

Revised Red Data List of Estonian bryophytes

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Abstract: All Estonian bryophyte species (597) that had written records up to 2018 were evaluated against IUCN criteria. More than half of the species belong to the least concern category, but almost one fourth (158) is evaluated as threatened, and one tenth (65) as near threatened. Eleven species are data deficient and 15 species are considered to be regionally extinct from Estonia. To achieve adequate assessment results for a small country, some criteria were adjusted. Changes compared to the previous red list and threats to the species are discussed.

Keywords: IUCN criteria, criteria adjustments, threats, life longevity

INTRODUCTION

The first Red Data Book of Estonia (Kumari, 1982) did not include bryophytes. L. Laasimer, A. Kalda, and L. Kannukene compiled the first list of threatened bryophytes in 1987–1988, that remained unpublished. This list included 50 species, among them seven liverworts and one hornwort. In 1992, Kalda et al. published the list of 130 threatened mosses that were divided into five threat categories (extinct, endangered, vulnerable, rare, and rare with unknown threat status).

The second Red Data Book of Estonia appeared in 1998 (Lilleleht, 1998). This edition incorporates threatened bryophytes from all three bryophyte phyla, altogether 199 species, that were divided into six categories (extinct or probably extinct, endangered, vulnerable, rare, care demanding, and indeterminate). Here also summarizing tables about the habitats and threats of the bryophytes were presented (Ingerpuu, 1998). Starting from this book, a new version is compiled after every ten years. Therefore, the third Red Data Book appeared in 2008, and the fourth will be ready in the end of 2018.

The third book has only web-version (Red Data Book of Estonia, 2008). In this book, seven categories were applied according to the IUCN red list categories and criteria (IUCN 2001). Around two thirds of the known Estonian bryoflora was assessed then, among them 218 were assessed as threatened, regionally extinct or with data deficiency. However, since the evaluators missed

training, the guidelines were not always understood properly.

The aim of the present study is to present data about the new red list of Estonian bryophytes, give explanations to the changes in comparison of the previous red list, and discuss about further improvement of the assessment process.

MATERIAL AND METHODS

For the present red list all bryophyte species that have been registered in Estonia up to 2018 (Vellak et al., 2015; Vellak et al., 2017) were evaluated. Thus, altogether two hornworts, 127 liverworts and 468 mosses were assessed against IUCN criteria. Downlisting was not done since we do not have data about the immigration possibilities of our species. Almost two thirds of the Estonian border is sea line. The main wind direction is from west and the propagules carried by wind have to cross the Baltic Sea that might be a major geographical barrier.

To obtain data for localities and locations the database of Estonian biodiversity was used (<https://elurikkus.ut.ee/en>), also specimens from all Estonian herbaria (TAA; TALL; TAM and TU) were checked if necessary, and for 41 species that are included in the state monitoring program, more precise data on the population sizes and state of habitats were used. Before the present evaluation, the assessors passed the IUCN Red List Assessor Training Workshop

were the correct explanations for the essential terms and assessment procedures were given by IUCN Red List trainers. The species evaluation was done according to updated version of guidelines (IUCN, 2012a, b), taking into account also supplementary guidelines for application IUCN criteria for bryophytes (Hallingbäck, 2006, 2007). These guidelines were important to understand the content of such terms as location, individual, generation length and fragmentation of populations.

The preamble of the Guidelines, point 5 (IUCN, 2012a) allows to determine applications and modifications in regional red lists. We have considered to be necessary to make some modifications. Since the territory of the Republic of Estonia (45,336 km²) is ca. 225 times smaller

than that of Europe (10,180,000 km²), we made adjustments to the sizes of the extent of occurrence (EOO), area of occurrence (AOO), numbers of localities, grid size of localities, and numbers of individuals, to avoid assessing many species, that are in favourable status in Estonia, as threatened. Such adjustments have earlier been done for the bryophytes of Canary Islands (González-Mancebo et al., 2012) that are even much smaller than Estonia. The adjustments in comparison to those of Canary Islands and of IUCN is given in Table 1.

