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A BRYOPHYTE SITE REGISTER FOR BRITAIN

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SUMMARY— *The Joint Nature Conservation Committee (JNCC), one of the British governmental conservation agencies, is setting up a computer database to generate a site register for bryophytes and other lower plants. JNCC liaises with local bryologists and the Biological Records Centre to obtain a full picture of the status of threatened and scarce species in each region. One of the aims of the database is to provide information over time on specific populations of threatened and scarce bryophytes, so that any changes can be monitored. The Register also links with the protected sites database at JNCC to give an indication of the degree of protection for important bryophyte sites in Britain. Preliminary analyses indicate that the Register can be used to determine the percentage occurrence of threatened species on protected sites, and to relate this to habitat and life strategy. This is expected to have implications for the practical conservation of threatened bryophytes.*

KEYWORDS: — *Great Britain, nature reserve, threatened species, conservation, bryophytes*

ZUSAMMENFASSUNG — *Ein Verzeichnis wichtiger Moosvorkommen für Grossbritannien*

Das 'Joint Nature Conservation Committee' (JNCC), eine der britischen Regierungsfachstellen für Naturschutz, baut eine Computerdatenbank auf zur Erstellung eines Verzeichnisses wichtiger Vorkommen von Moosen und anderen Niederen Pflanzen. JNCC setzt sich mit Fachleuten der Bryologie und mit dem 'Biological Records Centre' in Verbindung, um ein vollständiges Bild der Situation gefährdeter und seltener Arten in jeder Region zu erhalten. Die Datenbank hat u. a. den Zweck, zeitlich differenzierte Information über einzelne Populationen gefährdeter und seltener Moose zu liefern, so dass jede Änderung verfolgt werden kann. Das Verzeichnis lässt sich mit der Datenbank des JNCC über Schutzgebiete verbinden, um Hinweise auf den Schutzstatus wichtiger Moosvorkommen in Grossbritannien zu geben. Vorläufige Analysen zeigen, dass das Verzeichnis dazu verwendet werden kann, den Prozentsatz der Vorkommen gefährdeter Arten in Schutzgebieten zu bestimmen, und diesen mit Standort und Lebensform in Verbindung zu bringen. Es wird erwartet, dass dies Auswirkungen auf den praktischen Schutz gefährdeter Moose hat.

Introduction

For some time it has been apparent that a register of sites of particular value for non-vascular plants in Britain would be a valuable conservation tool. Following Hodgetts (1992a), it became possible to designate protected sites in Britain specifically for lower plants (bryophytes, lichens, fungi and algae). However, the identification of potential Sites of Special Scientific Interest (SSSIs) has been difficult because of the still relatively poor state of our knowledge of lower plants, compared with better-known groups such as birds and flowering plants. Furthermore, even when a site is given statutory protection, lower plants are seldom a major consideration in management. There exists in Britain good information on the distribution of most bryophytes, particularly since the publication of the Atlas of bryophytes of Britain and Ireland (Hill & al. 1991-94). There is now a need for site-specific and population-specific information so that threatened species and communities of importance can be given adequate protection. To address this, the Joint Nature Conservation Committee (JNCC), one of the British statutory conservation agencies, started the Lower Plant Biodiversity Register project in 1993.

Species collectively referred to as 'threatened' throughout this paper include those on the provisional British Red Data List (Stewart & Church, in prep.) classified as endangered (E), vulnerable (V) or rare (R), and exclude extinct species. Nomenclature follows Hill & al. (1991-94).

The Lower Plant Biodiversity Register

Preliminary work has been carried out to establish a computerised site register of threatened lower plant species. This Register is designed to contain details of the location, abundance

and threats to individual populations of threatened taxa. To build the Register, skeleton information has been derived about the number and location of populations from previous recording effort, including the extensive bryophyte database at the Biological Records Centre and the database used for the British and Irish Red Data Book (Stewart & Church, in prep.). Further information of relevance to conservation is scattered among the literature and the experience of amateur botanists. Existing computerised information was collated to produce regional reports for

bryophytes, which were circulated to members of the British Bryological Society Recorders Network, and other interested BBS members, for comment. Population recording forms were sent out with the reports, to standardise the replies. The response so far has been good and has produced much useful information.

