

AZOREAN BRYOPHYTES: A PRELIMINARY REVIEW OF RARITY PATTERNS

Rosalina Gabriel¹, Nídia Homem¹, Adalberto Couto¹, Silvia Calvo Aranda^{1,2} & Paulo A.V. Borges¹

¹*Azorean Biodiversity Group – CITA-A, Dep. Ciências Agrárias, Universidade dos Açores, 9700-042 Angra do Heroísmo, Portugal e-mail: rgabriel@uac.pt*

²*Dep. Biodiversidad y Biología Evolutiva, Museo Nacional de Ciencias Naturales (CSIC). C/ José Gutiérrez Abascal, 2. 28006, Madrid, Spain*

ABSTRACT

Bryophytes are not exempt of rarity and threat, although their small size, mute colours and difficult field identification may mask their true conservation status. Actually, it is known that a quarter of all European bryophytes are under actual or potential threat. The first Red Data Book for European Bryophytes was produced in 1995, largely based on national red lists and on the work of a vast team of bryologists who assessed the conservation status of each European species. The red listing of bryophytes has undoubtedly contributed to increase the awareness of planners to this group of organisms, and several efforts have been made, through Europe, to preserve sites based on their bryological interest. Accordingly, a specific Red List for the Azorean Bryophytes may help regional managers to identify particularly endangered species, thus allowing for the creation of measures to improve their preservation. In this paper we have used an adaptation of the works of Deborah Rabinowitz (1981), who created a typology to access different forms of rarity, using three variables: Geographical Distribution, Abundance and Habitat Specificity. All the 480 species and subspecies known to occur in the Azores were surveyed; of these, 215 species lacked sufficient data to be analyzed (data deficient), 121 were not considered rare and 144 (1 hornworts, 56 liverworts and 87 mosses) were considered rare, at least in one of the three parameters considered. The benefits and limitations of the methodology are briefly discussed. Several practical suggestions are proposed in order to enhance the conservation of selected bryophyte species.

RESUMO

Os briófitos podem ser tão raros e estar tão ameaçados como os demais organismos do planeta, apesar de o seu pequeno tamanho, cores discretas e difícil identificação no campo poderem mascarar o seu verdadeiro estatuto de conservação. De facto, é reconhecido que cerca de um quarto de todos os briófitos da Europa estão efectiva ou potencialmente ameaçados. O primeiro “Livro Vermelho dos Briófitos da Europa” foi produzido em 1995, amplamente baseado em listas vermelhas nacionais e no trabalho de uma vasta equipa de briólogos que avaliaram o estatuto de conservação para as espécies Europeias. A classificação de briófitos em listas vermelhas tem contribuído para aumentar a sensibilidade dos gestores para este grupo de organismos e alguns esforços têm sido desenvolvidos na Europa, para preservar locais tendo como característica o seu interesse briológico. Consequentemente, uma lista vermelha para os briófitos dos Açores pode auxiliar os gestores regionais a identificar espécies particularmente ameaçadas, tornando-se o primeiro passo para assegurar a sua protecção. Neste artigo usamos uma adaptação dos trabalhos de Deborah Rabinowitz (1981), que criou uma tipologia para desocultar e avaliar várias formas de raridade, utilizando três variáveis: Distribuição Geográfica, Abundância e Especificidade do Habitat. Todas as 480 espécies e subespécies dos Açores foram investigadas: 215 *taxa* não tinham informação suficiente para ser analisados (deficientes em dados), 121 não foram consideradas raras e 144 briófitos (1 antocerota, 56 hepáticas e 87 musgos) foram considerados raros pelo menos num dos parâmetros considerados. Os benefícios e limitações desta metodologia são brevemente discutidos. São propostas algumas sugestões práticas para melhorar a estratégia de conservação dos briófitos seleccionados.