We have accepted the locality grid size 0.25 km² according to González-Mancebo et al. (2012). The grid size used in Sweden is 2×2 km (Hallingbäck et al., 2007), but we consider this to be too large for Estonia since our monitoring results

Table 1. The comparison between IUCN, adjusted Canary Islands (González-Mancebo et al., 2012), and adjusted Estonian criteria

	CR	EN	VU	NT	Change in comparison with IUCN values
B1 EOO km²					
IUCN	<100	<5000	<20000	-	
Canary	<5	<50	<500	<1000	20, 100 and 40 times smaller, NT criteria added
Estonia	<10	<500	<2000	-	10 times smaller
B2 AOO km²					
IUCN	<10	<500	<2000	-	
Canary	0.25	≤1.25	≤5	≤20	40, 400 and 400 times smaller, NT criteria added
Estonia	1	<5	<20	-	10 and 100 times smaller
Number of locations					
IUCN	1	≤5	≤10	-	
Canary	1	2	3 to 5	5 to 10	Same, 2.5 and up to twice smaller, NT criteria added
Estonia	1	≤5	≤10	-	Same
D number of individuals					
IUCN	<50	<250	<1000	-	
Canary	-	-	-	-	
Estonia	<5	<25	<100	-	10 times smaller
D2					
IUCN			≤20 km ² or ≤5 locations	-	
Canary			≤2.5 km ²	≤5 km ²	8 times smaller, NT criteria added
Estonia			<2 km ² (up to 7 grids) or ≤5 locations	<4 km ² (8 to 15 grids)	10 times smaller, NT criteria added

have shown that local population sizes of majority of species rarely exceed this size in Estonia.

We have considered as regionally extinct (RE) species that do not have any documented records after 1950. Due to lack of data, only IUCN criteria B1 (two species), B2, D and D2 were used in the evaluation process.

Known threat factors and grouping according to life longevity were searched for all species belonging to categories CR, EN, VU and NT. Life longevity was determined using life strategy groups (During, 1992; Dierßen, 2001) as following: species belonging to fugitive, colonist, and short-lived, shuttle species were delimited as short-lived, long-lived shuttle and perennials as long-lived species.

RESULTS

Altogether 597 species were assessed. The list of regionally extinct, threatened, near threatened and species with data deficiency is in supplementary material, least concerned species can be found in Vellak et al. (2015). From the assessed species 348 (59%) are considered to be of least concern. As threatened (CR; EN or VU) were evaluated 158 (26%) species, 65 (10%) as near threatened, 15 (3%) as regionally extinct, and 11 (2%) are data deficient (Fig. 1).

Only for one species (*Campylopus introflexus*) the criteria were not applicable, since it is an invasive species for Estonia.

Comparison of the threatened species in 2008 and 2018 red data lists showed that twelve species have now higher threat category, but 61 species have lower category. Of the last group, 11 species are excluded from RE category due to new findings during last ten years. The most peculiar of these is *Meesia longiseta* that was found to germinate from a diaspore bank (Ingerpuu & Vellak, 2018). Fifty species obtained lower threat categories due to recent inventories.

There are different reasons for rising the category. The area of occupancy of one species (*Zygodon viridissimus*) shrunk remarkably due to re-identification of several herbarium specimens. *Schistidium rivulare* was formerly estimated as LC since another species (*S. platyphylla*) was treated as its variety then. Estimation of the

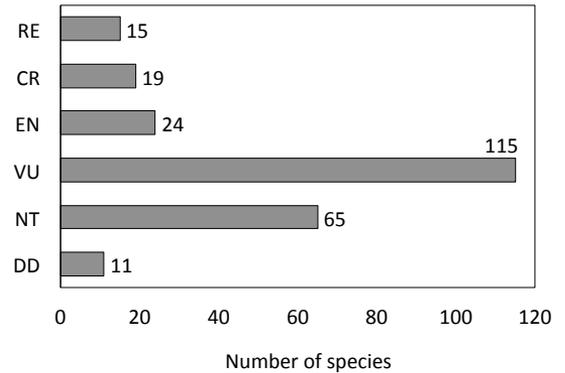


Figure 1. Estonian bryophyte species in IUCN categories: Regionally Extinct (RE), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Data Deficient (DD).

number of individuals led to higher category for two species (*Racomitrium aciculare*, *Sphagnum molle*). For five species (*Amblyodon dealbatus*, *Bryum salinum*, *Hylocomium umbratum*, *Oleophozia perssonii*, *Oxystegus tenuirostris*) the low number of new findings and observed/projected decline of the habitat quality and area were reasons for rising their threat category. For three species (*Encalypta mutica*, *Frullania tamarisci*, *Saelania glaucescens*) the decline of population size and habitat quality or small number of individuals was confirmed by the results of monitoring.