Some thought has gone into the nature of such a database and how it should relate to other sources of information about lower plants. How, for example, can the Lower Plant Biodiversity Register relate to biological recording activity, or how can the locations of lower plant populations be linked to computerised information about protected sites? The structure of the Lower Plant Biodiversity Register is gradually evolving.

Once compiled, the information on the Register will be available to staff of all the other statutory conservation agencies (English Nature, the Countryside Council for Wales and Scottish Natural Heritage), either in a computerised form or as regional reports. This means that local staff without specialist knowledge will have the information they need for the effective conservation of bryophytes and other lower plants.

JNCC will be able to use the information on the Register to get an overview of the state of lower plant conservation in Britain. It will then be

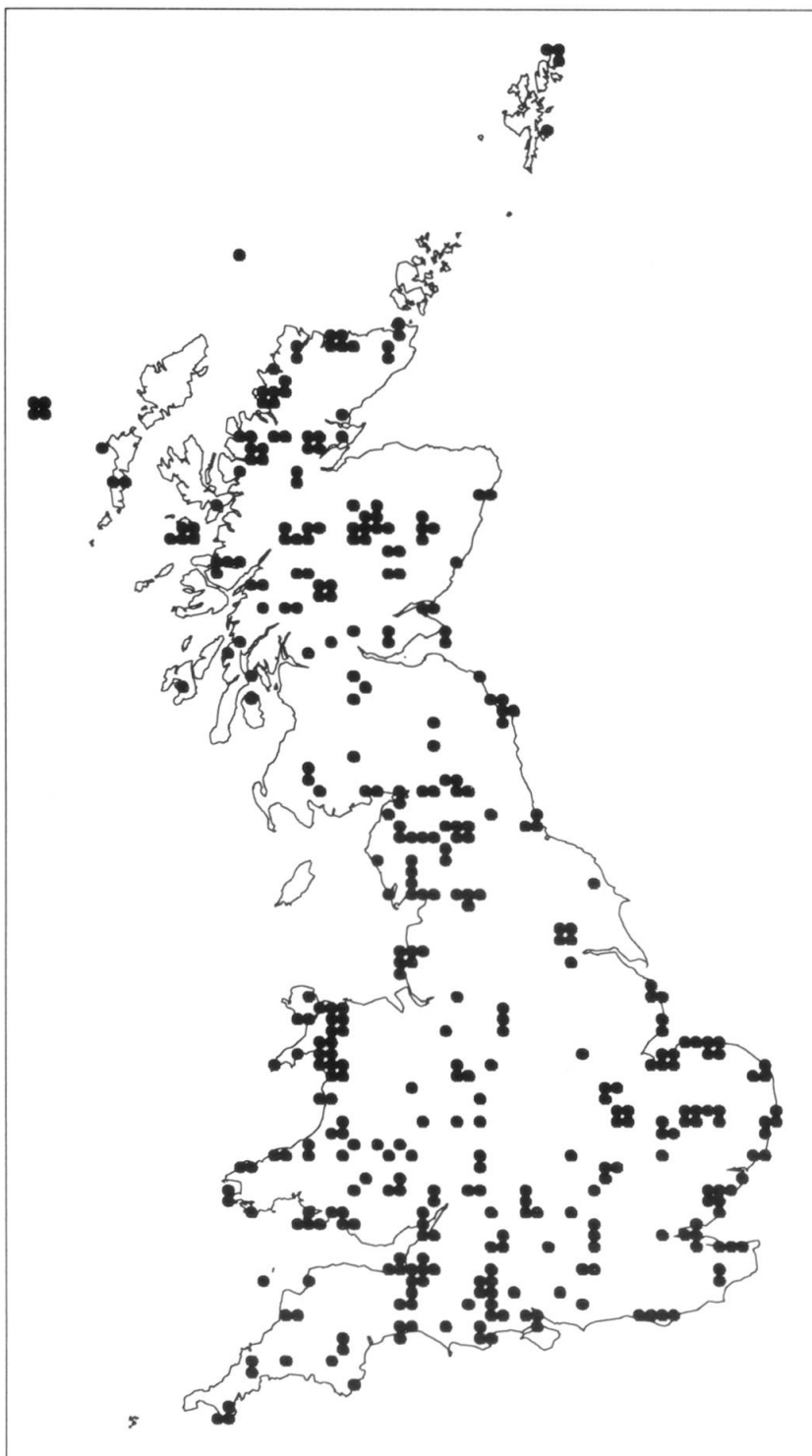


FIGURE 1. Ten km squares with National Nature Reserves.

This figure shows all the 10 km squares in Great Britain in which at least some of the area is covered by a National Nature Reserve.

possible to identify a series of sites of importance for rare and threatened species and to assess the value of particular populations.

Occurrence of threatened species on National Nature Reserves

The Lower Plant Biodiversity Register offers the opportunity to analyse the occurrence of populations of rare and threatened species at a national level. Although the development of the database is still at an early stage, some crude analysis of the occurrence of threatened bryophytes in National Nature Reserves (NNRs) has been done. (See Fig. 1 for an indication of the distribution of NNRs in Great Britain.) Future work will analyse the occurrence of threatened species on the second tier of designated sites (SSSIs). Refer to Hodgetts (1992b) for a fuller explanation of the British protected sites system.

54.1% of threatened species are represented on NNRs. (See Appendix 1 for details of the occurrence of individual species.) This leaves a residue of 45.9% of threatened species that have no occurrences within a NNR. Many of these will, however, be represented within SSSIs, which normally confer less protection. Many of the Atlantic species (*sensu* Ratcliffe 1968) not considered threatened in Britain but very restricted internationally, have occurrences within NNRs.

