

A revised Red List of bryophytes in Britain

Conservation Officer **Nick Hodgetts** presents the latest revised Red List for bryophytes in Britain.

Dumortiera hirsuta in north Cornwall. Ian Atherton

The first published Red List of bryophytes in Britain was produced in 2001 as part of a *Red Data Book* for bryophytes (Church *et al.*, 2001).

The list was updated on an ad hoc basis as part of the large species status table on the Joint Nature Conservation Committee (JNCC) website, with 2005 the last time an update to the bryophyte list was approved by JNCC, but it was becoming increasingly clear that a new published Red List was now needed, as there have been many changes in our knowledge of the status of British bryophytes over the past decade or so. New lists of nationally rare and nationally scarce bryophytes have been published recently (Preston, 2006, 2010). These are expressions of frequency, but do not necessarily indicate the degree of threat to which species are subjected. The Red List uses criteria and categories developed by the International Union for the Conservation of Nature (IUCN) to ascertain which species are most threatened and therefore in need of conservation action.

This revised Red List covers England, Scotland, Wales and the Isle of Man, but excludes Ireland, Northern Ireland and the Channel Islands. Nomenclature follows Hill *et al.* (2008) for most species, with the addition of a few species added to the British list more recently. As in Church

et al. (2001) and Preston (2010), varieties and subspecies have been disregarded.

1980 has been chosen as the cut-off year to represent the threshold between old and recent records for the purposes of assessing decline. There has been much new survey work over the last 30 years, and it is considered important that the data used to assign threat categories are as up-to-date as is practicably possible. This contrasts with the nationally rare and nationally scarce lists, which both use 1950 as the cut-off year.

The IUCN threat categories and criteria

The IUCN system for allocating threat status was originally designed to be applied to large animals on a global scale, but has been developed so that it is applicable to any organism at any geographical scale, if interpreted sensibly. This process began with the publication of the new IUCN threat categories (World Conservation Union, 1994). The old IUCN threat categories (Extinct, Endangered, Vulnerable and Rare) were replaced by a revised system that abandoned the Rare category (as it was an expression of frequency rather than of threat), and introduced the Critically Endangered category. The sub-Red List category of Near Threatened was also established, and later the categories of Regionally Extinct and Extinct in the Wild were

distinguished from Extinct. This Red List uses version 3.1 of the categories and criteria (IUCN, 2001), along with guidelines produced to assist with their interpretation and use (IUCN, 2006, 2008), further guidelines for using the system at a regional level (IUCN, 2003), and specific guidelines for applying the system to bryophytes (Hallingbäck *et al.*, 1995).

How these categories and criteria have been interpreted and applied to the British bryophyte flora is summarized below, but anyone interested in looking into them in more depth should consult the original IUCN documents, which are available on the IUCN website (www.iucnredlist.org/technical-documents/categories-and-criteria). However, two IUCN concepts in particular, 'extent of occurrence' and 'area of occupancy', require a brief explanation here. Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a taxon, excluding cases of vagrancy. Extent of occurrence is thus essentially equivalent to range – the area on a map over which a species is distributed – and so is easily estimated using dot maps. The so-called 'α-hull method' for calculating the extent of occurrence, which is designed to exclude aberrant occurrences well outside the normal range of a species, was introduced later (IUCN, 2006). Area of occupancy is defined as the area within its extent of occurrence which is occupied by a taxon, excluding cases of vagrancy, and this can also be determined conveniently using dot maps.

Definitions of IUCN threat categories

Extinct (EX) – a taxon is Extinct when there is no reasonable doubt that the last individual has died. There are only two taxa in this category in the British bryophyte flora.

Extinct in the Wild (EW) – a taxon is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population well outside the past range. There are no taxa in this category in the British bryophyte flora.

Regionally Extinct (RE) – a taxon is regarded as Regionally Extinct in Britain if there are no post-1979 records and all known localities have been visited and surveyed without success, or if colonies recorded post-1979 are known to have disappeared. It should be appreciated that regional 'extinction' for bryophytes is sometimes less final than for other, more conspicuous organisms. This may be because bryophytes are easily overlooked, or because their very efficient dispersal mechanisms can readily bring in 'new blood' from elsewhere. For example, *Grimmia anodon* and *G. elatior* were long considered 'extinct' in Britain, but both have been refound recently. An effort has been made to apply the 'extinct' categories sensibly, while acknowledging that it is quite possible that some 'extinct' species may turn up again in the future. It is considered preferable to err on the side of over-using the Regionally Extinct category rather than overloading the Data Deficient category.

Critically Endangered (CR) – a taxon is Critically Endangered when it is facing an extremely high risk of regional extinction in the wild in the immediate future, as detailed by any of the criteria A, B or D (*see below*).

Endangered (EN) – a taxon is Endangered when it is not Critically Endangered but is facing a very high risk of regional extinction in the wild in the near future, as defined by any of the criteria A, B or D (*see below*).

Vulnerable (VU) – a taxon is Vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of regional extinction in the wild in the medium-term future, as defined by any of the criteria A, B or D (*see below*).

Near Threatened (NT) – a taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable, but is close to qualifying for a threatened category in the future. A taxon is regarded as close to qualifying for a threatened category in Britain if it occurs in 6–15 hectads (post-1979) but has not declined; or in 16–19 hectads (post-1979) and has declined. These numbers are not included in the IUCN definition of NT, but are an interpretation for the purposes of this assessment.

