT		Rare	Yes				
M	<i>Hymenostylium recurvirostrum</i> var. <i>recurvirostrum</i>	(Hedw.) Dixon	LC							
M	<i>Hyocomium armoricum</i>	(Brid.) Wijk & Margad.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Hypnum andoi</i>	A.J.E.Sm.	LC							
M	<i>Hypnum callichroum</i>	Brid.	NT		LC					
M	<i>Hypnum cupressiforme</i> var. <i>cupressiforme</i>	Hedw.	LC							
M	<i>Hypnum cupressiforme</i> var. <i>lacunosum</i>	Brid.	LC							
M	<i>Hypnum cupressiforme</i> var. <i>resupinatum</i>	(Taylor) Schimp.	LC							
M	<i>Hypnum jutlandicum</i>	Holmen & E.Warncke	LC							
M	<i>Hypnum uncinulatum</i>	Jur.	NT		Regionally Threatened. Endemic	Yes	In Ireland, but not in Britain			
M	<i>Hypopterygium immigrans</i>	Lett	NE				Not in CC			
M	<i>Isopterygiopsis muelleriana</i>	(Schimp.) Z.Iwats.	VU	D2	LC					
M	<i>Isopterygiopsis pulchella</i>	(Hedw.) Z.Iwats.	LC							
M	<i>Isothecium alopecuroides</i>	(Lam. ex Dubois) Isov.	LC							
M	<i>Isothecium holtii</i>	Kindb.	LC							
M	<i>Isothecium myosuroides</i> var. <i>brachythecioides</i>	(Dixon) Braithw.	LC							
M	<i>Isothecium myosuroides</i> var. <i>myosuroides</i>	Brid.	LC							
M	<i>Kiaeria blyttii</i>	(Bruch & Schimp.) Broth.	LC							
M	<i>Kiaeria falcata</i>	(Hedw.) I.Hagen	CR	D	LC				1.2 Population size, distribution & trends	1.1 Sites/area protection; 4.3 Awareness & communications
M	<i>Kindbergia praelonga</i>	(Hedw.) Ochyra	LC							
M	<i>Leptobarbula berica</i>	(De Not.) Schimp.	VU	D2	LC	Yes		FPO	1.2 Population size, distribution & trends	
M	<i>Leptobryum pyriforme</i>	(Hedw.) Wilson	LC							
M	<i>Leptodictyum riparium</i>	(Hedw.) Warnst.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Leptodon smithii</i>	(Hedw.) F.Weber & D.Mohr	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC	Yes				1.2 Resource & habitat protection; 4.3 Awareness & communications
M	<i>Leptodontium flexifolium</i>	(Dicks.) Hampe	NT		LC	Yes				
M	<i>Leptotheca gaudichaudii</i> var. <i>gaudichaudii</i>	Schwägr.	NE							
M	<i>Leskea polycarpa</i>	Hedw.	LC							
M	<i>Leucobryum glaucum</i>	(Hedw.) Ångstr.	LC					Hab. Dir. Annex 5		
M	<i>Leucobryum juniperoideum</i>	(Brid.) Müll.Hal.	LC							
M	<i>Leucodon sciuroides</i> var. <i>sciuroides</i>	(Hedw.) Schwägr.	LC							
M	<i>Loeskeobryum brevirostre</i>	(Brid.) M.Fleisch.	LC							
M	<i>Meesia triquetra</i>	(L. ex Jolycl.) Ångstr.	RE		LC	Yes	Re-found in 2012. In Ireland, but not in Britain.		1.2 Population size, distribution & trends; 3.1 Population trends	2.3 Habitat & natural process restoration; 3.4 Ex-situ conservation; 4.3 Awareness & communications
M	<i>Meesia uliginosa</i>	Hedw.	EN	D	LC					4.3 Awareness & communications
M	<i>Microbryum curvicolium</i>	(Hedw.) R.H.Zander	RE		LC					
M	<i>Microbryum davallianum</i> var. <i>davallianum</i>	(Sm.) R.H.Zander	LC							
M	<i>Microbryum rectum</i>	(With.) R.H.Zander	LC							
M	<i>Microbryum starckeanum</i>	(Hedw.) R.H.Zander	RE		LC					
M	<i>Mnium hornum</i>	Hedw.	LC							
M	<i>Mnium marginatum</i> var. <i>marginatum</i>	(Dicks.) P.Beauv.	LC							
M	<i>Mnium stellare</i>	Hedw.	LC							
M	<i>Mnium thomsonii</i>	Schimp.	NT		LC					
M	<i>Molendoa warburgii</i>	(Crundw. & M.O.Hill) R.H.Zander	VU	D2	Rare. Endemic	Yes				
M	<i>Myurella julacea</i>	(Schwägr.) Schimp.	EN	B2a, bii, iv	LC			Priority NI		4.3 Awareness & communications

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Myurium hochstetteri</i>	(Schimp.) Kindb.	RE		Endemic	Yes, if re-found				
M	<i>Neckera complanata</i>	(Hedw.) Huebener	LC							
M	<i>Neckera crispa</i>	Hedw.	LC							
M	<i>Neckera pumila</i>	Hedw.	LC							
M	<i>Oedipodium griffithianum</i>	(Dicks.) Schwägr.	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC	Yes				4.3 Awareness & communications
M	<i>Oligotrichum hercynicum</i>	(Hedw.) Lam. & DC.	LC							
M	<i>Orthodontium gracile</i>	(Wilson) Schwägr. ex Bruch & Schimp.	CR	B2a, biii	VU*	Yes	NI only	UKBAP; Priority NI		
M	<i>Orthodontium lineare</i>	Schwägr.	LC							
M	<i>Orthothecium intricatum</i>	(Hartm.) Schimp.	LC							
M	<i>Orthothecium rufescens</i>	(Dicks. ex Brid.) Schimp.	NT		LC					
M	<i>Orthotrichum affine</i>	Schrad. ex Brid.	LC							
M	<i>Orthotrichum anomalum</i>	Hedw.	LC							
M	<i>Orthotrichum cupulatum</i>	Hoffm. ex Brid.	LC							
M	<i>Orthotrichum diaphanum</i>	Schrad. ex Brid.	LC							
M	<i>Orthotrichum lyellii</i>	Hook. & Taylor	LC							