Tab. 1 summarises the occurrence of threatened species on National Nature Reserves. Only records made since 1950 have been used. Of the 220 Red Data List species, there are locality details for 193 species. Sixteen species have not been recorded since 1950, ten have been recorded but without locality details, and details of localities are confidential for one species (*Adelanthus lindenbergianus*). The table is arranged by decreasing NNR index. The NNR index is a percentage value calculated from the sum of 10x10 km squares for which at least one occurrence of a species is in a NNR, divided by the sum of all 10x10 km occurrences for species of each status. A second column indicates the number of species assigned to each status category. The sum of all values in the second column exceeds the 193 species included in the analysis since the categories are not mutually exclusive.

Tab. 1 shows that the more threatened a species is, the less likely it is to occur in a NNR. This appears paradoxical, but reflects the fact that threatened bryophytes are, for the most part, included in NNRs by chance, as an incidental result of the notification of the site for other reasons. This means that the fewer populations of a species there are, the less chance there is of the species being included in a NNR. By definition, endangered species (E) usually have fewer populations than vulnerable species (V), which in turn have fewer populations than rare species (R).

Tab. 2 shows that rare species do not coincide very often. There is a small number of NNRs with a large number of threatened species (mainly extensive upland sites such as Caenlochan and Ben Lawers, both in the Scottish Highlands), but many species (62%) occur in NNRs only in complete isolation from other threatened species.

Atlantic woods and threatened bryophytes

Britain has a particular international responsibility for the conservation of its Atlantic woodlands, which are very rich in bryophytes. However, most of the Atlantic species, as defined by Ratcliffe

Status	NNR index	Number of species
Listed on Appedix 1 of the Bern Convention	32	3
Listed on Schedule 8 (the British protected species schedule)	23	30
Rare	17	105
Vulnerable	14	62
Endangered	6	30

TABLE 1. Occurrence of threatened bryophytes on National Nature Reserves. NNR index (see text) is approximately the percentage of 10 x10 km square occurrences in National Nature Reserves.