INTRODUCTION

One of the most interesting characteristics of the Azores is their extraordinary wealth of bryophytes (480 species and subspecies, Gabriel *et al.*, 2010), comparable to the diversity present in other Macaronesian ar-

chipelagos (González-Mancebo *et al.*, 2008; Sérgio *et al.*, 2008), a feature unparalleled in other groups of Azorean organisms (Izquierdo *et al.*, 2004; Borges *et al.*, 2008, 2010a). In addition, Azorean islands host a high proportion of European bryophyte species (Homem & Gabriel,

2008) and also many endemic species of vascular plants, molluscs and arthropods (Borges *et al.*, 2010b), many of which are in danger as a consequence of historical human occupation and land-use changes (Borges *et al.*, 2000, 2009; Cardoso *et al.*, 2010; Martín *et al.*, 2010; Triantis *et al.*, 2010). In fact, the conservation of island biota was always considered a true priority since most of the recorded extinctions have occurred in islands (Sax & Gaines, 2008).

In spite of more than four centuries of Human occupation, the Azores and other Macaronesian archipelagos, still possess natural habitats (Borges *et al.*, 2009; Gaspar *et al.*, 2011), and these islands are some of the very few places in Europe where the 'biodiversity crisis' is particularly critical and a proper conservation strategy may effectively contribute to preserve unique pristine communities. Presently, about a fifth of the Azorean islands area is under some legal protection status (Monteiro & Furtado, 2010), and a few remnants of native forests have persisted since the Portuguese occupation in the early 15th century, although grasslands and exotic

plantation forests dominate the islands these days (Borges *et al.*, 2009).

Most ecological studies in islands, and in particular in the Azores, are limited in their time span and a detailed understanding of the long-term responses of island bryophyte communities to global change drivers is not known. Bryophytes have long been considered indicator groups for habitat change, as their lack of roots makes them totally dependent on the atmospheric (or aquatic) inputs of nutrients (eg. Frego, 2007; Gignac, 2010). Besides, bryophytes are a characteristic part of the Azorean native forests, covering all kinds of substrata, including leaves of vascular species, with luxuriant communities (Homem & Gabriel, 2008), and are generally considered remnants of the subtropical flora that endured the Quaternary glaciations (but see Aigoïn *et al.*, 2009, who recently questioned the relictual origin of Macaronesian bryophytes). Thus, assessing the conservation status for bryophytes may couple with policies for native habitats protection.

A red list ranks *taxa* according to their threat level and

extinction risk, and assessments for the red list compile current knowledge of conservation status and threats to individual species (ex. Knapp & Monterrosa Salomón, 2010). Few vascular plants and even fewer bryophytes (only 101 of the ca. 18000 species!) have been formally assessed using the IUCN system (IUCN, 2010). However, one of the targets of the Global Strategy for Plant Conservation is “a preliminary assessment of the conservation status of all known plant species, at national, regional and international levels” (UNEP, 2002). There are various approaches to achieve this goal, including the use of expert’s opinions (ex. Sérgio *et al.*, 1992; Schumacker, 2001; Sjögren, 1995), the use of herbarium labels information (ex. Krupnick *et al.*, 2008), the creation of specific software to create red lists accommodating the IUCN criteria (ex. RAMAS, 2007), but lately it has been advised that a thorough use of all available information, including georeferenced herbarium specimens and other parameters such as population size and local abundance, would be a good way forward to stimulate conservation (ex.

Brummitt *et al.*, 2008). In practice, not many species have been studied in any of these ways and the information necessary to do so is impressive. Nevertheless, the need to better understand the rarity of species is pressing and simple methods of ranking should at least be essayed for all groups of organisms.

The pioneer work of Deborah Rabinowitz (1981, 1986) has enlightened the rarity concept, acknowledging that

“There are many ways in which a species can become rare and this path has profound evolutionary and ecological consequences” (Rabinowitz, 1981: 205).

To define rarity, she used a three dimensional system including distribution, abundance and habitat specificity. Each one of these dimensions was further subdivided into two qualitative categories (wide or narrow, large or small, generalist or specialist, respectively), resulting in an eight cells table, from which, only one cell includes common species, those with wide distributions, large populations and generalist. All other combinations suffer from at least one form of rarity. Knowing the rarity status of species is critical to evaluate

both their extinction proneness and their roles in the ecosystems (Gaston, 1994, 2010).