Data Deficient (DD) – a taxon is Data Deficient when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and population status. A taxon is regarded as Data Deficient in Britain 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 Britain if it occurs in 20 or more hectads (post-1979); or in 16–19 hectads (post-1979) and shows no decline. These numbers are not included in the IUCN definition of NT, but are an interpretation for the purposes of this assessment.

Not Evaluated (NE). A taxon is Not Evaluated when it has not been assessed against the criteria. Taxa assigned to this category include aliens, taxa not confirmed on the British list, and synonymized taxa.

The Red List consists of all species in the categories EX, EW, RE, CR, EN and VU. Species in the categories NT and DD are of conservation concern but are outwith the Red List.

The frequency categories of Nationally Rare and Nationally Scarce are not IUCN categories. Most Red List species are also Nationally Rare,

but some are Nationally Scarce. Most Nationally Scarce species are in the LC category. The NT category is defined by both threat and frequency, and all NT species are either Nationally Rare or Nationally Scarce.

Summary of the IUCN criteria and categories as interpreted for the British bryophyte flora

Fulfilling any one of these criteria leads to the application of a threat category at the appropriate level.

Criterion A. Rapid decline. A2c is used for a small number of taxa, on the basis of a decline in habitat quality; A3c is used for a small number of taxa, on the basis of a predicted decline and loss of habitat. >80% decline (CR); >50% decline (EN); >30% decline (VU). The timescale used by IUCN for assessing these percentage declines is ‘the last 10 years or three generations, whichever is the longer’.

Criterion B. Small range, fragmented, declining or fluctuating. Fragmented and extreme fluctuations only used for specialist reservoir species, as both phenomena are common natural features of bryophyte populations.

1. **Extent of occurrence** (estimated using the α -hull method, where $\alpha=2$): <100 km² (CR), <5,000 km² (EN), <20,000 km² (VU), and:

- (a) Single location (CR); 5 locations or fewer (EN); 10 locations or fewer (VU).
- (b) Continuing decline observed, inferred or projected, in any of the following:
 - (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

2. **Area of occupancy:** <10 km², using 1 hectad (CR); <500 km², using 5 hectads (EN); <2,000 km², using 20 hectads (VU), and at least two of (a)–(c):

(a) Single location (CR); 5 locations or fewer (EN); 10 locations or fewer (VU).

(b) Continuing decline observed, inferred or projected, in any of the following:

- (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 the following (but only used for reservoir species):
- (i) extent of occurrence
 - (ii) area of occupancy
 - (iii) number of locations or subpopulations
 - (iv) number of mature individuals

Criterion C requires detailed data on both

population size and decline, and has not been used, since this level of information is not available for British bryophytes.

Criterion D/D1. Very small population. Used very sparingly, and only if there is no reasonable doubt: <50 individuals estimated (CR); <250 individuals estimated (EN); <1,000 individuals estimated (VU).

Criterion D2. Very small range. Used extensively to assign taxa to VU: 5 or fewer locations.

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 Britain.

Table 1. Revised Red List of bryophytes in Britain, with Near Threatened and Data Deficient species also listed

Species that are also Nationally Scarce, according to Preston (2006) with additions listed in Table 1 of Preston (2010), are marked with an asterisk. WCA, listed on Schedule 8 of the Wildlife & Countryside Act 1981; BAP, listed in the UK Biodiversity Action Plan (not all listed species necessarily have their own Species Action Plan). Hectad counts have been derived from information on the Threatened Bryophyte Database and the BRC database via the NBN Gateway. Some species are known to have been recorded from further hectads very recently, but this information has not yet entered the system. ‘Old status’ is taken from Church *et al.* (2001).

Species	Pre-1980 hectads	1980+ hectads	Dual	Total	New status	Criteria (IUCN 2001)	Old status	WCA/BAP
Extinct/Regionally Extinct								
Liverworts								
<i>Fossombronia mittenii</i>	2	0	0	2	RE	Last seen 1972	EX	
<i>Lophozia longiflora</i> *	1	0	0	1	RE	Last seen 1956	DD	BAP
Mosses								
<i>Bryum turbinatum</i>	15	0	0	15	RE	Last seen 1947	EX	
<i>Bryum uliginosum</i>	48	0	0	48	RE	Last seen 1953	CR	BAP
<i>Cratoneuron curvicaule</i>	2	0	0	2	RE	Last seen 1913	NE	
<i>Cynodontium fallax</i>	1	0	0	1	RE	Last seen 1868	EX	
<i>Dicranum elongatum</i>	9	0	0	9	RE	Last seen 1964	CR	BAP
<i>Encalypta brevicollis</i>	1	0	0	1	RE	Last seen 1871	EX	
<i>Grimmia sessitana</i>	1	0	0	1	RE	Last seen 1966	NE	BAP
<i>Gyroueiaia reflexa</i>	1	0	0	1	RE	Last seen 1938	EX	
<i>Helodium blandowii</i>	4	0	0	4	RE	Last seen 1901	EX	
<i>Lescuraea saxicola</i>	2	0	0	2	RE	Last seen 1911	EX	
<i>Mielichhoferia mielichhoferiana</i>	2	0	0	2	RE	Last seen 1971	VU	WCA, BAP
<i>Neckera pennata</i>	1	0	0	1	RE	Last seen 1835	EX	
<i>Orthotrichum shawii</i>	1	0	0	1	RE	Last seen 1863	NE	
<i>Paludella squarrosa</i>	3	0	0	3	RE	Last seen 1916	EX	
<i>Philonotis cernua</i>	6	0	0	6	RE	Last seen 1961	CR	BAP
<i>Plagiothecium piliferum</i>	2	0	0	2	RE	Last seen 1939	CR	WCA
<i>Pohlia crudoides</i>	1	0	0	1	RE	Last seen 1968	VU	
<i>Pterygoneurum lamellatum</i>	37	0	0	37	RE	Last seen 1970	EX	
<i>Sphagnum obtusum</i>	2	0	0	2	RE	Last seen 1911	EX	