National Nature Reserve Name	Number of species
Ben Lawers NNR	42
Cairngorms NNR	21
Caenlochan NNR	18
Ben Lui NNR	8
Dyfi a Cors Fochno NNR	7
Beinn Eighe NNR	5
Creag Meagaidh NNR	5
Lizard NNR	5
Ben Wyvis NNR	4
Morfa Harlech NNR	4
Ainsdale Sand Dunes NNR	3
Inchnadamph NNR	3
Stanner Rocks NNR	3
Upper Teesdale NNR	3
Den of Airlie NNR	2
Gower Coast NNR	2
Invernaver NNR	2
Malham Tarn NNR	2
Newborough Warren and Ynys Llanddwyn NNR	2
Rhinog NNR	2
Tring Reservoirs NNR	2
Y Wyddfa - Snowdon NNR	2
Axmouth - Lyme Regis Undercliffs NNR	1
Bowness Common NNR	1
Braunton Burrows NNR	1
Burnham Beeches NNR	1
Ceunant Llennyrch NNR	1
Coed Ganllwyd NNR	1
Coed Y Rhygen NNR	1
Coedydd A Chorsydd Aber Teifi NNR	1
Coille Thogabhaig NNR	1
Craigellachie NNR	1
Derbyshire Dales NNR	1
Dunnet Links NNR	1
Glasson Moss NNR	1
Glencripesdale NNR	1
Gordano Valley NNR	1
Ingleborough NNR	1
Inverpoll NNR	1
Kenfig Pool and Dunes NNR	1
Lady Park Wood NNR	1
Lindisfarne NNR	1
Loch Lomond NNR	1
Monks Wood NNR	1
Muckle Moss NNR	1
North Walney NNR	1
Old Winchester Hill NNR	1
Rassal Ashwood NNR	1
Rhum NNR	1
Slapton Ley NNR	1
Somerset Levels NNR	1
St. Cyrus NNR	1
Thorne Moors NNR	1
Thursley NNR	1
Wedholme Flow NNR	1
Whiteford Burrows - Landimore Marsh NNR	1
Wybunbury Moss NNR	1
Ynys Enlli - Bardsey Island NNR	1

(1968), are not considered threatened in Britain, although their international distribution is very restricted. Only 4% of threatened bryophyte species occur in Scottish Atlantic woodlands, according to the species listed by Averis (1991).

Eighteen woodlands, out of a total of 448 woodlands in Scotland surveyed by Averis (1991), contain threatened species. Only two of these (Coille na Glas Leitire with *Herbertus borealis* and *Dicranodontium subporodictyon* and Salem-Resipole with *Acrobolbus wilsonii* and *Radula carringtonii*) have two threatened species. The other sixteen have a single threatened species each. Three of the eighteen are NNRs.

Fifteen woods out of the eighteen with threatened species are among the 126 woods defined by Averis as 'rich' or 'very rich' in Atlantic bryophytes. These categories were applied to woods with more than 20 and 25 Atlantic bryophyte species respectively, as defined by Ratcliffe (1968) and modified by Averis (1991). Thus the presence of threatened species is a good indicator of a 'bryophyte-rich' Atlantic wood. However, since only a few threatened species occur in Atlantic woods, only 12% of the 126 'bryophyte-rich' woods contain threatened bryophytes.

While most of the Atlantic species that are not considered threatened in Britain occur on NNRs at least once, it is clear (though figures are not yet available for this) that only a small percentage of their populations are on NNRs. This contrasts to some extent with the threatened species, which tend to have a greater percentage of their occurrences on NNRs, if they occur on NNRs at all (see Tab. 1 and Appendix 1). Again

TABLE 2. Occurrence of threatened bryophytes on specific National Nature Reserves.

this is an inevitable consequence of threatened species having relatively few populations compared with species that are not threatened.