The main threats for the species were grouped as following: forestry 25%, draining of mires and changing the natural state of water bodies 18%, and neglecting of traditional management of meadows 12%. For 45% of the threatened species the threat factor is unknown.

The plotting of life longevity groups against known and unknown threat factors showed that the amount of species where threat factor is unknown is much higher in the group of short-lived species (Fig. 2).

DISCUSSION

For the assessment of the threat categories of Estonian bryophytes, only B and D criteria were used (Supplementary material). The reason of not using A and C criteria is that we do not have

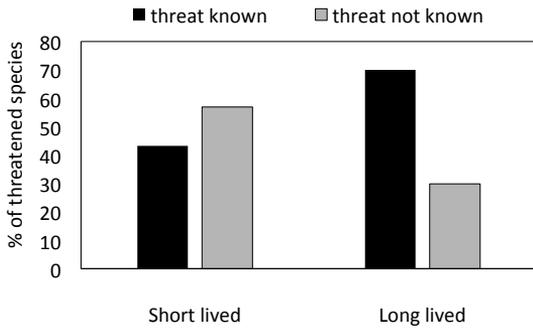


Figure 2. Percentages of threatened bryophyte species with known and unknown threats according to their life-span class.

information for the whole population size and the number of individuals, except a few species, and those species do not have such reduction that is needed to evaluate them to a threat category. For the species estimated as CR or EN, the reason was mainly small area of occupancy, small number of locations and decline of the area of occupancy or/and habitat (B2ab). For the species estimated as VU, the reason was mainly small area of occupancy or small number of locations without known decline (D2). We think it is essential that the size of EOO, AOO and number of individuals be adjusted according to the size of the country, since otherwise the number of threatened species could rise unreasonably. The critical size of EOO according to B criteria is 20,000 km², which is 44% of the whole territory of Estonia. If we had followed this, we should have assessed several species that have smaller EOO, but up to 10 locations and declining habitat, e.g. *Bazzania trilobata* and *Reboulia hemisphaerica* as vulnerable. According to our adjusted criteria they belong to near threatened category. Also the critical size of AOO (20 km²) according to D2 criteria is too large. For example, *Andreaea rupestris* has 15 locations with AOO of little less than 4 km² and should have been assessed as vulnerable. According to our adjusted criteria we evaluated it as near threatened. The number of locations of *Tortella rigens* is 21 and AOO is less than 6 km², we have evaluated it as least concern.

There are no general strict criteria for regionally extinct category. In some European countries the species is assessed as RE only if the known localities have been investigated thoroughly and

the species has been found to be gone. In other countries RE category is applied if a species has not been collected after a certain time limit. During ten years, eleven species in Estonia have been re-found at new localities. It is impossible to ascertain if these are recent distributional events from elsewhere or the species has been there for a long time. Most peculiar is the germination of a species from a propagule bank; this species has been evaluated as regionally extinct (Ingerpuu & Vellak, 2018). If we consider viable spore to be an individual, then according to the IUCN guidelines such species is not extinct anymore, even if we never find it growing in the recently recorded habitat. Therefore, we evaluated *Meesia longisetata* that has six historical localities and one germination from a seedbank, as critically endangered, not regionally extinct.

The percentage of species belonging to the three threat categories (CR, EN, VU) is fluctuating in different European countries. It is ca 15% in Britain (Hodgetts, 2011), ca 20% in Finland and Canary islands (Syrjänen et al., 2010; González-Mancebo et al., 2012), around 25% in Hungary and Estonia (Papp et al., 2010), or even over 30% in Bulgaria and Romania (Natcheva et al., 2006; Stefanut & Goia, 2012). Main reason for such fluctuation could be the history and rate of bryological investigations in different countries, although differences in assessments, countries climate, number of habitats and land use can also play a role. Another reason for high number of threatened species is including species that have very few localities, but inhabit readily sites with human impact and have no known threat factors. Such species are usually short-lived, as became evident by our analysis. They can change their location easily and are usually of small size, being hard to find in the nature. Many of these species, that we have evaluated as vulnerable, could actually not be threatened and could even gain from the disturbances made by humans (*Ephemerum serratum*, *Bryum klinggraffii*, *Ptychostomum rubens*). Some of such rare species that have mainly or only recent finds could be expanding their area due to climate warming (*Bryum subapiculatum*, *B. radiculosum*, *Didymodon vinealis*). On the other hand, species that belong to the same category, but have more northern or mountainous distribution, might be in greater threat (*Aplodon wormskioldii*, *Grimmia longirostris*, *Rhizomnium magnifolium*). If a