M	<i>Orthotrichum pallens</i>	Bruch ex Brid.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC			FPO		4.3 Awareness & communications
M	<i>Orthotrichum pulchellum</i>	Brunt.	LC							
M	<i>Orthotrichum rivulare</i>	Turner	NT		LC					
M	<i>Orthotrichum rupestre</i>	Schleich. ex Schwägr.	LC							
M	<i>Orthotrichum sprucei</i>	Mont.	VU	B2a, biii	Rare.	Yes		FPO; Priority NI		4.3 Awareness & communications
M	<i>Orthotrichum stramineum</i>	Hornsch. ex Brid.	VU	B2a, bii, iv	LC			FPO		
M	<i>Orthotrichum striatum</i>	Hedw.	LC							
M	<i>Orthotrichum tenellum</i>	Bruch ex Brid.	LC							
M	<i>Oxyrrhynchium hians</i>	(Hedw.) Loeske	LC							
M	<i>Oxyrrhynchium pumilum</i>	(Wilson) Loeske	LC							
M	<i>Oxyrrhynchium schleicheri</i>	(R.Hedw.) Röhl	CR	B2a, biii	LC					
M	<i>Oxyrrhynchium speciosum</i>	(Brid.) Warnst.	NT		LC					

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Paludella squarrosa</i>	(Hedw.) Brid.	CR	B2a, biii, D	LC	Yes	In Ireland, but not in Britain. Boreal relict.	FPO	3.1 Population trends	3.4 Ex-situ conservation; 4.3 Awareness & communications
M	<i>Palustriella commutata</i>	(Hedw.) Ochyra	LC							
M	<i>Palustriella falcata</i>	(Brid.) Hedenäs	LC							
M	<i>Paraleptodontium recurvifolium</i>	(Taylor) D.G.Long	NT		Rare	Yes				
M	<i>Phascum cuspidatum</i> var. <i>cuspidatum</i>	Hedw.	LC							
M	<i>Phascum cuspidatum</i> var. <i>papillosum</i>	(Lindb.) G.Roth	DD		NE		NI only		1.1 Taxonomy	
M	<i>Phascum cuspidatum</i> var. <i>piliferum</i>	(Hedw.) Hook. & Taylor	DD		NE					
M	<i>Philonotis arnellii</i>	Husn.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC					
M	<i>Philonotis caespitosa</i>	Jur.	NT		LC					
M	<i>Philonotis calcarea</i>	(Bruch & Schimp.) Schimp.	LC							
M	<i>Philonotis cernua</i>	(Wilson) D.G.Griffin & W.R.Buck	CR	B1a, bi, ii, iii, iv, B2a, bi, ii, iii, iv	Rare	Yes	In Britain and Ireland, but not in rest of Europe.			2.3 Habitat & natural process restoration
M	<i>Philonotis fontana</i>	(Hedw.) Brid.	LC							
M	<i>Philonotis rigida</i>	Brid.	VU	B2a, bii, iv	LC	Yes		Priority NI		
M	<i>Philonotis tomentella</i>	Molendo	VU	D2	LC					
M	<i>Physcomitrium pyriforme</i>	(Hedw.) Bruch & Schimp.	LC							
M	<i>Physcomitrium sphaericum</i>	(C.F.Ludw. ex Schkuhr) Brid.	VU	D2	Rare	Yes	NI only	Priority NI		2.1. Site/area management
M	<i>Plagiobryum zieri</i>	(Hedw.) Lindb.	NT		LC					
M	<i>Plagiomnium affine</i>	(Blandow ex Funck) T.J.Kop.	LC							
M	<i>Plagiomnium cuspidatum</i>	(Hedw.) T.J.Kop.	NT		LC					
M	<i>Plagiomnium elatum</i>	(Bruch & Schimp.) T.J.Kop.	LC							
M	<i>Plagiomnium ellipticum</i>	(Brid.) T.J.Kop.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Plagiomnium rostratum</i>	(Schrad.) T.J.Kop.	LC							
M	<i>Plagiomnium undulatum</i>	(Hedw.) T.J.Kop.	LC							
M	<i>Plagiopus oederianus</i>	(Sw.) H.A.Crum & L.E.Anderson	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC				1.2 Population size, distribution & trends	
M	<i>Plagiothecium cavifolium</i>	(Brid.) Z.Iwats.	VU	D2	LC					
M	<i>Plagiothecium curvifolium</i>	Schlieph. ex Limpr.	VU	D2	LC					1.2 Resource & habitat protection
M	<i>Plagiothecium denticulatum</i> var. <i>denticulatum</i>	(Hedw.) Schimp.	LC							
M	<i>Plagiothecium denticulatum</i> var. <i>obtusifolium</i>	(Turner) Moore	NT		NE					
M	<i>Plagiothecium laetum</i>	Schimp.	VU	D2	LC					
M	<i>Plagiothecium latebricola</i>	Schimp.	VU	D2	LC					1.2 Resource & habitat protection
M	<i>Plagiothecium nemorale</i>	(Mitt.) A.Jaeger	LC							
M	<i>Plagiothecium platyphyllum</i>	Mönk.	VU	D2	LC					
M	<i>Plagiothecium succulentum</i>	(Wilson) Lindb.	LC							
M	<i>Plagiothecium undulatum</i>	(Hedw.) Schimp.	LC							
M	<i>Plasteurhynchium striatulum</i>	(Spruce) M.Fleisch.	NT		LC					
M	<i>Platydictya jungermannioides</i>	(Brid.) H.A.Crum	NT		LC					
M	<i>Platyhypnidium lusitanicum</i>	(Schimp.) Ochyra & Bednarek-Ochyra	NT		LC. Endemic	Yes				
M	<i>Platyhypnidium riparioides</i>	(Hedw.) Dixon	LC							
M	<i>Pleuroidium acuminatum</i>	Lindb.	LC							
M	<i>Pleuroidium subulatum</i>	(Hedw.) Rabenh.	LC							
M	<i>Pleurochaete squarrosa</i>	(Brid.) Lindb.	NT		LC					
M	<i>Pleurozium schreberi</i>	(Willd. ex Brid.) Mitt.	LC							
M	<i>Pogonatum aloides</i>	(Hedw.) P.Beauv.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Pogonatum nanum</i>	(Hedw.) P.Beauv.	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC				1.2 Population size, distribution & trends	
M	<i>Pogonatum urnigerum</i>	(Hedw.) P.Beauv.	LC							