*This taxon as currently understood in Britain (Paton, 1999) is RE, but other interpretations (e.g. Damsholt, 2002) suggest that there may be further work to do on its taxonomy.

<i>Tetradontium repandum</i>	2	0	0	2	RE	Last seen 1958	CR	BAP
<i>Tortella limosella</i>	1	0	0	1	EX	Last seen 1906	EX	
<i>Trematodon ambiguus</i>	1	0	0	1	RE	Last seen 1883	EX	
<i>Weissia mittenii</i> ²	5	0	0	5	EX	Last seen 1920	EX	

Critically Endangered

Liverworts								
<i>Cephaloziella dentata</i>	1	1	0	2	CR	B1a, biii; B2a, biii	CR	BAP
<i>Liocblaena lanceolata</i>	11	1	1	11	CR	B1a, bi-v; B2a, bi-v	CR	BAP
Mosses								
<i>Aplodon wormskioldii</i>	6	2	0	8	CR	B1a, bi-v; B2a, bi-v (but last seen 1981)	CR	BAP
<i>Arrichum angustatum</i> *	33	1	0	34	CR	B1a, bi-v; B2a, bi-v	EN	BAP
<i>Bartramia stricta</i>	4	1	1	4	CR	B1a, bi-iv; B2a, bi-iv	CR	WCA, BAP
<i>Bruchia vogesiaca</i>	0	1	0	1	CR	D	NE	
<i>Bryum schleicheri</i>	6	1	1	6	CR	B1a, bi-v; B2a, bi-v	CR	WCA, BAP
<i>Ceratodon conicus</i>	19	2	1	20	CR	A2c; B1a, bi-v; B2a, bi-v (but last seen 1990)	EN	BAP
<i>Didymodon glaucus</i>	3	1	1	3	CR	B1a, bi-iv; B2a, bi-iv	CR	WCA, BAP
<i>Grimmia anodon</i>	2	1	1	2	CR	D	CR	
<i>Hygrohypnum styriacum</i>	0	1	0	1	CR	B1a, bi-v; B2a, bi-v; D	CR	BAP
<i>Pseudoleskeella nervosa</i>	1	1	1	1	CR	D	VU	
<i>Rhynchostegium rotundifolium</i>	3	2	2	3	CR	B1a, bi-iv; B2a, bi-v; D	CR	WCA, BAP
<i>Seligeria carniolica</i>	2	1	1	2	CR	B1a, bi-iv; B2a, bi-iv	CR	BAP
<i>Tayloria tenuis</i>	15	0	0	15	CR	B1a, bi-v; B2a, bi-v (but last seen 1977)	CR	BAP
<i>Weissia multicapsularis</i>	20	5	3	22	CR	B1a, bi-v; B2a, bi-v; D	EN	BAP