species that produces frequently small spores is distributed in all surrounding countries, downgrading should be done after an inventory that confirms that the area of occupancy of the species is stable or increasing.

Our experience has shown that the most reliable data for assessing the threat categories come from monitoring, even if the monitoring is done only for a part of populations in the country. For example *Encalypta mutica* has six recently proved localities (=locations) in the country. Without monitoring the species would have been assessed as vulnerable according to B2 ab(iii), as this was done in the previous red list (2008). Meanwhile the monitoring of four populations has shown that the number of individuals per location is only 1–2. Thus, the total number of the individuals in the country is less than 25 and the species could be evaluated as EN according to criteria D.

The protection of threatened bryophytes functions best if the nature protection laws of the country support it. In Estonia, we have lists of species, divided into three categories that are under state protection. For protected species outside of nature reserves, special protection areas should be established and all management that could harm the populations should be stopped. Such regulations are valid for all known locations of first category species, for half locations of second category species and for 10% of locations of the third category species. The species belonging to the first and second category are included in the state monitoring program. We have 45 bryophytes on the list of protected species and this list is revised after every ten years. During evaluation of species against IUCN threat criteria, we get also additional data for updating species protection list.

ACKNOWLEDGEMENTS

The study has been supported by the European Union through the European Regional Development Fund (Centre of Excellence EcolChange), the Estonian Environment Agency, the Estonian Research Council (projects IUT20-29 and IUT34-7), and State programme KOGUD for botanical collections of the Natural History Museum of the University of Tartu.

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Supplement. The list of regionally extinct, threatened and near threatened species, and species with data deficiency

Species	IUCN cat	Criteria
<i>Barbilophozia sudetica</i>	RE	
<i>Bartramia ithyphylla</i>	RE	
<i>Campylopus pyriformis</i>	RE	
<i>Clevea hyalina</i>	RE	
<i>Dicranella rufescens</i>	RE	
<i>Harpantus scutatus</i>	RE	
<i>Lioclaena subulata</i>	RE	
<i>Schistochilopsis opacifolia</i>	RE	
<i>Oncophorus wahlenbergii</i>	RE	
<i>Pelekiium minutulum</i>	RE	
<i>Solenostoma gracillimum</i>	RE	
<i>Sphagnum aongstroemii</i>	RE	
<i>Splachnum sphaericum</i>	RE	
<i>Splachnum vasculosum</i>	RE	
<i>Tortula randii</i>	RE	
<i>Amblyodon dealbatus</i>	CR	B2ab(i,ii,iii)
<i>Bryum calophyllum</i>	CR	B2ab(iii); D2
<i>Bryum knowltonii</i>	CR	B2ab(iii)
<i>Bryum turbinatum</i>	CR	B2ab(iii)
<i>Bryum weigelii</i>	CR	D1
<i>Dichelyma capillaceum</i>	CR	D1
<i>Discelium nudum</i>	CR	B2ab(iii,iv)
<i>Grimmia crinita</i>	CR	B2ab(iii)
<i>Hypnum fertile</i>	CR	B2ab(iii)
<i>Oleolophozia perssonii</i>	CR	B2ab(iii)
<i>Meesia longiseta</i>	CR	D1
<i>Metzgeria conjugata</i>	CR	D1
<i>Microbryum starckeanum</i>	CR	B2ab(iii)
<i>Pseudocrossidium revolutum</i>	CR	B2ab(iii)
<i>Saelania glaucescens</i>	CR	B2ab(iii)
<i>Schistidium elegantulum</i>	CR	B2ab(iii)
<i>Syntrichia caninervis</i>	CR	B2ab(iii)
<i>Thamnobryum neckeroides</i>	CR	B2ab(iii)
<i>Tortula lindbergii</i>	CR	B2ab(iii)
<i>Brachythecium tommasinii</i>	EN	B2ab(iii)
<i>Bryum radiculosum</i>	EN	B2ab(iii),D2