M	<i>Pohlia andalusica</i>	(Höhn.) Broth.	EN	B1a, biii, B2a, biii	LC					2.1. Site/area management; 4.3 Awareness & communications
M	<i>Pohlia annotina</i>	(Hedw.) Lindb.	LC							
M	<i>Pohlia bulbifera</i>	(Warnst.) Warnst.	LC							
M	<i>Pohlia camptotrachela</i>	(Renauld & Cardot) Broth.	LC							
M	<i>Pohlia cruda</i>	(Hedw.) Lindb.	LC							
M	<i>Pohlia drummondii</i>	(Müll.Hal.) A.L.Andrews	LC							
M	<i>Pohlia elongata</i> var. <i>elongata</i>	Hedw.	NT		LC [<i>P. elongata</i>]					
M	<i>Pohlia elongata</i> var. <i>greenii</i>	(Brid.) A.J.Shaw	EN	B1a, bi, ii, iv, B2a, bi, ii, iv	LC [<i>P. elongata</i>]					
M	<i>Pohlia filum</i>	(Schimp.) Martensson	VU	A3c, D1	LC			Priority NI		
M	<i>Pohlia flexuosa</i>	Hook.	LC							
M	<i>Pohlia lescuriana</i>	(Sull.) Ochi	DD		LC					
M	<i>Pohlia lutescens</i>	(Limpr.) H.Lindb.	LC							
M	<i>Pohlia melanodon</i>	(Brid.) A.J.Shaw	LC							
M	<i>Pohlia nutans</i>	(Hedw.) Lindb.	LC							
M	<i>Pohlia proligera</i>	(Kindb.) Lindb. ex Broth.	RE		LC					
M	<i>Pohlia wahlenbergii</i> var. <i>calcarea</i>	(Warnst.) E.F.Warb.	DD		NE					
M	<i>Pohlia wahlenbergii</i> var. <i>glacialis</i>	(Brid.) E.F.Warb.	RE		NE					
M	<i>Pohlia wahlenbergii</i> var. <i>wahlenbergii</i>	(F.Weber & D.Mohr) A.L.Andrews	LC							
M	<i>Polytrichastrum alpinum</i>	(Hedw.) G.L.Sm.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Polytrichastrum formosum</i>	(Hedw.) G.L.Sm.	LC							
M	<i>Polytrichastrum longisetum</i>	(Sw. ex Brid.) G.L.Sm.	LC							
M	<i>Polytrichum commune</i> var. <i>commune</i>	Hedw.	LC							
M	<i>Polytrichum commune</i> var. <i>perigoniale</i>	(Michx.) Hampe	DD		NE					
M	<i>Polytrichum juniperinum</i>	Hedw.	LC							
M	<i>Polytrichum piliferum</i>	Hedw.	LC							
M	<i>Polytrichum strictum</i>	Menzies ex Brid.	LC							
M	<i>Pseudephemerum nitidum</i>	(Hedw.) Loeske	LC							
M	<i>Pseudocalliergon lycopodioides</i>	(Brid.) Hedenäs	VU	A2c	Regionally Threatened	Yes		Priority NI		4.3 Awareness & communications
M	<i>Pseudocalliergon trifarium</i>	(F.Weber & D.Mohr) Loeske	VU	D2	LC					
M	<i>Pseudocrossidium hornschuchianum</i>	(Schultz) R.H.Zander	LC							
M	<i>Pseudocrossidium revolutum</i>	(Brid.) R.H.Zander	LC							
M	<i>Pseudoscleropodium purum</i>	(Hedw.) M.Fleisch.	LC							
M	<i>Pseudotaxiphyllum elegans</i>	(Brid.) Z.Iwats.	LC							
M	<i>Pterigynandrum filiforme</i>	Hedw.	RE		LC					
M	<i>Pterogonium gracile</i>	(Hedw.) Sm.	LC							
M	<i>Pterygoneurum lamellatum</i>	(Lindb.) Jur.	RE		VU*	Yes, if re-found				
M	<i>Pterygoneurum ovatum</i>	(Hedw.) Dixon	RE		LC				1.2 Population size, distribution & trends	
M	<i>Ptilium crista-castrensis</i>	(Hedw.) De Not.	CR	B2a, biii, D	LC					4.3 Awareness & communications
M	<i>Ptychomitrium polyphyllum</i>	(Dicks. ex Sw.) Bruch & Schimp.	LC							
M	<i>Racomitrium aciculare</i>	(Hedw.) Brid.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Racomitrium affine</i>	(F.Weber & D.Mohr) Lindb.	LC							
M	<i>Racomitrium aquaticum</i>	(Brid. ex Schrad.) Brid.	LC							
M	<i>Racomitrium canescens</i>	(Hedw.) Brid.	VU	D2	LC			Priority NI		
M	<i>Racomitrium ellipticum</i>	(Turner) Bruch & Schimp.	LC							
M	<i>Racomitrium elongatum</i>	Ehrh. ex Frisvoll	VU	D2	LC					
M	<i>Racomitrium ericoides</i>	(Brid.) Brid.	LC							
M	<i>Racomitrium fasciculare</i>	(Hedw.) Brid.	LC							
M	<i>Racomitrium heterostichum</i>	(Hedw.) Brid.	LC							
M	<i>Racomitrium lanuginosum</i>	(Hedw.) Brid.	LC							
M	<i>Racomitrium macounii</i> subsp. <i>alpinum</i>	(E.Lawton) Frisvoll	VU	D2	LC					
M	<i>Racomitrium sudeticum</i>	(Funck) Bruch & Schimp.	LC							
M	<i>Rhabdoweisia crenulata</i>	(Mitt.) H.Jameson	LC							
M	<i>Rhabdoweisia crispata</i>	(Dicks.) Lindb.	NT		LC				3.1 Population trends	
M	<i>Rhabdoweisia fugax</i>	(Hedw.) Bruch & Schimp.	VU	B1a, bi, ii, iv, B2a, bi, ii, iv	LC			Priority NI	1.2 Population size, distribution & trends; 3.1 Population trends	
M	<i>Rhizomnium pseudopunctatum</i>	(Bruch & Schimp.) T.J.Kop.	NT		LC					
M	<i>Rhizomnium punctatum</i>	(Hedw.) T.J.Kop.	LC							
M	<i>Rhodobryum roseum</i>	(Hedw.) Limpr.	NT		LC					
M	<i>Rhynchostegiella curviseta</i>	(Brid.) Limpr.	RE		LC		NI only			
M	<i>Rhynchostegiella tenella</i>	(Dicks.) Limpr.	LC							
M	<i>Rhynchostegiella teneriffae</i>	(Mont.) Dirkse & Bouman	LC							
M	<i>Rhynchostegium confertum</i>	(Dicks.) Schimp.	LC							
M	<i>Rhynchostegium megapolitanum</i>	(Blandow ex F.Weber & D.Mohr) Schimp.	NT		LC					