Endangered

Liverworts								
<i>Adelanthus lindenbergianus</i>	0	1	0	1	EN	D	VU	WCA, BAP
<i>Cephaloziella baumgartneri</i>	10	6	4	12	EN	B1a, bii-iv; B2a, bii-iv	EN	BAP
<i>Leiocolea rutheana</i>	6	5	2	9	EN	B2a, bi-v	EN	WCA, BAP
<i>Lejeunea mandonii</i>	7	5	5	7	EN	B1a, bii-iv; B2a, bii-iv	EN	BAP
<i>Riccia bifurca</i>	2	3	2	3	EN	B1a, bii-iv; B2a, bii-iv	VU	WCA, BAP
<i>Riccia nigrella</i>	6	4	4	6	EN	B1a, bii-iv; B2a, bii-iv	VU	BAP
<i>Telaranea europaea</i>	1	1	1	1	EN	D	VU	BAP
Mosses								
<i>Acaulon triquetrum</i>	10	5	3	12	EN	B1a, bii-iv; B2a, bii-iv	EN	WCA, BAP
<i>Anomodon attenuatus</i>	2	2	2	3	EN	D	EN	
<i>Bryum cyclophyllum</i>	7	3	0	10	EN	B2a, bi-iv, ci-iv	EN	BAP
<i>Bryum gemmiparum</i>	6	4	3	7	EN	B2a, bi-iv	EN	BAP
<i>Bryum salinum</i>	6	2	0	8	EN	B2a, bii-iv	VU	BAP
<i>Cyclodictyon laetevirens</i>	3	2	2	3	EN	D	EN	WCA, BAP
<i>Didymodon cordatus</i>	1	1	1	1	EN	D	VU	WCA
<i>Ditrichum cornubicum</i>	2	2	1	3	EN	B1a, bi-iv; B2a, bi-iv	EN	WCA, BAP
<i>Ephemerum cohaerens</i>	3	3	0	6	EN	B1a, bii-iv; B2a, bii-iv, cii-iv	CR	BAP
<i>Eurhynchiastrum pulchellum</i>	2	5	0	7	EN	D	EN	BAP
<i>Fissidens curvatus</i>	15	4	1	18	EN	B2a, bi-v	NT	BAP
<i>Hygrohypnum polare</i>	1	1	1	1	EN	D	EN	WCA
<i>Hypnum revolutum</i>	2	1	1	2	EN	D	EN	
<i>Micromitrium tenerum</i>	10	2	0	12	EN	B2a, bii-iv, ci-iv	CR	WCA, BAP
<i>Myurella tenerima</i>	5	2	2	5	EN	D	EN	
<i>Orthotrichum pallens</i>	5	5	1	9	EN	B2a, bi-iv	EN	BAP
<i>Orthotrichum pumilum</i>	6	3	0	9	EN	B1a, bi-iv; B2a, bi-iv	CR	BAP
<i>Philonotis marchica</i>	2	1	1	2	EN	B1a, bi-iv; B2a, bi-iv	EN	BAP
<i>Physcomitrium curystomum</i>	4	3	2	5	EN	B1a, bi-iv; B2a, bi-iv	EN	BAP
<i>Plagiobryum demissum</i>	9	3	2	10	EN	B1a, bi-iv; B2a, bi-iv	EN	BAP
<i>Pohlia obtusifolia</i>	3	5	1	7	EN	B2a, bi-v	EN	BAP
<i>Sciuro-hypnum starkei</i>	3	5	2	6	EN	D	VU	
<i>Sphagnum balticum</i>	8	5	2	11	EN	B2a, bi-v	EN	WCA, BAP
<i>Syntrichia norvegica</i>	5	2	2	5	EN	B1a, bi, ii, iv, v; B2a, bi, ii, iv, v; D	VU	
<i>Thamnobryum angustifolium</i>	1	2	1	2	EN	D	CR	WCA, BAP
<i>Thamnobryum cataractarum</i>	0	1	0	1	EN	D	VU	BAP
<i>Timmia austriaca</i>	6	2	2	6	EN	B1a, bi-v; B2a, bi-v	EN	BAP
<i>Tortula cernua</i>	9	4	4	9	EN	B1a, bi-iv; B2a, bi-iv	EN	WCA, BAP

² *W. mittenii* was excluded from the European checklist (Hill *et al.*, 2006) as a hybrid, but is included in the British checklist (Hill *et al.*, 2008). This is largely academic, as it is an extinct taxon.

<i>Tortula cuneifolia</i> ³	39	8	4	43	EN	B2a; bi-v	VU	BAP
<i>Tortula leucostoma</i>	2	2	2	2	EN	D	VU	
<i>Weissia levieri</i>	3	4	2	5	EN	B2a, bi-v	EN	BAP
<i>Zygodon forsteri</i>	6	4	3	7	EN	B1a, bi-iv; B2a, bi-iv	EN	WCA, BAP
<i>Zygodon gracilis</i>	5	2	2	5	EN	B1a, bi-v; B2a, bi-v	EN	WCA, BAP