Species	IUCN cat	Criteria
<i>Bryum salinum</i>	EN	B2ab(iii)
<i>Dichelyma falcatum</i>	EN	B2ab(iii)
<i>Encalypta mutica</i>	EN	D2
<i>Frullania tamarisci</i>	EN	B2ab(iii,iv)
<i>Fuscocephalozopsis catenulata</i>	EN	B2ab(iii)
<i>Solenostoma confertissimum</i>	EN	B2ab(iv); D2
<i>Loeskypnum badium</i>	EN	D1
<i>Meesia uliginosa</i>	EN	B2ab(iii,iv)
<i>Microbryum floerkeanum</i>	EN	D2
<i>Myrinia pulvinata</i>	EN	B2ab(iii)
<i>Neoorthocaulis floerkei</i>	EN	B2ab(ii,iii)
<i>Oxyrrhynchium schleicheri</i>	EN	B2ab(iii)
<i>Oxystegus tenuirostris</i>	EN	B2ab(iii)
<i>Pogonatum aloides</i>	EN	B2ab(iv)
<i>Pogonatum nanum</i>	EN	B2ab(iii)
<i>Racomitrium aciculare</i>	EN	D1
<i>Riccia beyrichiana</i>	EN	B2ab(iii)
<i>Sphagnum auriculatum</i>	EN	B2ab(iii)
<i>Sphagnum molle</i>	EN	D1
<i>Splachnum rubrum</i>	EN	B2ab(iii)
<i>Tayloria tenuis</i>	EN	D1
<i>Thamnobryum subserratum</i>	EN	B2ab(iii)
<i>Aloina rigida</i>	VU	D2
<i>Anomodon rugelii</i>	VU	B2ab(iii); D2
<i>Aplodon wormskioldii</i>	VU	D2
<i>Atrichum angustatum</i>	VU	D2
<i>Bryum blindii</i>	VU	D2
<i>Bryum dichotomum</i>	VU	D2
<i>Bryum funckii</i>	VU	D2
<i>Bryum klinggraeffii</i>	VU	D2
<i>Bryum marratii</i>	VU	B2ab(iii)
<i>Bryum subapiculatum</i>	VU	D2
<i>Buxbaumia viridis</i>	VU	B2ab(iii)
<i>Calliargon megalophyllum</i>	VU	D2
<i>Campylopus fragilis</i>	VU	D2
<i>Cephaloziella elachista</i>	VU	D2