Habitats and life strategies

Tab. 3 gives a summary of the occurrence of populations of threatened species according to habitat type and NNR occurrence. Bryophyte habitats have been grouped into 26 broad categories. Statistics are calculated as for Tab. 1. Several threatened species occur in more than one of

Habitat	NNR index	Number of species
Mountain summits	30	4
Montane cliffs and rocks (basic)	29	45
Upland heath and bog	28	7
Snow patch	27	10
Dunes	23	13
Lowland heath and bog	23	6
Upland flushes and mountain streams	21	18
Salt marsh and saline grasslands	20	1
Atlantic ravine woodland	17	11
Montane cliffs and rocks (non-basic)	17	14
Lowland riverine and aquatic	14	6
Coastal grassland, rocks and thin turf	13	15
Lowland rock exposures (basic)	11	15
Margins of upland lochs	11	3
Lowland fen	10	2
Lowland grassland, quarries and waste ground (basic)	9	18
Non-Atlantic woodland	9	8
Margins of lowland pools and reservoirs	6	7
Lowland rock exposures (non-basic)	5	6
Woodland rides (non-basic soil)	5	5
Sea caves and dripping gullies in coastal cliffs	5	4
Cultivated fields	4	4
Heavy metal rich rocks and mine waste	4	5
Lowland grassland, quarries and waste ground (non-basic)	3	14
Epiphytic (not necessarily woodland)	2	8
Thatch	0	1

TABLE 3. Summary of occurrence of threatened bryophytes of different habitat types in National Nature Reserves.

Life strategy	NNR index	Number of species
Dominant	30	3
Perennial stayer	20	80
Long-lived shuttle	18	35
Fugitive	15	2
Colonist	10	88
Short-lived shuttle	10	54
Annual shuttle	6	17

TABLE 4. Summary of occurrence of threatened bryophytes of different life strategies (*sensu* During 1992) in National Nature Reserves.

these categories, and are therefore counted more than once in the table. Note that figures are sometimes based on only a very few species, and these should be treated with caution.

Tab. 3 shows that bryophytes of certain habitats have a higher incidence of occurrence on NNRs than those of other habitats (i.e. some habitats that support threatened bryophytes are more protected than others). Habitats relatively well represented on NNRs include dune slacks and montane habitats. This reflects the fact that NNRs containing these habitats are often very extensive and continuous and therefore have a good chance of including a large number of threatened species. Poorly represented habitats include cultivated ground, non-woodland trees, lowland riversides and poolsides and heavy metal-rich mine-waste sites. In contrast to dune slacks and montane habitats, these bryophyte habitats are often small and fragmented. It is therefore much less likely that bryophytes occurring in these habitats will be within an NNR, unless (as seldom happens) bryophytes are consciously given due attention in NNR designation.

Tab. 4 applies the life strategies devised and developed by During (1979, 1992) to threatened species and shows the proportion of populations with each life strategy that occur within NNRs. As pointed out by González-Mancebo & al. (1991), some bryophytes are capable of exploiting more than one life strategy according to their habitat and the prevailing conditions. Where this is the case, species have been counted more than once in the table. Some species seldom produce spores but it is possible to allocate a life strategy to them on the basis of the nature and behaviour of their vegetative propagules (e.g., *Cephaloziella* spp.).

The differences shown in Tab. 4 are perhaps less marked than might have been expected, probably because some of the broader habitat categories adopted contain niches suitable for all or most of the bryophyte life strategies. On the whole, the short-lived species (fugitives, annual shuttle species, short-lived shuttle species and colonists) are relatively poorly represented on NNRs, with between 6% and 15% of their populations occurring on NNRs, while the longer-lived species (dominants, long-lived shuttle species and perennial stayers) are better represented, with between 18% and 30% of their populations occurring on NNRs. This is more or less as expected, since the habitats less well represented in NNRs tend to support more of the shorter-lived threatened bryophytes. Indeed, it is clear that some life strategies are highly characteristic of certain habitats. For example, the threatened species of lowland pool and reservoir margins (a habitat poorly represented on NNRs) are nearly all annual or short-lived shuttle species (e.g., *Ephemerum cohaerens*). These strategies are clearly necessary for survival in an environment that is submerged for most of the year and only suitable for growth for a short time, if at all, in any given year.