Vulnerable

Liverworts								
<i>Athalamia hyalina</i>	0	1	0	1	VU	D2	DD	
<i>Cephaloziella integerrima</i>	8	8	1	15	VU	B1a, bi-iv; B2a, bi-iv	VU	BAP
<i>Cephaloziella massalongi</i>	15	12	7	20	VU	A3c	VU	
<i>Cephaloziella nicholsonii</i> *	13	16	10	19	VU	A3c	VU	BAP
<i>Dumortiera hirsuta</i>	10	7	5	12	VU	B2a, bi-iv	VU	BAP
<i>Geocalyx graveolens</i>	3	8	2	9	VU	D1	VU	WCA
<i>Gymnocolea acutiloba</i>	1	4	1	4	VU	D2	VU	
<i>Gymnomitrium apiculatum</i>	3	3	2	4	VU	D2	VU	WCA
<i>Herbertus delawayi</i>	1	2	1	2	VU	D2	VU	BAP
<i>Jamesoniella undulifolia</i>	7	8	2	13	VU	B2a, bi-iv	EN	WCA, BAP
<i>Jungermannia polaris</i>	4	4	1	7	VU	D2	NT	
<i>Lejeunea eckloniana</i>	1	1	1	1	VU	D2	VU	BAP
<i>Lophozia capitata</i> *	15	7	0	22	VU	A2c, A3c; B2a, biii	VU	BAP
<i>Lophozia herzogiana</i> ⁴	0	2	0	2	VU	D2	NE	
<i>Marsupella arctica</i>	0	2	0	2	VU	D2	VU	BAP
<i>Marsupella boeckii</i>	3	3	2	4	VU	D2	NT	
<i>Marsupella profunda</i>	3	4	2	5	VU	A2c, A3c; B2a, bi-iv; D2	VU	WCA, BAP
<i>Marsupella sparsifolia</i>	1	4	1	4	VU	D2	VU	
<i>Nardia insecta</i>	1	1	1	1	VU	D2	DD	
<i>Odontoschisma macounii</i>	2	4	2	4	VU	D2	NT	
<i>Plagiobrya norvegica</i> ⁵	0	1	0	1	VU	D2	DD	
<i>Radula carringtonii</i>	6	8	3	11	VU	D1	VU	BAP
<i>Riccia canaliculata</i>	11	3	1	13	VU	D2	VU	BAP
<i>Scapania praetervisa</i>	4	2	1	5	VU	D2	VU	
<i>Solenostoma caespiticium</i>	13	5	1	17	VU	D2	NT	
<i>Southbya nigrella</i>	2	3	2	3	VU	D2	VU	WCA, BAP
<i>Southbya tophacea</i>	5	3	1	7	VU	D2	NT	
<i>Telaranea murphyae</i> ⁶	1	3	1	3	VU	D2	NE	
Mosses								
<i>Acaulon mediterraneum</i>	2	5	0	7	VU	D2	NE	
<i>Andreaea frigida</i>	4	5	3	6	VU	D2	VU	BAP
<i>Andreaea sinuosa</i>	0	5	0	5	VU	D2	NE	
<i>Anomodon longifolius</i>	12	6	5	13	VU	B2a, bi-v	VU	WCA, BAP
<i>Arctoa anderssonii</i> Wich. ⁷	0	1	0	1	VU	D2	NE	
<i>Blindia caespiticia</i>	3	2	2	3	VU	D2	EN	
<i>Brachythecium trachypodium</i>	1	2	1	2	VU	D2	CR	
<i>Brachythecium cirrosom</i> ⁸	5	3	3	5	VU	D2	NT	
<i>Bryum arcticum</i>	7	4	1	10	VU	D2	DD	
<i>Bryum calophyllum</i>	22	7	2	27	VU	B2a, bi-iv	VU	BAP
<i>Bryum knowltonii</i> *	34	8	2	40	VU	B2a, bi-iv	VU	BAP
<i>Bryum marratii</i>	18	8	2	24	VU	B2a, bi-iv	EN	BAP
<i>Campylophyllum balleri</i>	5	2	2	5	VU	D2	EN	
<i>Cheilothea chloropus</i>	4	5	3	6	VU	D2	NT	
<i>Cinclidotus riparius</i>	1	4	1	4	VU	D2	VU	
<i>Ctenidium procerrium</i>	3	3	3	3	VU	D2	VU	
<i>Cynodontium polycarpon</i>	6	2	0	8	VU	D2	DD	
<i>Cynodontium tenellum</i> *	16	6	1	21	VU	B1a, bi, ii, iv; B2a, bi, ii, iv	NT	
<i>Daltonia splachmoides</i>	6	6	3	9	VU	B2a, biii-iv	VU	BAP
<i>Dialytrichia saxicola</i>	1	2	0	3	VU	D2	NE	

³ Although recorded in 8 hectads post-1979, this species has continued to decline. It now occurs in no more than three hectads in Cornwall (D. Holyoak, pers. comm.) and is unlikely to be faring any better elsewhere.

⁴ Previously assumed to be an introduction, but now seems a good candidate for a native species.

⁵ Cronberg (2000) considers this a mutant of *P. porelloides*, but it is a distinctive entity that is retained in the current checklist (Hill *et al.*, 2008).

⁶ Alien and increasing in Isle of Scilly, but not yet known from outside Britain, so included in assessment as GB has sole responsibility for it.

⁷ Rothero (2009).

⁸ This species may also have declined, but it grows in remote places and is seldom recorded.

<i>Dicranella grevilleana</i>	9	6	1	14	VU	D2		NT
<i>Dicranum spurium*</i>	75	15	8	82	VU	A2c		BAP
<i>Dicranum undulatum</i>	23	13	9	27	VU	A2c		BAP
<i>Ditrichum subulatum</i>	10	6	2	14	VU	B2a, bii-iv		BAP
<i>Fissidens serrulatus</i>	4	3	2	5	VU	D2		BAP
<i>Grimmia arenaria</i>	8	6	2	12	VU	B2a, bii, iv		NT
<i>Grimmia elatior</i>	1	2	0	3	VU	D2		EX
<i>Grimmia elongata*</i>	12	9	5	16	VU	B2a, bii, iv		BAP
<i>Grimmia unicolor</i>	1	2	1	2	VU	D2		WCA
<i>Homomallium incurvatum?</i>	21	5	4	22	VU	B2a, bii-v; D2		BAP
<i>Hygrohypnum molle</i>	5	5	3	7	VU	D2		VU
<i>Hypnum vaucheri</i>	1	5	1	5	VU	D2		WCA
<i>Mielichhoferia elongata</i>	3	4	3	4	VU	D2		VU
<i>Mnium lycopodioides</i>	5	5	4	6	VU	D2		NT
<i>Orthodontium gracile</i>	22	6	6	22	VU	B2a, bi-v		BAP
<i>Orthotrichum gymnostomum</i>	1	3	1	3	VU	D2		BAP
<i>Plasteurhynchium meridionale</i>	2	3	2	3	VU	D2		VU
<i>Pohlia scotica</i>	4	5	0	9	VU	D2		BAP
<i>Pseudocalliergon turgescens</i>	1	2	1	2	VU	D2		WCA
<i>Pseudoleskea incurvata</i>	15	6	5	16	VU	B1a, bi-v; B2a, bi-v		BAP
<i>Racomitrium himalayianum</i>	2	5	2	5	VU	D2		DD
<i>Saelania glaucescens</i>	2	1	1	2	VU	D2		WCA
<i>Schistidium atrofusum</i>	3	3	1	5	VU	D2		NE
<i>Schistidium dupretii</i>	3	3	0	6	VU	D2		NE
<i>Schistidium flaccidum</i>	1	1	0	2	VU	D2		NE
<i>Schistidium flexipile</i>	0	2	0	2	VU	D2		NE
<i>Scopelophila cataractae</i>	1	17	1	17	VU	A3c		BAP
<i>Seligeria brevifolia</i>	2	3	1	4	VU	D2		VU
<i>Seligeria diversifolia</i>	1	1	0	2	VU	D2		DD
<i>Seligeria oelandica</i>	0	1	0	1	VU	D2		NE
<i>Sematophyllum demissum</i>	4	3	2	5	VU	D2		BAP
<i>Splachnum vasculosum*</i>	31	13	8	36	VU	A2c		BAP
<i>Tayloria lingulata</i>	8	6	5	9	VU	B2a, bi-v		BAP
<i>Timmia megapolitana</i>	0	1	0	1	VU	D2		VU
<i>Tomentypnum nitens*</i>	72	35	12	95	VU	A2c, A3c		NE
<i>Tortella fragilis</i>	7	5	1	11	VU	D2		NT
<i>Tortula solmsii</i>	2	5	2	5	VU	D2		NT
<i>Tortula vahlbiana</i>	19	9	4	24	VU	B2a, bi-v		BAP
<i>Tortula wilsonii*</i>	50	7	4	53	VU	B2a, bi-v		BAP