One of the most useful resources to study biodiversity in the Azores is the regional species database, ATLANTIS, where grid-based spatial incidence information, allied to temporal data, has been gathered for several groups of organisms (lichens, bryophytes, vascular plants, marine invertebrates, terrestrial molluscs, arthropods and vertebrates) (Borges *et al.*, 2010c; Martín *et al.*, 2010). Parallel to this work, the biological and ecological features of bryophytes have also been noted by RG and co-workers. The information thus gathered may therefore serve as a starting point for an assessment of the rarity of bryophytes, using Rabinowitz' approach (considering range, abundance and distribution). Such a characterization has been applied to vascular plant species (ex. Rabinowitz *et al.*, 1986; McIntyre, 1992), vertebrates (ex. Kattan, 1992; Goerck, 1997), insects (ex. Fattorini, 2011) and was essayed for European liverworts (Weibull & Söderström, 1995).

In this study we used all the information available to

Azorean bryophytes, as inserted in ATLANTIS database, supplemented with literature and herbaria ecological features, to analyze the rarity patterns of the species and provide a preliminary conservation assessment, at the regional level, of this important indicator group. It is expected that it may be the basis of an Azorean Red List for Azorean bryophytes.

METHODS

Study Area

The nine islands composing the archipelago of the Azores, are situated in the North Atlantic Ocean, extending along a west-northwest to east-southeast orientation (between 36° 30' - 40° North latitudes and 24° 30' - 31° 30' West longitudes). The joined area of the islands is 2,323 km² (larger island, São Miguel, 745 km²; smaller island, Corvo, 17 km²) (Forjaz, 2004). The archipelago's highest altitude is reached in Pico Island, at 2,350 m, but the second highest island (São Miguel) is just 1,105 m altitude. The Azores were uninhabited when Portuguese navigators arrived in the early 15th century, and the earlier descriptions of the islands por-

tray them as intensely forested (Frutuoso, 1963). Nowadays the Azorean population includes about 241,800 people, at a density of 104 inhabitants per square kilometre (Forjaz, 2004). It is estimated that laurel forests occupied about 85% of the present area of Azores; unfortunately, most of this natural habitat has been disturbed, remaining only around 6,000 ha (Fernández-Palacios *et al.*, 2011; Gaspar *et al.*, 2011).

Data Sources

A tentative categorization of rarity was essayed for all the 480 bryophyte species and subspecies included in the most recent check-list of the Azorean Islands (Gabriel *et al.*, 2010). The analyzed data came from literature and herbarium records. The first step included a thorough analysis and interpretation of the available literature, dating back to the 19th century (167 sources; see Appendix 1); this list includes books, chapters and papers as well as some grey literature such as academic thesis, letters and fieldwork reports (see Borges *et al.*, 2010c for details). Secondly, the collection of bryophytes deposited at the University of the Azores was

also examined. All information was fed to the ATLANTIS database (Borges, 2005). This database includes 29,323 species citations coming from literature (most of them, ca. 80%, with recognizable locations and indication of date of collection) and 11,237 citations coming from herbarium records (most of them placed at the bryophyte collection of the University of the Azores). One of the authors (RG) has further compiled information on fruiting, ecology and substrate preferences for each bryophyte record; in some occasions the habitat type was inferred from other published sources or direct knowledge of local experts. Although gaps of information are inevitable, and have indeed been demonstrated (see Aranda *et al.*, 2010), this database is deemed to be as complete as possible and a good starting point to analyze rarity issues. A webpage, the Azorean Biodiversity Portal (<http://www.azoresbioportal.angra.uac.pt/>), with data on the taxonomy, detailed distribution of the species on the Azorean Islands (grid of 500 m x 500 m), European conservation status and some pictures and common names (whenever possible) has been

available to the general public since 2008 (Borges *et al.*, 2010c).

Rarity dimensions

Geographical distribution

Due to the high dispersal ability characteristic of the group (see revision in Rydin, 2008), bryophytes occurring in the Azores were considered to have a narrow geographical distribution when their presence was known only from the Macaronesian Islands (i.e. Macaronesian endemic species and subspecies) and a wide distribution, whenever they also occurred elsewhere. This data was obtained from the recent checklist for Azorean bryophytes (Gabriel *et al.*, 2010).