Threatened species and 'hotspots'

Tab. 5 summarises the occurrence of threatened liverworts in 'hotspots'. For present purposes a 'hotspot' is defined as a 10x10 km square with more than 100 liverwort species recorded, according to Hill & al. (1991-94). There are 34 of these in Great Britain.

Prendergast & al. (1993) found that, in the liverwort flora as a whole, the presence of rare species does not correlate very closely with 'hotspots'. This is clearly the case for species of certain habitats and life strategy, such as *Sphaerocarpos texanus*, which is an annual or short-lived shuttle species of cultivated ground in the south of England. When only Atlantic species (*sensu* Ratcliffe 1968) are considered, threatened species such as *Acrobolbus wilsonii* and *Radula carringtonii* certainly occur in 'hotspots' (though not exclusively so), but clearly a series of oceanic woodland National Nature Reserves for bryophytes based solely on the presence of these species will be inadequate. For example, it would lead to a maximum of only fifteen out of 126 'rich' or 'very rich' Scottish woodlands (12%), a habitat for which Britain has international responsibility, being designated. Other factors, such as those taken into consideration by Averis (1991) and Hodgetts (1992a) have to be considered.

In the end, the conservationist still has to make a value judgement about what should be given the highest priority for conservation: assemblages of internationally restricted species that may be widespread in Britain, or assemblages of internationally widespread species that happen

to be rare in Britain. Conserving rare species sites does one, conserving 'hotspots' the other. In practice, a system taking both these, and other factors, into consideration must be developed, such as the method suggested by Margules & al. (1988).

Discussion

The Lower Plant Biodiversity Register provides a means of keeping and analysing data on populations of threatened species at particular sites and acts as an interface between lower plant specialists and conservation managers. The knowledge of the specialists, which has up to now sometimes been rather inaccessible, can be communicated to site managers and used in practical conservation.

Analysis of the habitats and the life strategies of bryophytes will help us to make appropriate conservation recommendations. Site protection may be appropriate for certain habitats and 'stayer' species faithful to these habitats but different measures may need to be suggested for species of fragmented habitats or shifting life styles. For example, effective measures for the protection of species of arable fields need to be devised. Analysis also reveals if particular bryophyte habitats have been neglected in NNR designation. Examples of important bryophyte habitats that are apparently under-represented in the NNR series include margins of lowland pools and reservoirs, heavy metal-rich rocks and mine-waste and Atlantic ravine woodland.

Preliminary analyses show that where threatened bryophytes occur within National Nature Reserves, they do so largely as an incidental result of the designation of sites for other reasons. There is a higher occurrence in NNRs of bryophytes with long-lived life strategies than of those with short-lived life strategies, and of bryophytes of large, unfragmented habitats than of those of small, fragmented ones. Although these are merely preliminary results, and take no account of site protection through SSSIs or what management may or may not be taking place on NNRs, the indication is that protection of lowland bryophytes of small, fragmented habitats is less adequate compared with that of upland species of large, continuous habitats. Therefore, with the additional observation that semi-natural lowland sites are usually under more threat from development, etc., than semi-natural upland sites, the former group of bryophytes can be considered more threatened than the latter.

Many Atlantic woodland sites in Britain (NNRs or not) qualify for protected status on the basis of their bryophyte flora, using the criteria presented by Hodgetts (1992a). Many sites with threatened species also qualify using these criteria. However, when a threatened species occurs in isolation, its site does not necessarily qualify for protection using the criteria. For example, thatched roofs with *Leptodontium gemmascens* would not qualify for notification as SSSIs, nor is it appropriate to designate a roof on someone's house a nature reserve! In other cases, it may not be appropriate to notify sites that do qualify for protection using the criteria for practical reasons. The concept of a national series of SSSIs is not to designate every site which qualifies under the selection criteria, but to ensure that statutory protection is in place for an adequate number and representative selection of sites. The problem remains of how best to protect bryophytes that grow in important sites for which statutory protection is

	Total number of 10x10km square records	Number of 10x10km records in 'hotspots'	Total number of species	Number of species with at least one occurrence in a 'hotspot'
Rare	270	35	32	14 (43.7%)
Vulnerable	104	9	15	6 (40.0%)
Endangered	18	0	7	0 (0%)
Total	392	44	54	20 (37.0%)

TABLE 5. The occurrence of threatened liverworts in 'hotspots'.

not necessarily appropriate. The answer may lie in management agreements and broader but less rigid conservation designations over wider areas of countryside.