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Rhynchostegium murale</i>	(Hedw.) Schimp.	LC							
M	<i>Rhytidiadelphus loreus</i>	(Hedw.) Warnst.	LC							
M	<i>Rhytidiadelphus squarrosus</i>	(Hedw.) Warnst.	LC							
M	<i>Rhytidiadelphus subpinnatus</i>	(Lindb.) T.J.Kop.	RE		LC					
M	<i>Rhytidiadelphus triquetrus</i>	(Hedw.) Warnst.	LC							
M	<i>Rhytidium rugosum</i>	(Hedw.) Kindb.	VU	D2	LC		NI only	Priority NI		
M	<i>Sanionia uncinata</i>	(Hedw.) Loeske	LC							
M	<i>Sarmentypnum exannulatum</i>	(Schimp.) Hedenäs	LC							
M	<i>Sarmentypnum sarmentosum</i>	(Wahlenb.) Tuom. & T.J.Kop.	LC							
M	<i>Schistidium agassizii</i>	Sull. & Lesq.	VU	D2	LC				1.2 Population size, distribution & trends; 3.1 Population trends	4.3 Awareness & communications
M	<i>Schistidium apocarpum</i>	(Hedw.) Bruch & Schimp.	LC							
M	<i>Schistidium confertum</i>	(Funck) Bruch & Schimp.	DD		LC				1.2 Population size, distribution & trends	
M	<i>Schistidium crassipilum</i>	H.H.Blom	LC							
M	<i>Schistidium elegantulum</i> subsp. <i>elegantulum</i>	H.H.Blom	DD		NE					
M	<i>Schistidium elegantulum</i> subsp. <i>wilsonii</i>	H.H.Blom	DD		NE					
M	<i>Schistidium maritimum</i>	(Sm. ex R.Scott) Bruch & Schimp.	LC							
M	<i>Schistidium platyphyllum</i>	(Mitt.) H.Perss.	VU	B2a, bii, iii, iv	LC			Priority NI		
M	<i>Schistidium pruinatum</i>	(Wilson ex Schimp.) G.Roth	DD		Insufficiently Known	Yes	NI only		1.2 Population size, distribution & trends	
M	<i>Schistidium rivulare</i>	(Brid.) Podp.	LC							
M	<i>Schistidium robustum</i>	(Nees & Hornsch.) H.H.Blom	DD		NE				1.2 Population size, distribution & trends	

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Schistidium strictum</i>	(Turner) Loeske ex Martensson	NT		LC					
M	<i>Schistidium trichodon</i>	(Brid.) Poelt	VU	D2	Insufficiently Known	Yes		Priority NI		
M	<i>Sciuro-hypnum plumosum</i>	(Hedw.) Ignatov & Huttunen	LC							
M	<i>Sciuro-hypnum populeum</i>	(Hedw.) Ignatov & Huttunen	LC							
M	<i>Scleropodium cespitans</i>	(Wilson ex Müll.Hal.) L.F.Koch	NT		LC					
M	<i>Scleropodium touretii</i>	(Brid.) L.F.Koch	EN	B1a, bi, ii, iii, iv, B2a, bi, ii, iii, iv	LC	Yes				1.1 Sites/area protection; 4.3 Awareness & communications
M	<i>Scopelophila cataractae</i>	(Mitt.) Broth.	VU	D2	NE					1.1 Sites/area protection; 2.1. Site/area management
M	<i>Scorpidium cossonii</i>	(Schimp.) Hedenäs	LC							
M	<i>Scorpidium revolvens</i>	(Sw. ex anon.) Rubers	LC							
M	<i>Scorpidium scorpioides</i>	(Hedw.) Limpr.	LC							
M	<i>Scorpiurium circinatum</i>	(Bruch) M.Fleisch. & Loeske	LC							
M	<i>Seligeria acutifolia</i>	Lindb.	LC							
M	<i>Seligeria calcarea</i>	(Hedw.) Bruch & Schimp.	VU	B2a, bii, iv	LC		NI only	Priority NI		
M	<i>Seligeria calycina</i>	Mitt. ex Lindb.	RE		LC. Endemic	Yes, if re-found	NI only		1.2 Population size, distribution & trends	
M	<i>Seligeria donniana</i>	(Sm.) Müll.Hal.	LC							
M	<i>Seligeria oelandica</i>	C.E.O.Jensen & Medelius	VU	D1	Insufficiently Known	Yes		UKBAP; Priority NI		
M	<i>Seligeria patula</i>	(Lindb.) I.Hagen	NT		Insufficiently Known. Endemic	Yes				
M	<i>Seligeria pusilla</i>	(Hedw.) Bruch & Schimp.	LC							
M	<i>Seligeria recurvata</i>	(Hedw.) Bruch & Schimp.	LC							
M	<i>Sematophyllum demissum</i>	(Wilson) Mitt.	NT		Rare	Yes				

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Sematophyllum substrumulosum</i>	(Hampe) E.Britton	VU	D2	NE	Yes				2.3 Habitat & natural process restoration
M	<i>Sphagnum affine</i>	Renauld & Cardot	VU	D2	LC			Hab. Dir. Annex 5	3.1 Population trends	1.2 Resource & habitat protection
M	<i>Sphagnum angustifolium</i>	(C.E.O.Jensen ex Russow) C.E.O.Jensen	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum austinii</i>	Sull.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum capillifolium</i> subsp. <i>capillifolium</i>	(Ehrh.) Hedw.	DD		LC			Hab. Dir. Annex 5		
M	<i>Sphagnum capillifolium</i> subsp. <i>rubellum</i>	(Wilson) M.O.Hill	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum compactum</i>	Lam. & DC.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum contortum</i>	Schultz	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum cuspidatum</i>	Ehrh. ex Hoffm.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum denticulatum</i>	Brid.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum fallax</i>	(H.Klinggr.) H.Klinggr.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum fimbriatum</i>	Wilson	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum flexuosum</i>	Dozy & Molk.	VU	D2	LC			Hab. Dir. Annex 5	1.2 Population size, distribution & trends	