Near Threatened

Liverworts & hornworts

<i>Anastrophyllum alpinum</i>	9	10	7	12	NT	No decline		NE	BAP?
<i>Anastrophyllum joergensenii</i>	7	6	5	8	NT	No decline		NT	BAP
<i>Anastrophyllum saxicola</i>	8	8	5	11	NT	At least 6-7 localities, no decline		NT	
<i>Barbilophozia kunzeana*</i>	15	12	2	25	NT	Possibly declined		NT	BAP
<i>Barbilophozia quadriloba</i>	10	7	5	12	NT	Probably no decline - inconspicuous species		NT	
<i>Cephaloziella calyculata</i>	9	9	4	14	NT	Possible slight range contraction but more than 10 localities and no, if any, significant recent decline		VU	BAP
<i>Cephaloziella elachista</i>	9	8	0	17	NT	Apparently overlooked, so probably unreasonable to infer decline		NE	
<i>Cephaloziella spinigera*</i>	31	8	2	37	NT	Apparently overlooked, so probably unreasonable to infer decline		NE	
<i>Cephaloziella turneri*</i>	37	13	7	43	NT	Declined, but not recently		NT	
<i>Fossombronina maritima*</i>	10	10	3	17	NT	Probably no decline		NT	
<i>Gongylanthus ericetorum</i>	4	4	3	5	NT	Very restricted but >5 sites, and locally frequent		NT	
<i>Gymnomitrium corallioides</i>	15	9	4	20	NT	Probably no real decline		NT	
<i>Leiocolea fitzgeraldiae*</i>	16	10	4	22	NT	Probably no decline		NT	
<i>Leiocolea gillmanii*</i>	11	10	2	19	NT	Probably no decline		NT	
<i>Marsupella condensata</i>	5	11	3	13	NT	No decline		NT	
<i>Nardia breidleri*</i>	16	11	7	20	NT	No decline		NT	
<i>Phaeoceros carolinianus*</i>	14	12	1	25	NT	No evidence of decline		EN	

*The figures overstate the possibility that this species has declined. It was probably over-recorded in the past (there are several historical records for which vouchers are lacking or inconclusive), but there are certainly more populations in the north of England waiting to be discovered (T. L. Blockeel, pers. comm., 2010).