Acknowledgements

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APPENDIX I (next page). Populations of each threatened species occurring within National Nature Reserves.

This shows the percentage of populations of each threatened species that occur within National Nature Reserves. The figures actually refer to the number of 10 km squares which contain at least one population of the species in an NNR. In some cases, there will be populations occurring both within and outside an NNR in the same 10 km square, but it is unlikely that these occurrences will distort the figures significantly. This table is still at a crude stage of development, but it suffices to give an indication of what proportion of the populations of a threatened species occurs within an NNR.

Species name	NNR occurrence	NNR occurrence	NNR occurrence		
Liverworts					
Acrobolbus wilsonii	6%	Barbula cordata	0%	Hygrohypnum polare	0%
Adelanthus lindenbergerianus	0%	Barbula glauca	0%	Hygrohypnum smithii	20%
Anastrophyllum saxicola	0%	Barbula icmadophila	11%	Hypnum bambergeri	29%
Barbilophozia kunzeana	27%	Bartramia stricta	33%	Hypnum revolutum	100%
Barbilophozia quadriloba	0%	Bartramidula wilsonii	0%	Hypnum vaucheri	50%
Cephalozia ambigua	33%	Blindia caespiticia	50%	Leptodontium gemmascens	0%
Cephaloziella baumgartneri	0%	Brachythecium appleyardiae	0%	Lescuraea incurvata	40%
Cephaloziella calyculata	14%	Brachythecium erythrorrhizon	100%	Lescuraea plicata	40%
Cephaloziella dentata	100%	Brachythecium reflexum	15%	Micromitrium tenerum	0%
Cephaloziella integerrima	0%	Brachythecium starkei	0%	Mnium ambiguum	40%
Cephaloziella massalongi	0%	Bryoerythrophyllum caledonicum	25%	Mnium spinosum	33%
Cephaloziella nicholsonii	0%	Bryum arcticum	33%	Myrnia pulvinata	0%
Cephaloziella turneri	0%	Bryum calophyllum	10%	Myurella tenerima	20%
Dumortiera hirsuta	0%	Bryum cyclophyllum	0%	Oncophorus wahlenbergii	21%
Fossombronina crozalsii	0%	Bryum gemmiparum	0%	Orthodontium gracile	0%
Geocalyx graveolens	33%	Bryum knowltonii	21%	Orthotrichum gymnostomum	0%
Gongylanthus ericetorum	13%	Bryum mamillatum	0%	Orthotrichum obtusifolium	0%
Gymnocolea acutiloba	50%	Bryum marratii	33%	Orthotrichum pallens	0%
Gymnomitrium apiculatum	50%	Bryum muehlenbeckii	13%	Orthotrichum schimperi	0%
Gymnomitrium corallioides	29%	Bryum neodamense	25%	Orthotrichum speciosum	0%
Herbertus borealis	50%	Bryum salinum	20%	Paraleucobryum longifolium	67%
Jamesoniella undulifolia	0%	Bryum schleicheri	0%	Philonotis marchica	0%
Jungemannia caespiticia	0%	Bryum stirtonii	17%	Physcomitrium eurystomum	25%
Jungemannia leiantha	0%	Bryum turbinatum	0%	Physcomitrium sphaericum	0%
Jungemannia polaris	20%	Bryum uliginosum	0%	Plagiobryum demissum	60%
Leiocolea gillmanii	23%	Bryum warneum	13%	Plagiomnium medium	29%