M	<i>Sphagnum fuscum</i>	(Schimp.) H.Klinggr.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum girgensohnii</i>	Russow	NT		LC			Hab. Dir. Annex 5		
M	<i>Sphagnum inundatum</i>	Russow	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum magellanicum</i>	Brid.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum molle</i>	Sull.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum palustre</i> var. <i>palustre</i>	L.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum papillosum</i>	Lindb.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum platyphyllum</i>	(Lindb. ex Braithw.) Warnst.	NT		LC			Hab. Dir. Annex 5		
M	<i>Sphagnum pulchrum</i>	(Lindb. ex Braithw.) Warnst.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum quinquefarium</i>	(Braithw.) Warnst.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum russowii</i>	Warnst.	NT		LC			Hab. Dir. Annex 5		

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Sphagnum skyense</i>	Flatberg	DD		Insufficiently Known. Endemic	Yes		Hab. Dir. Annex 5	3.1 Population trends	
M	<i>Sphagnum squarrosum</i>	Crome	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum strictum</i>	Sull.	DD		LC	Yes		Hab. Dir. Annex 5	1.2 Population size, distribution & trends	
M	<i>Sphagnum subnitens</i> var. <i>ferrugineum</i>	(Flatberg) M.O.Hill	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum subnitens</i> var. <i>subnitens</i>	Russow & Warnst.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum subsecundum</i>	Nees	NT		LC			Hab. Dir. Annex 5		
M	<i>Sphagnum tenellum</i>	(Brid.) Pers. ex Brid.	LC					Hab. Dir. Annex 5		
M	<i>Sphagnum teres</i>	(Schimp.) Ångstr.	NT		LC			Hab. Dir. Annex 5	3.1 Population trends	
M	<i>Sphagnum warnstorffii</i>	Russow	VU	B2a, bii, iv	LC			Hab. Dir. Annex 5		1.2 Resource & habitat protection
M	<i>Splachnum ampullaceum</i>	Hedw.	LC							
M	<i>Splachnum sphaericum</i>	Hedw.	LC							
M	<i>Straminergon stramineum</i>	(Dicks. ex Brid.) Hedenäs	LC							
M	<i>Syntrichia laevispila</i>	Brid.	LC							
M	<i>Syntrichia latifolia</i>	(Bruch ex Hartm.) Huebener	LC							
M	<i>Syntrichia montana</i>	Nees	LC							
M	<i>Syntrichia papillosa</i>	(Wilson) Jur.	LC							
M	<i>Syntrichia princeps</i>	(De Not.) Mitt.	RE		LC		Re-found in 2012			
M	<i>Syntrichia ruralis</i> var. <i>ruraliformis</i>	(Besch.) Delogne	LC							
M	<i>Syntrichia ruralis</i> var. <i>ruralis</i>	(Hedw.) F.Weber & D.Mohr	LC							
M	<i>Syntrichia virescens</i>	(De Not.) Ochyra	DD		LC				1.2 Population size, distribution & trends	
M	<i>Taxiphyllum wissgrillii</i>	(Garov.) Wijk & Margad.	LC							
M	<i>Taylora tenuis</i>	(Dicks.) Schimp.	RE		LC		NI only	UKBAP		
M	<i>Tetraphis pellucida</i>	Hedw.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Tetraplodon angustatus</i>	(Hedw.) Bruch & Schimp.	DD		LC			FPO		
M	<i>Tetraplodon mmioides</i>	(Hedw.) Bruch & Schimp.	LC							
M	<i>Tetrodontium brownianum</i>	(Dicks.) Schwägr.	NT		LC					
M	<i>Thamnobryum alopecurum</i>	(Hedw.) Gangulee	LC							
M	<i>Thuidium assimile</i>	(Mitt.) A.Jaeger	LC							
M	<i>Thuidium delicatulum</i>	(Hedw.) Schimp.	LC					Priority NI		
M	<i>Thuidium recognitum</i>	(Hedw.) Lindb.	VU	B2a, bii, iv	LC					
M	<i>Thuidium tamariscinum</i>	(Hedw.) Schimp.	LC							
M	<i>Timmia norvegica</i>	J.E.Zetterst.	VU	D1	LC					
M	<i>Tomentypnum nitens</i>	(Hedw.) Loeske	VU	A3c	LC					
M	<i>Tortella bambergi</i>	(Schimp.) Broth.	LC							
M	<i>Tortella densa</i>	(Lorentz & Molendo) Crundw. & Nyholm	NT		LC					
M	<i>Tortella flavovirens</i>	(Bruch) Broth.	LC							
M	<i>Tortella inclinata</i>	(R.Hedw.) Limpr.	EN	B2a, bii, iv	LC			FPO; Priority NI	3.1 Population trends	2.3 Habitat & natural process restoration; 4.3 Awareness & communications
M	<i>Tortella nitida</i>	(Lindb.) Broth.	LC							
M	<i>Tortella tortuosa</i>	(Hedw.) Limpr.	LC							
M	<i>Tortula atrovirens</i>	(Sm.) Lindb.	NT		LC					
M	<i>Tortula canescens</i>	Mont.	DD		LC	Yes			1.2 Population size, distribution & trends; 3.1 Population trends	
M	<i>Tortula cuneifolia</i>	(Dicks.) Turner	CR	B1a, bi, ii, iv, B2a, bi, ii, iv	LC	Yes		UKBAP	1.2 Population size, distribution & trends	
M	<i>Tortula lanceola</i>	R.H.Zander	CR	B1a, bi, ii, iii, iv, B2a, bi, ii, iii, iv	LC					