Abundance

Abundance was the most difficult parameter to quantify, as it refers to the size of the populations, which is not immediate in bryophyte studies (Hallingbäck *et al.*, 1998; Hallingbäck, 2007). Different authors have used different approaches to estimate abundance, such as the examination of museum specimens (see Fattorini, 2011 for arthropods), and others have not considered this parameter for bryophytes (ex. Söderström & Séneca, 2008;

Vanderpoorten & Hallingbäck, 2008). In order to reach an estimation of abundance for bryophytes, we have taken advantage of a recurrent pattern in ecological communities, i.e. the positive intraspecific or interspecific relationship between mean local abundance and regional distribution (Gaston, 1994, 1996), which assumes that

“Within a taxonomic assemblage, locally abundant species tend to be widespread and locally rare species tend to be restricted in their distribution.” (Gaston, 1996: 211).

The key issue here is the use of the small-scale distribution as a proxy of abundance. The importance of scaling, rarity and risk, has been highlighted by Hartley & Kunin (2003), working with two plant species (*Dianthus armeria* L. and *Silene otites* (L.) Wibel) at a distribution resolution of 1-km in Great Britain. Bearing this in mind, and using the ATLANTIS database, we have calculated for each species the number of geographical cells (500 m x 500 m) allocated with the highest precision values (precision 1 – very precise locations, usually point UTM data; 2 – localities never exceeding 25 km²) in all Azorean Islands (see Borges *et al.*, 2010c), and subsequently divided

that value by the total number of 500 m² cells of the archipelago (10044 cells), thus reaching an estimate of the area of occupancy (AOO) for each bryophyte. This ratio of relative area of occupancy was then considered a predictor of the local abundance for each species. All the species were ranked by this index, and those which fell below the median value were considered of low abundance while the others were considered as abundant.

Ecological tolerance

Habitat specificity was used as a proxy of ecological tolerance. RG's species database on ecological traits was categorized in 12 different habitat types (Coastal habitats, Mesic areas, Native forests, Semi-natural grasslands, Mountainous areas, Aquatic habitats, Peat bogs, Urban habitats, Parks and Gardens, Intensive pastures, Exotic forest plantations and Cave entrances). Table 1 includes a summary description of each of the habitats considered.

The islands survey is not equitable (Table 2); for example, if the number of records per km² is considered, Corvo, Terceira and Graciosa are the best inspected of the Azorean Islands while São

Miguel is the worst. Likewise, the percentage of records to which it was not possible to assign a habitat varied according to the islands (highest in Faial and São Jorge and lowest in Terceira and Corvo) but, in average it did not reach one tenth (9.7%) of the 34976 records considered.

To appreciate the ecological range of a species, all the records where this was possible, were allocated to one of the 12 habitat types. Then, the number of records present in one habitat was divided by the total number of locations of that habitat (normalizing the records per habitat). Finally, for those species that had 12 or more described occurrences, the Lloyds Index of Patchiness (L) was applied: $L = S_x^2 - x / x^2 + 1$ (Basset, 1999), where S_x^2 and x are respectively the variance and mean of the samples in the 12 different habitat types. A specialist species in the present context is a species that showed preference for a particular habitat, the value of the index increasing for more specialized species. According to the interpretation of different authors (eg. Basset, 1999; Gabriel & Bates, 2005) those species with an L value larger or equal to three, were considered

TABLE 1. Brief description of the habitats considered in this paper and an indication of the number of independent locations where bryophytes were collected in the Azores.