<i>Pleurocladula albescens*</i>	18	13	4	27	NT	Probably no significant decline but very habitat-restricted		NE	
<i>Scapania curta*</i>	7	13	0	20	NT	Probably under-recorded		NE	
<i>Scapania gymnostomophila</i>	7	12	3	16	NT	Probably no decline		NT	
Mosses									
<i>Amblystegium radicale</i>	1	12	1	12	NT	Down-graded in light of recent discoveries; probably still under-recorded		CR	
<i>Andreaea blyttii</i>	0	10	0	10	NT	No decline		NT	
<i>Andreaea nivalis*</i>	18	12	7	23	NT	Possible slight range contraction north-westwards, but too frequent to be VU		NT	BAP
<i>Aongstroemia longipes</i>	9	6	2	13	NT	Probably no decline, but very infrequently recorded; weedy species		NT	
<i>Bryoerythrophyllum caledonicum</i>	4	13	4	13	NT	No decline		NT	BAP
<i>Bryum creberrimum*</i>	37	8	0	45	NT	A rare and impersistent casual that is unpredictable in its occurrence; also no doubt under-recorded		NE	
<i>Bryum dyffrynense</i>	0	8	0	8	NT	No decline		NE	
<i>Bryum gemmilucens*</i>	11	9	0	20	NT	No decline		DD	
<i>Bryum kunzei*</i>	16	10	0	26	NT	No real evidence of decline		NE	
<i>Bryum muehlenbeckii</i>	10	13	3	20	NT	No decline		NT	
<i>Bryum warneum*</i>	37	16	12	41	NT	Probably declined but too frequent for VU		VU	BAP
<i>Buxbaumia aphylla*</i>	56	14	3	67	NT	Very infrequent and sporadic, but too early to say whether there has been a decline		NE	
<i>Buxbaumia viridis</i>	7	15	5	17	NT	No decline		EN	WCA, BAP
<i>Campylopus subparadiclyon</i>	2	8	2	8	NT	No decline		NT	
<i>Cynodontium strumiferum*</i>	12	13	4	21	NT	Probably no real decline		NT	
<i>Dendrocryphaea lamyana</i>	8	14	8	14	NT	Probably no decline		VU	WCA, BAP
<i>Dicranum flexicaule</i>	13	9	1	21	NT	Probably widely overlooked, but still rare		NE	
<i>Didymodon icadophilus</i>	10	8	5	13	NT	Probably no decline		NT	
<i>Entosthodon pulchellus</i>	17	10	7	20	NT	Probably no decline		NT	BAP
<i>Fissidens monguillonii*</i>	7	12	2	17	NT	Probably no decline		NT	
<i>Grimmia atrata*</i>	23	11	4	30	NT	Probably no decline		NE	
<i>Grimmia muehlenbeckii</i>	10	9	3	16	NT	Almost certainly under-recorded and no decline		NE	
<i>Grimmia tergestina</i>	3	9	1	11	NT	No sign of decline		VU	
<i>Habrodon perpusillus*</i>	39	12	6	45	NT	Declined substantially, but still frequent in Killin area and well scattered elsewhere; now extinct in north-west England		EN	BAP
<i>Heterocladium dimorphum</i>	5	8	2	11	NT	No decline		VU	
<i>Hygrohypnum duriusculum*</i>	21	13	5	29	NT	Possibly declined in some areas		NE	
<i>Hygrohypnum smithii</i>	10	8	3	15	NT	No convincing decline		NT	
<i>Hylacomiastrum pyrenaicum*</i>	20	11	7	24	NT	Possibly declined in some areas		NE	
<i>Hypnum bambergi*</i>	16	8	6	18	NT	No recent records from the Cairngorms, but has been recorded in some new sites, so apparent decline may not be real		NE	
<i>Leptodontium gemmascens*</i>	28	17	3	42	NT	Declined overall, especially in south-east England and Gloucestershire area.		VU	BAP
<i>Mnium spinosum</i>	10	6	6	10	NT	Probably no real decline		NT	
<i>Myrinia pulvinata*</i>	23	17	3	37	NT	Significant decline		NT	
<i>Oncophorus wahlenbergii*</i>	19	12	9	22	NT	Probably no real decline		NT	
<i>Orthotrichum obtusifolium</i>	25	11	0	36	NT	Recolonizing in England		EN	WCA, BAP
<i>Orthotrichum speciosum*</i>	26	17	6	37	NT	May be some decline in north, but recolonizing in south		NT	
<i>Palustriella decipiens</i>	18	10	6	22	NT	Probably no decline		NT	
<i>Paraleucobryum longifolium</i>	4	9	3	10	NT	No decline		VU	
<i>Philonotis tomentella*</i>	18	10	1	27	NT	No decline		NE	
<i>Plagiomnium medium</i>	5	7	3	9	NT	Probably no decline		NT	
<i>Pohlia andalusica*</i>	9	14	7	16	NT	No decline		NT	
<i>Pseudocalliergon lycopodioides*</i>	42	17	11	48	NT	Clearly declined substantially across range		NE	
<i>Pseudoleskeella rupestris*</i>	13	11	5	19	NT	Probably no decline		NT	
<i>Ptychodium plicatum</i>	6	6	5	7	NT	No significant decline		NT	
<i>Rhynchostegiella litorea</i>	25	10	0	35	NT	Probably no real decline		NE	
<i>Rhytidiadelphus subpinnatus</i>	11	13	1	23	NT	Possibly declined in north England		EN	BAP
<i>Schistidium frigidum</i>	9	10	1	18	NT	No decline		NE	
<i>Schistidium papillosum</i>	4	13	2	15	NT	No decline and probably under-recorded		NE	
<i>Sciuro-hypnum glaciale*</i>	11	12	4	19	NT	No convincing decline		DD	
<i>Sciuro-hypnum reflexum*</i>	13	14	6	21	NT	No convincing decline		DD	
<i>Seligeria campylopoda</i>	4	5	2	7	NT	Very restricted but >5 sites, and locally frequent		DD	
<i>Sematophyllum substrumulosum</i>	1	12	1	12	NT	No decline (widespread in Isles of Scilly)		DD	
<i>Sphagnum skyense</i>	0	15	0	15	NT	No evidence of decline and probably still under-recorded		DD	

<i>Stegonia latifolia</i>	10	7	6	11	NT	No real decline	NT
<i>Syntrichia princeps</i> *	31	14	6	39	NT	Possibly declined	NE
<i>Timmia norvegica</i>	9	8	6	11	NT	Probably no decline	NT
<i>Weissia condensata</i> *	20	11	3	28	NT	Declined but too frequent to be VU	VU BAP
<i>Weissia squarrosa</i> *	44	15	1	58	NT	Possible range contraction	EN BAP
<i>Weissia sterilis</i> *	33	15	3	45	NT	Possible decline	NT BAP