M	<i>Tortula marginata</i>	(Bruch & Schimp.) Spruce	NT		LC	Yes				

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Tortula modica</i>	R.H.Zander	VU	B2a, bii, iv	LC					
M	<i>Tortula muralis</i>	Hedw.	LC							
M	<i>Tortula protobryoides</i>	R.H.Zander	RE		LC		NI only			
M	<i>Tortula subulata</i>	Hedw.	LC							
M	<i>Tortula truncata</i>	(Hedw.) Mitt.	LC							
M	<i>Tortula vahliana</i>	(Schultz) Mont.	RE		LC					
M	<i>Tortula viridifolia</i>	(Mitt.) Blockeel & A.J.E.Sm.	LC							
M	<i>Tortula wilsonii</i>	(Hook.) R.H.Zander	RE		LC			FPO		
M	<i>Trichodon cylindricus</i>	(Hedw.) Schimp.	LC							
M	<i>Trichostomum brachydontium</i>	Bruch	LC							
M	<i>Trichostomum crispulum</i>	Bruch	LC							
M	<i>Trichostomum hibernicum</i>	(Mitt.) Dixon	LC		Rare	Yes				
M	<i>Trichostomum tenuirostre</i>	(Hook. & Taylor) Lindb.	LC							
M	<i>Ulota bruchii</i>	Hornsch. ex Brid.	LC							
M	<i>Ulota calvescens</i>	Wilson	LC							
M	<i>Ulota coarctata</i>	(P.Beauv.) Hammar	CR	D	Regionally Threatened	Yes				4.3 Awareness & communications
M	<i>Ulota crispa</i>	(Hedw.) Brid.	LC							
M	<i>Ulota drummondii</i>	(Hook. & Grev.) Brid.	RE		LC				1.2 Population size, distribution & trends	
M	<i>Ulota hutchinsiae</i>	(Sm.) Hammar	LC							
M	<i>Ulota phyllantha</i>	Brid.	LC							
M	<i>Warnstorfia fluitans</i>	(Hedw.) Loeske	LC							
M	<i>Weissia brachycarpa</i> var. <i>brachycarpa</i>	(Nees & Hornsch.) Jur.	DD		NE				1.2 Population size, distribution & trends	
M	<i>Weissia brachycarpa</i> var. <i>obliqua</i>	(Nees & Hornsch.) M.O.Hill	LC							
M	<i>Weissia condensa</i>	(Voit) Lindb.	DD		LC				1.1 Taxonomy	1.2 Resource & habitat protection; 4.3 Awareness & communications
M	<i>Weissia controversa</i> var. <i>controversa</i>	Hedw.	LC							

Group	Taxon name	Authority	Threat category (IRL)	Criteria	Threat Status (Europe)	Special responsibility	Notes	Current Protection Status	Research needed	Conservation Actions needed
M	<i>Weissia controversa</i> var. <i>crispata</i>	(Nees & Hornsch.) Nyholm	DD		NE					
M	<i>Weissia controversa</i> var. <i>densifolia</i>	(Bruch & Schimp.) Wilson	LC							
M	<i>Weissia longifolia</i> var. <i>angustifolia</i>	(Baumgartner) Crundw. & Nyholm	VU	B1a, bii, iv, B2a, bii, iv	NE			FPO	3.1 Population trends	
M	<i>Weissia perssonii</i>	Kindb.	LC		Rare	Yes				
M	<i>Weissia rostellata</i>	(Brid.) Lindb.	NT		Rare. Endemic	Yes		FPO		2.1. Site/area management
M	<i>Weissia rutilans</i>	(Hedw.) Lindb.	VU	B2a, bii, iv	LC			Priority NI		
M	<i>Zygodon conoideus</i> var. <i>conoideus</i>	(Dicks.) Hook. & Taylor	LC							
M	<i>Zygodon rupestris</i>	Schimp. ex Lorentz	LC							
M	<i>Zygodon viridissimus</i> var. <i>stirtonii</i>	(Schimp. ex Stirt.) I.Hagen	LC							
M	<i>Zygodon viridissimus</i> var. <i>viridissimus</i>	(Dicks.) Brid.	LC							

REFERENCES

- Aleffi, M. 2005. New checklist of the Hepaticae and Anthocerotae of Italy. *Flora Mediterranea* **15**: 486–566.
- Bisang, I. 1996. Quantitative analysis of the diaspore banks of bryophytes and ferns in cultivated fields in Switzerland. *Lindbergia* **21**: 9–20.
- Blackstock, T.H. & Long, D.G. 2002. *Heteroscyphus fissistipus* (Hook.f. & Taylor) Schiffn. established in south-west Ireland, new to the Northern Hemisphere. *Journal of Bryology* **24**: 147–150.
- Blockeel, T.L. & Long, D.G. 1998. *A Check-list and Census Catalogue of British and Irish Bryophytes*. Cardiff: British Bryological Society.
- Bosanquet, S. & Preston, C. 2010. BBS Summer Meeting: Co. Cork and Co. Kerry, 27 June–11 July 2009. *Field Bryology* **100**: 47–63.
- Brummitt, R.K. & Powell, C.E. 1992. *Authors of plant names*. Kew: Royal Botanic Gardens.
- Church, J.M., Hodgetts, N.G., Preston, C.D. & Stewart, N.F. 2001. *British Red Data Books: mosses and liverworts*. Peterborough: Joint Nature Conservation Committee.
- DAHG 2011. *Actions for Biodiversity 2011–2016. Ireland's National Biodiversity Plan*. Department of Arts, Heritage and the Gaeltacht, Dublin, 60 pp.
- DAHGI 2002. *National biodiversity action plan*. Department of Arts, Heritage, Gaeltacht and the Islands, Dublin, 49 pp.
- Dickson, J.H. 1973. *Bryophytes of the Pleistocene. The British record and its chronological and ecological implications*. Cambridge: Cambridge University Press.
- Dixon, H.N. 1924. *The student's handbook of British mosses*. 3rd ed. Eastbourne: Sumfield & Day Ltd., London: Wheldon & Wesley Ltd.