Species	IUCN cat	Criteria	Species	IUCN cat	Criteria
<i>Cephaloziella integerrima</i>	VU	D2	<i>Philonotis capillaris</i>	VU	D2
<i>Cephaloziella spinigera</i>	VU	D2	<i>Physcomitrella patens</i>	VU	D2
<i>Ceratodon conicus</i>	VU	D2	<i>Physcomitrium eurystomum</i>	VU	D2
<i>Conardia compacta</i>	VU	D2	<i>Plagiopus oederianus</i>	VU	D2
<i>Cynodontium polycarpon</i>	VU	D2	<i>Plagiothecium undulatum</i>	VU	B2ab(iii)
<i>Dicranella humilis</i>	VU	D2	<i>Pohlia andalusica</i>	VU	D2
<i>Dicranella subulata</i>	VU	D2	<i>Pohlia annotina</i>	VU	D2
<i>Dicranoweisia cirrata</i>	VU	D2	<i>Pohlia bulbifera</i>	VU	D2
<i>Didymodon vinealis</i>	VU	D2	<i>Pohlia elongata</i>	VU	D2
<i>Ditrichum lineare</i>	VU	D2	<i>Pohlia lescuriana</i>	VU	D2
<i>Ditrichum pallidum</i>	VU	D2	<i>Polytrichum pallidisetum</i>	VU	B2ab(iii); D2
<i>Ditrichum pusillum</i>	VU	D2	<i>Pseudephemerum nitidum</i>	VU	D2
<i>Encalypta ciliata</i>	VU	D2	<i>Pseudocampyllum radicale</i>	VU	D2
<i>Ephemerum serratum</i>	VU	D2	<i>Pseudotaxiphyllum elegans</i>	VU	D2
<i>Eucladium verticillatum</i>	VU	D2	<i>Ptychostomum arcticum</i>	VU	D2
<i>Fissidens arnoldii</i>	VU	D2	<i>Ptychostomum rubens</i>	VU	D2
<i>Exsertotheca crispa</i>	VU	D2	<i>Racomitrium fasciculare</i>	VU	D2
<i>Fissidens fontanum</i>	VU	B2ab(iii); D2	<i>Racomitrium sudeticum</i>	VU	D2
<i>Fontinalis dalecarlica</i>	VU	D2	<i>Rhizomnium magnifolium</i>	VU	D2
<i>Fontinalis squamosa</i>	VU	D2	<i>Rhytidadelphus loreus</i>	VU	B2ab(iii); D2
<i>Fossombronia foveolata</i>	VU	D2	<i>Rhytidium rugosum</i>	VU	D2
<i>Grimmia anomala</i>	VU	D2	<i>Riccardia incurvata</i>	VU	D2
<i>Grimmia laevigata</i>	VU	D2	<i>Riccia warnstorffii</i>	VU	D2
<i>Grimmia longirostris</i>	VU	D2	<i>Scapania gymnostomophila</i>	VU	D2
<i>Harpantus flotovianus</i>	VU	D2	<i>Scapania nemorea</i>	VU	D2
<i>Herzogiella striatella</i>	VU	D2	<i>Scapania umbrosa</i>	VU	D2
<i>Herzogiella turfacea</i>	VU	B2ab(iii); D2	<i>Scapania undulata</i>	VU	D2
<i>Hylocomiastrum umbratum</i>	VU	B2ab(iii); D2	<i>Schistidium agassizii</i>	VU	D2
<i>Heterogemma laxa</i>	VU	D2	<i>Schistidium confertum</i>	VU	D2
<i>Hygroamblystegium humile</i>	VU	D2	<i>Schistidium crassipilum</i>	VU	D2
<i>Jungermannia atrovirens</i>	VU	D2	<i>Schistidium submuticum</i>	VU	B2ab(iii); D2
<i>Kiaeria blyttii</i>	VU	D2	<i>Sciuro-hypnum plumosum</i>	VU	D2
<i>Lophozia ascendens</i>	VU	D2	<i>Seligeria calcarea</i>	VU	B2ab(iii,iv)
<i>Mannia pilosa</i>	VU	D2	<i>Seligeria donniana</i>	VU	D2
<i>Mannia sibirica</i>	VU	D2	<i>Seligeria patula</i>	VU	D2
<i>Mesophychia heterocolpus</i>	VU	D2	<i>Seligeria recurvata</i>	VU	B2ab(iv); D2
<i>Nardia geoscyphus</i>	VU	D2	<i>Serpoleskea confervoides</i>	VU	D2
<i>Nardia insecta</i>	VU	D2	<i>Sphagnum austinii</i>	VU	D2
<i>Obtusifolium obtusum</i>	VU	D2	<i>Solenostoma hyalinum</i>	VU	D2
<i>Orthotrichum lyellii</i>	VU	D2	<i>Solenostoma sphaerocarpum</i>	VU	D2
<i>Orthotrichum patens</i>	VU	B2ab(iii); D2	<i>Sphagnum jensenii</i>	VU	D2
<i>Orthotrichum pylaesii</i>	VU	D2	<i>Sphagnum subfulvum</i>	VU	D2
<i>Orthotrichum stramineum</i>	VU	D2	<i>Sphenolobus minutus</i>	VU	D2
<i>Palustriella decipiens</i>	VU	D2	<i>Syntrichia latifolia</i>	VU	D2
<i>Phaeoceros carolinianus</i>	VU	D2	<i>Syntrichia montana</i>	VU	D2