Data Deficient							
Liverworts							
<i>Cephalozia ambigua</i>	–	–	–	–	DD	Either very rare or overlooked and not well understood by field bryologists	DD
<i>Lophozia wenzelii</i>	–	–	–	–	DD	This taxon needs revision in GB	NT
<i>Moerckia flotoviana</i>	–	–	–	–	DD	Status in GB unclear following recent taxonomic revision	
<i>Moerckia hibernica</i>	–	–	–	–	DD	Status in GB unclear following recent taxonomic revision	
<i>Scapania parvifolia</i>	–	–	–	–	DD	A little-known species	DD
Mosses							
<i>Andreaea alpestris</i>	–	–	–	–	DD	Still a taxonomically dubious and cryptic species	DD
<i>Brachythecium erythrorhizon</i>	–	–	–	–	DD	Still a question over the identity of the Scottish plant	DD
<i>Bryum intermedium</i>	–	–	–	–	DD	A rare and declining species but too early to put into a threat category.	NE
<i>Dicranum leioneuron</i>	–	–	–	–	DD	Many records could be erroneous (G. Rothero pers. comm.) and revision of distribution in GB is needed, if indeed it is a British species at all	VU
<i>Grimmia alpestris</i>	–	–	–	–	DD	Rare, but status unknown on Cader Idris and not refound at its other two localities	DD
<i>Grimmia crinita</i>	–	–	–	–	DD	Occurring as a result of temporary colonizations, it no longer occurs at either of its recorded sites	DD BAP
<i>Orthotrichum acuminatum</i> H.Philib. ¹⁰	–	–	–	–	DD	Single transient occurrence; not yet known if it will become established as a British plant	NE
<i>Orthotrichum consimile</i>	–	–	–	–	DD	Newly rediscovered and seems to be spreading in north England; more time needed to determine its status	DD
<i>Schistidium confertum</i>	–	–	–	–	DD	Seems even more confusion around this species in GB than most members of the genus	NE
<i>Schistidium helveticum</i> (Schkuhr) Deguchi ¹¹	–	–	–	–	DD	Newly discovered and too early to assign to a threat category	NE
<i>Seligeria patula</i>	–	–	–	–	DD	Distributions of <i>S. trifaria</i> and <i>S. patula</i> need revising	NE
<i>Seligeria trifaria</i>	–	–	–	–	DD	Distributions of <i>S. trifaria</i> and <i>S. patula</i> need revising	NE
<i>Tortula inermis</i> (Brid.) Mont.	–	–	–	–	DD	Found very recently; too early to assign to a threat category	NE
<i>Tortula schimperii</i> (= <i>T. subulata</i> var. <i>angustifolia</i>)	–	–	–	–	DD	Recently elevated to species; too early to assign to a threat category	NE

¹⁰Blockeel (2009).

¹¹Blockeel *et al.* (2009).

Table 2. Not Evaluated (NE) taxa

The following rare taxa have not been evaluated under the IUCN criteria.

Taxon	Reason for non-evaluation
Liverworts	
<i>Lophocolea brookwoodiana</i>	Alien
<i>Riccia crystallina</i>	Alien
<i>Riccia rhenana</i>	Alien
<i>Telaranea tetradactyla</i> (<i>T. longii</i>)	Alien
Mosses	
<i>Achrophyllum dentatum</i>	Alien
<i>Brachythecium appleyardiae</i>	Now synonymized with <i>Scleropodium cespitans</i>
<i>Bryum apiculatum</i> Schwaegr. ¹²	Alien
<i>Bryum lawersianum</i>	No longer considered a good species (= <i>B. arcticum</i>)
<i>Bryum mamillatum</i>	No longer considered a good species (= <i>B. warneum</i>)

¹²Rothero (2010).

<i>Bryum neodamense</i>	No longer considered a good species (= <i>B. pseudotriquetrum</i>)
<i>Bryum stirtonii</i>	No longer considered a good species (= <i>B. elegans</i>)
<i>Bryum subelegans</i>	No longer considered a good species (= <i>B. pallens</i>)
<i>Bryum valparaisense</i>	Alien
<i>Calypstrochaeta apiculata</i>	Alien
<i>Didymodon mamillosus</i>	Now synonymized with <i>D. rigidulus</i>
<i>Ephemerum hibernicum</i> ¹³	Recently reduced to a subspecies of <i>E. crassinervium</i>
<i>Ephemerum sessile</i> ¹⁴	Recently reduced to a subspecies of <i>E. crassinervium</i>
<i>Ephemerum stellatum</i>	No longer considered a good species (= <i>E. serratum</i> & <i>E. minutissimum</i>)
<i>Fissidens exiguus</i>	No longer considered a good species (= <i>F. viridulus</i>)
<i>Hymenostylium recurvirostrum</i> var. <i>insigne</i> (<i>Hymenostylium insigne</i>)	Reduced to a variety
<i>Leptodontium proliferum</i>	Alien
<i>Leptophascum leptophyllum</i> (<i>Chenia leptophylla</i>)	Alien
<i>Leptotheca gaudichaudii</i>	Alien
<i>Pictus scoticus</i>	Now synonymized with <i>Hygrohypnum luridum</i>
<i>Thamnobryum maderense</i>	Possibly alien, but taxonomy also needs to be clarified
<i>Tortula amplexa</i> (<i>Syntrichia amplexa</i>)	Alien

¹³According to Holyoak (2010), *E. crassinervium* includes *E. crassinervium* subsp. *rubeanum* (formerly *E. hibernicum*) and *E. crassinervium* subsp. *sessile* (formerly *E. sessile*). The species has so far been recorded from 24 hectares since 1980.

¹⁴See previous footnote.

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