- During, H.J. 1992. Ecological classifications of bryophytes and lichens. In: Bates, J.W., Farmer, A.M., (eds) *Bryophytes and lichens in a changing environment*. Oxford: Clarendon Press.
- During, H.J. 1997. Bryophyte diaspore banks. *Advances in Bryology* **6**: 103–134.
- EHS 2002. *Northern Ireland Biodiversity Strategy*. Belfast: Environment and Heritage Service, 22 pp.
- European Committee for the Conservation of Bryophytes (ed.) 1995. *Red Data Book of European bryophytes*. Trondheim: European Committee for the Conservation of Bryophytes.
- Ferriss, S.E., Inskipp, T.P., Kloda, J. & Sinovas, P. 2007. *Wildlife trade in Ireland – a review*. Confidential report to the National Parks and Wildlife Service, Ireland. UNEP World Conservation Monitoring Centre, Cambridge. 85 pp.
- Gilpin, M. & Hanski, I. (eds) 1991. Metapopulation dynamics: empirical and theoretical investigations. *Biological Journal of the Linnean Society* **42**: 1–336.
- Grolle, R. & Long, D.G. 2000. An annotated check-list of the Hepaticae and Anthocerotae of Europe and Macaronesia. *Journal of Bryology* **22**: 103–140.
- Hallingbäck, T., Hodgetts, N.G. & Urmi, E. 1995. How to apply the new IUCN Red List categories to bryophytes. *Species* **24**: 37–41.
- Hedenäs, L., Herben, T., Rydin, H. & Söderström, L. 1989. Ecology of the invading moss species *Orthodontium lineare* in Sweden: substrate preference and interactions with other species. *Journal of Bryology* **15**: 565–581.
- Hill, M.O., Blackstock, T.H., Long, D.G. & Rothero, G.P. 2008. *A checklist and census catalogue of British and Irish bryophytes updated 2008*. Middlewich, Cheshire: British Bryological Society.

- Hill, M.O., Preston, C.D., Bosanquet, S.D.S. & Roy, D.B. 2007. *BRYOATT. Attributes of British and Irish mosses, liverworts and hornworts*. NERC Centre for Ecology and Hydrology & Countryside Council for Wales.
- Hill, M.O., Preston, C.D. & Smith, A.J.E. 1991. *Atlas of the bryophytes of Britain and Ireland. 1. Liverworts (Hepaticae and Anthocerotae)*. Colchester: Harley Books.
- Hill, M.O., Preston, C.D. & Smith, A.J.E. 1992. *Atlas of the bryophytes of Britain and Ireland. 2. Mosses (except Diplolepideae)*. Colchester: Harley Books.
- Hill, M.O., Preston, C.D. & Smith, A.J.E. 1994. *Atlas of the bryophytes of Britain and Ireland. 3. Mosses (Diplolepideae)*. Colchester: Harley Books.
- Holyoak, D.T. 2003. *The distribution of bryophytes in Ireland*. Dinas Powys, Vale of Glamorgan: Broadleaf Books.
- Holyoak, D.T. 2006a. Summer field meeting 2005, Co. Fermanagh, Co. Leitrim and Co. Cavan, Ireland. *Field Bryology* **88**: 12–17.
- Holyoak, D.T. 2006b. Progress towards a species inventory for conservation of bryophytes in Ireland. *Biology and Environment, Proceedings of the Royal Irish Academy* **106B**: 225–236.
- Holyoak, D.T. & Long, D.G. 2005. Notable records of mosses (Bryopsida) from Co. Mayo, including four species new to Ireland. *Irish Naturalists' Journal* **28**: 7–10.
- IUCN 1978. *The IUCN Plant Red Data Book*. Richmond: International Union for the Conservation of Nature.
- IUCN 2001. *IUCN Red List Categories and Criteria. Version 3.1*. Gland: International Union for the Conservation of Nature.
- IUCN 2003. *Guidelines for Application of IUCN Red List Criteria at Regional Levels. Version 3.0*. Gland: International Union for the Conservation of Nature.
- IUCN 2006. *Guidelines for using the IUCN Red List Categories and Criteria. Version 6.2 (December 2006)*. Gland: International Union for the Conservation of Nature.
- IUCN 2008. *Guidelines for using the IUCN Red List Categories and Criteria. Version 7.0 (August 2008)*. Gland: International Union for the Conservation of Nature.
- IUCN 2010. *Guidelines for using the IUCN Red List Categories and Criteria. Version 8.1 (August 2010)*. Gland: International Union for the Conservation of Nature.
- Konstantinova, N.A. & Bakalin, V.A. 2009. Checklist of liverworts (Marchantiophyta) of Russia. *Arctoa* **18**: 1–64.
- Laaka-Lindberg, S., Hedderson, T. & Longton, R.E. 2000. Rarity and reproductive characters in the British hepatic flora. *Lindbergia* **25**: 78–84.
- Lett, H.W. 1904. Notes on *Hypopterygium*. *Journal of Botany* **42**: 249–252.
- Lett, H.W. 1915. Census report on the mosses of Ireland. *Proceedings of the Royal Irish Academy* **32**, Section B, No. 7: 65–166.
- Lockhart, N., Hodgetts, N. & Holyoak, D. 2012. *Rare and Threatened Bryophytes of Ireland*. Belfast: National Museums Northern Ireland Publication No. 028.
- Longton, R.E. 1992. Reproduction and rarity in British mosses. *Biological Conservation* **59**: 89–98.
- Longton, R.E. 1994. Reproductive biology in bryophytes. The challenge and the opportunities. *Journal of the Hattori Botanical Laboratory* **76**: 159–172.
- Longton, R.E. 1997. Reproductive biology and life history strategies. *Advances in Bryology* **6**: 65–101.

- Longton, R.E. & Schuster, R.M. 1983. Reproductive biology. In: R.M. Schuster (ed.) *New Manual of Bryology*, Vol. 1. Nichinan: Hattori Botanical Laboratory, pp. 386–462.
- Macvicar, S.M. 1926. *The student's handbook of British hepatics*. 2nd ed. Eastbourne: Sumfield & Day.