Species	IUCN cat	Criteria	Species	IUCN cat	Criteria
<i>Zygodon stirtonii</i>	VU	D2	<i>Pseudocrossidium hornschuchianum</i>	NT	
<i>Zygodon viridissimus</i>	VU	B1ab(iii); B2ab(iii); D2	<i>Pseudoleskeella catenulata</i>	NT	
<i>Tetraplodon mniodes</i>	VU	D2	<i>Ptychostomum cernuum</i>	NT	
<i>Timmia megapolitana</i>	VU	B1ab(iv); D2	<i>Reboulia hemisphaerica</i>	NT	
<i>Tortula norvegica</i>	VU	D2	<i>Riccia ciliata</i>	NT	
<i>Tortula protobryoides</i>	VU	D2	<i>Riccia fluitans</i>	NT	
<i>Trichostomum brachydontium</i>	VU	B2ab(iii); D2	<i>Scapania apiculata</i>	NT	
<i>Ulotia coarctata</i>	VU	D2	<i>Scapania calcicola</i>	NT	
<i>Ulotia curvifolia</i>	VU	D2	<i>Scapania lingulata</i>	NT	
<i>Ulotia drummondii</i>	VU	D2	<i>Schistidium maritimum</i>	NT	
<i>Warnstorfia tundrae</i>	VU	D2	<i>Schistidium rivulare</i>	NT	
<i>Andreaea rupestris</i>	NT		<i>Schistidium papillosum</i>	NT	
<i>Barbilophozia hatcheri</i>	NT		<i>Schistidium platyphyllum</i>	NT	
<i>Barbilophozia lycopodioides</i>	NT		<i>Schistochilopsis incisa</i>	NT	
<i>Bazzania trilobata</i>	NT		<i>Schljakovia kunzeana</i>	NT	
<i>Brachythecium turgidum</i>	NT		<i>Seligeria campylopoda</i>	NT	
<i>Bryum warneum</i>	NT		<i>Seligeria pusilla</i>	NT	
<i>Buxbaumia aphylla</i>	NT		<i>Sphagnum compactum</i>	NT	
<i>Calliergon richardsonii</i>	NT		<i>Sphagnum inundatum</i>	NT	
<i>Catoscopium nigratum</i>	NT		<i>Sphagnum lindbergii</i>	NT	
<i>Didymodon insulanus</i>	NT		<i>Sphagnum platyphyllum</i>	NT	
<i>Drepanocladus longifolius</i>	NT		<i>Sphagnum pulchrum</i>	NT	
<i>Drepanocladus sordidus</i>	NT		<i>Sphagnum quinquefarium</i>	NT	
<i>Drepanocladus trifarius</i>	NT		<i>Zygodon rupestris</i>	NT	
<i>Endogemma caespiticia</i>	NT		<i>Thamnobryum alopecurum</i>	NT	
<i>Fontinalis hypnoides</i>	NT		<i>Timmia bavarica</i>	NT	
<i>Fossombronia wondraczekii</i>	NT		<i>Tortula lingulata</i>	NT	
<i>Gymnocolea inflata</i>	NT		<i>Trematodon ambiguus</i>	NT	
<i>Gymnostomum aeruginosum</i>	NT		<i>Tritomaria exsectiformis</i>	NT	
<i>Hedwigia stellata</i>	NT		<i>Tritomaria quinquedentata</i>	NT	
<i>Hymenostylium recurvirostrum</i>	NT		<i>Ulotia hutchinsiae</i>	NT	
<i>Hypnum andoi</i>	NT		<i>Warnstorfia trichophylla</i>	NT	
<i>Isopterygiopsis pulchella</i>	NT		<i>Weissia squarrosa</i>	NT	
<i>Isothecium myosuroides</i>	NT		<i>Bartramia pomiformis</i>	DD	
<i>Lophozia silvicola</i>	NT		<i>Bryum kunzei</i>	DD	
<i>Meesia triquetra</i>	NT		<i>Calypogeia azurea</i>	DD	
<i>Mesoptychia bantriensis</i>	NT		<i>Cynodontium bruntonii</i>	DD	
<i>Microbryum davallianum</i>	NT		<i>Didymodon sicculus</i>	DD	
<i>Palustriella falcata</i>	NT		<i>Diphyscium foliosum</i>	DD	
<i>Plagiothecium nemorale</i>	NT		<i>Hamatocaulis lapponicus</i>	DD	
<i>Pohlia prolifera</i>	NT		<i>Orthotrichum rogeri</i>	DD	
<i>Porella cordaeana</i>	NT		<i>Schistidium robustum</i>	DD	
<i>Porella platyphylla</i>	NT		<i>Sphagnum affine</i>	DD	
			<i>Tortula schimperii</i>	DD	