Leiocolea rutheana	0%	Buxbaumia viridis	0%	Plagiothecium piliferum	100%
Lejeunea holtii	0%	Campylium halleri	50%	Pohlia crudoides	0%
Lejeunea mandonii	17%	Ceratodon purpureus ssp. conicus	0%	Pohlia obtusifolia	25%
Lophozia capitata	7%	Cheilothela chloropus	17%	Pohlia scotica	13%
Lophozia herzogiana	0%	Cirriphyllum cirrosum	20%	Pseudoleskeella nervosa	33%
Lophozia perssonii	0%	Cratoneuron decipiens	23%	Rhynchostegium rotundifolium	0%
Lophozia wenzelii	44%	Cryphaea lamyana	13%	Rhytidiadelphus subpinnatus	0%
Marsupella arctica	50%	Ctenidium procerimum	67%	Saelania glaucescens	100%
Marsupella boeckii var. boeckii	0%	Cyclodictyon laetevirens	0%	Schistidium agassizii	50%
Marsupella condensata	33%	Cynodontium polycarpon	0%	Schistidium atrofusum	33%
Marsupella profunda	0%	Cynodontium strumiferum	14%	Schistidium boreale	67%
Marsupella sparsifolia	0%	Cynodontium tenellum	0%	Schistidium turgescens	100%
Odontoschisma macounii	0%	Daltonia splachnoides	17%	Seligeria brevifolia	50%
Pallavicinia lyellii	13%	Desmatodon cernuus	0%	Seligeria carnioleica	0%
Petalophyllum ralfsii	40%	Desmatodon leucostoma	0%	Seligeria diversifolia	0%
Radula caringtonii	0%	Dicranella grevilleana	13%	Sematophyllum demissum	100%
Riccia bifurca	33%	Dicranodontium subporodictyon	20%	Sphagnum balticum	40%
Riccia canaliculata	13%	Dicranum elongatum	0%	Sphagnum lindbergii	25%
Riccia crystallina	0%	Dicranum undulatum	44%	Splachnum vasculosum	10%
Riccia huebeneriana	0%	Ditrichum cornubicum	0%	Stegonia latifolia	0%
Riccia nigrella	20%	Ditrichum plumbicola	8%	Tayloria lingulata	20%
Scapania gymnostomophila	11%	Ditrichum subulatum	0%	Tayloria longicollis	0%
Scapania paludicola	0%	Ephemerum cohaerens	33%	Tetradontium repandum	0%
Scapania parvifolia	0%	Ephemerum stellatum	0%	Thamnobryum angustifolium	100%
Scapania praetervisa	0%	Eurhynchium meridionale	0%	Timmia austriaca	40%
Southbya nigrella	0%	Fissidens algarvicus	8%	Timmia norvegica	30%
Southbya tophacea	17%	Fissidens exiguus	0%	Tortella fragilis	33%
Sphaerocarpos texanus	0%	Fissidens monguillonii	0%	Tortula cuneifolia	0%
Telaranea nematodes	0%	Fissidens serrulatus	0%	Tortula freibergii	0%
Mosses					
Acaulon triquetrum	0%	Funaria pulchella	0%	Tortula norvegica	50%
Amblystegium saxatile	0%	Grimmia alpestris	0%	Tortula solmsii	0%
Andreaea blyttii	13%	Grimmia anodon	0%	Tortula vahliana	0%
Andreaea frigida	25%	Grimmia elongata	14%	Weissia levieri	33%
Andreaea nivalis	20%	Grimmia ovalis	16%	Weissia multicapsularis	7%
Anomodon longifolius	40%	Grimmia unicolor	0%	Weissia squarrosa	9%
Apodan wormskjoldii	33%	Habrodon perpusillus	0%	Weissia tortilis	15%
Atrichum angustatum	0%	Heterocladium dimorphum	50%	Weissia wimmerana	100%
		Homomallium incurvatum	25%	Zygodon forsteri	33%
		Hygrohypnum molle	17%	Zygodon gracilis	33%