- McArdle, D. 1904. A list of Irish Hepaticae. *Proceedings of the Royal Irish Academy* **24B**: 387–502.
- Margadant, W.D. & Meijer, W. 1950. Preliminary remarks on *Orthodontium* in Europe. *Transactions of the British Bryological Society* **1**: 266–274.
- Miles, C.J. & Longton, R.E. 1987. Life history of the moss, *Atrichum undulatum* (Hedw.) P.Beauv. *Symposia Biologica Hungarica* **35**: 193–207.
- Paton, J.A. 1999. *The liverwort flora of the British Isles*. Colchester: Harley Books.
- Pearman, D.A. 2007. 'Far from any house' – assessing the status of doubtfully native species in the flora of the British Isles. *Watsonia* **26**: 271–290.
- Porley, R.D. 2008. *Arable bryophytes. A field guide to the mosses, liverworts and hornworts of cultivated land in Britain and Ireland*. Old Basing: WildGuides.
- Porley, R.D., Papp, B., Söderström, L. & Hallingbäck, T. 2008. European bryophyte conservation in the new millennium. In: Mohamed, H., Bakar, B., Boyce, A.N., Lee, P.K.Y., (eds) *Bryology in the New Millennium*. Kuala Lumpur: University of Malaya, pp. 459–485.
- Richards, P.W. & Smith, A.J.E. 1975. A progress report on *Campylopus introflexus* (Hedw.) Brid. and *C. polytrichoides* De Not. in Britain and Ireland. *Journal of Bryology* **8**: 293–298.
- Schumacker, R. & Váňa, J. 2000. *Identification keys to the liverworts and hornworts of Europe and Macaronesia (distribution & status)*. Documents de la Station scientifique des Hautes-Fagnes, Belgium.
- Schumacker, R. & Váňa, J. 2005. *Identification keys to the liverworts and hornworts of Europe and Macaronesia*. 2nd revised ed. Poznań: Sorus.
- Smith, A.J.E. 1978. *The Moss Flora of Britain and Ireland*. Cambridge, London, New York, Melbourne: Cambridge University Press.
- Smith, A.J.E. 1990. *The Liverworts of Britain and Ireland*. Cambridge, London, New York, Melbourne: Cambridge University Press.
- Smith, A.J.E. 2004. *The moss flora of Britain and Ireland*. 2nd ed. Cambridge: Cambridge University Press.
- Söderström, L. & During, H.J. 2005. Bryophyte rarity viewed from the perspectives of life history strategy and metapopulation dynamics. *Journal of Bryology* **27**: 261–268.
- Söderström, L. & Herben, T. 1997. Dynamics of bryophyte metapopulations. *Advances in Bryology* **6**: 205–240.
- Söderström, L. & Jonsson, B.G. 1989. Spatial pattern and dispersal in the leafy hepatic *Ptilidium pulcherrimum*. *Journal of Bryology* **15**: 793–802.
- Stewart, S.A. & Corry, T.H. 1888. *A flora of the north-east of Ireland ...* Cambridge: Macmillan & Bowes, for The Belfast Naturalists' Field Club.
- Stieperaere, H. 1994. *Lophocolea semiteres* (Lehm.) Mitt. in Belgium and the Netherlands. *Lindbergia* **19**: 29–36.

APPENDIX 1: SUMMARY OF THE FIVE CRITERIA (A-E) USED TO EVALUATE IF A TAXON BELONGS IN A THREATENED CATEGORY; CRITICALLY ENDANGERED, ENDANGERED OR VULNERABLE (IUCN, 2010).

Use any of the criteria A–E	Critically Endangered	Endangered	Vulnerable
A. Population reduction			
	Declines measured over the longer of 10 years or 3 generations		
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3 & A4	≥ 80%	≥ 50%	≥ 30%
<p>A1. Population reduction observed, estimated, inferred, or suspected in the past where the causes of the reduction are clearly reversible AND understood AND have ceased, based on and specifying any of the following:</p> <ul style="list-style-type: none"> (a) direct observation (b) an index of abundance appropriate to the taxon (c) a decline in area of occupancy (AOO), extent of occurrence (EOO) and/or habitat quality (d) actual or potential levels of exploitation (e) effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites. <p>A2. Population reduction observed, estimated, inferred, or suspected in the past where the causes of reduction may not have ceased OR may not be understood OR may not be reversible, based on (a) to (e) under A1.</p> <p>A3. Population reduction projected or suspected to be met in the future (up to a maximum of 100 years) based on (b) to (e) under A1.</p> <p>A4. An observed, estimated, inferred, projected or suspected population reduction (up to a maximum of 100 years) where the time period must include both the past and the future, and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible, based on (a) to (e) under A1.</p>			
B. Geographic range in the form of either B1 (extent of occurrence) AND/OR B2 (area of occupancy)			
B1. Extent of occurrence (EOO)	< 100 km ²	< 5,000 km ²	< 20,000 km ²
B2. Area of occupancy (AOO)	< 10 km ²	< 500 km ²	< 2,000 km ²
AND at least 2 of the following:			
(a) Severely fragmented, OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals.			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals.			
C. Small population size and decline			
Number of mature individuals	< 250	< 2,500	< 10,000
AND either C1 or C2:			
C1. An estimated continuing decline of at least:	25% in 3 years or 1 generation	20% in 5 years or 2 generations	10% in 10 years or 3 generations
	(up to a max. of 100 years in future)		
C2. A continuing decline			
AND (a) and/or (b):			
(a i) Number of mature individuals in each subpopulation:	< 50	< 250	< 1,000
or			
(a ii) % individuals in one subpopulation =	90–100%	95–100%	100%
(b) Extreme fluctuations in the number of mature individuals.			
D. Very small or restricted population			
Either:			
Number of mature individuals	< 50	< 250	D1. < 1,000 AND/OR
VU D2. Restricted area of occupancy or number of locations with a plausible future threat that could drive the taxon to CR or EX in a very short time.			D2. typically: AOO<20 km ² or number of locations ≤ 5
E. Quantitative Analysis			
Indicating the probability of extinction in the wild to be:	≥ 50% in 10 years or 3 generations (100 years max.)	≥ 20% in 20 years or 5 generations (100 years max.)	≥ 10% in 100 years