Habitat types	Description	Number of locations
Coastal habitats	Coastal habitats are situated at the lowest altitudes, near the sea, mostly up to an altitude of 50 m, which may be higher, depending on the Island.	124
Mesic areas	Mesic areas occur above the coastal habitats and receive intermediate amounts of precipitation. These areas are presently dominated by fields (mostly corn fields), intensive pastures and exotic plantations.	204
Native forests	Native forests are the remnants of the former dominant ecosystem types, found by the first settlers. They include evergreen tree species such as <i>Laurus azorica</i> , <i>Erica azorica</i> , <i>Ilex perado</i> subsp. <i>azorica</i> and <i>Juniperus brevifolia</i> .	522
Semi-natural grasslands	These are open areas, mostly located among native forest fragments, including several herbaceous plant species.	42
Mountainous areas	This habitat (high mountain) is restricted to Pico Island, above 1200 m altitude.	57
Aquatic habitats	This habitat includes lagoon margins, temporary and permanent rivulets, cascades and other interior waters habitats.	212
Peat bogs	Large, open areas dominated by <i>Sphagnum</i> spp.	115
Urban habitats	Habitats that may be found in cities and villages, including buildings and other human constructions.	70
Parks and Gardens	Areas covered with exotic species, organized to appreciate nature.	48
Intensive pastures	Areas dominated by <i>Holcus</i> , <i>Bromus</i> or <i>Lolium</i> species, used by grazing cattle.	129
Exotic plantation forests	Areas dominated by <i>Eucalyptus</i> spp., <i>Cryptomeria japonica</i> or <i>Pittosporum undulatum</i> .	163
Cave entrances	Specific habitat, including all the rocky walls of caves (lava tubes) and volcano entrances (pits and pit caves), where light penetrates.	81

with restricted habitat requirements. Before proceeding to the calculus of L , the number of occurrences in a given habitat was

normalized for the number of total occurrences in that habitat. For instance, while there were 522 locations inside native for-

TABLE 2. General characteristics of the Azorean Islands, including the total number of bryophyte records made in the archipelago and the absolute and relative frequencies of records to which no habitat could be attributed. (¹. Forjaz, 2004).

Azorean Island	Area ¹	Highest point ¹	Inhabitants ¹	Number of records	Records without habitat information	
	(km ²)	(m)	(Censos 2001)	(N _r)	(N _H)	(%)
Santa Maria	97	587	5578	942	98	10,4
São Miguel	745	1105	131609	3897	224	5,7
Terceira	400	1021	55833	13104	433	3,3
Graciosa	61	405	4780	1576	32	2,0
São Jorge	244	1053	9674	4054	744	18,4
Pico	445	2350	14806	6501	780	12,0
Faial	173	1043	15063	2076	404	19,5
Flores	141	911	3995	1551	126	8,1
Corvo	17	720	425	1275	103	8,1

ests, there were only 163 locations placed in exotic plantation forests.

Vulnerability index

Species considered rare on distribution, abundance and ecological tolerance, tend to be the most prone to extinction (Kattan, 1992; Manne & Pimm, 2001). The consequent application of the three criteria, with their binomial measurements: Distribution (large/small), Abundance (common/rare) and Ecological tolerance (wide/narrow), led to the follow-

ing categorization: 1. Species that are not rare; 2. Scarce species (rare in abundance); 3. Species with narrow ecological tolerance; 4. Restricted species (species rare by geographical range); 5. Scarce species with narrow ecological tolerance; 6. Scarce and restricted species; 7. Restricted species with narrow ecological range and 8. Restricted and scarce species with narrow ecological range. Similar categories may be appreciated for other groups such as vertebrates (ex. Kattan,

1992) and arthropods (Fattorini, 2011) and also for bryophytes Söderström (1995).

RESULTS

Of the 480 species referred to the Azores, only 265 (55.2%) could be analyzed following the combination of criteria used (Appendix 2). From the evaluated species, about half (121; 45.7%) were not considered rare (1. Species that are not rare) but six of the seven types of rarity proposed by Rabinowitz (1981) were found within the Azorean bryophytes' dataset (absolute and relative frequencies of the eight categories may be seen in Figure 1). If one considers single categories of rarity by themselves, less than half (112; 42.3%) of the evaluated species presented narrow ecological tolerance, more than one fifth (56; 21.1%) were considered scarce and only 17 evaluated species (6.8%) had restricted distributions.

The results of the Chi-square test show that the hypothesis of overall independence of the three factors may be rejected ($X^2=47.36$; $df=2$; $p < 0.05$), indicating that these factors are not independent. Separate analysis of the 2 x 2 tables also indicated

that all measures were not independent ($p < 0.05$).

Twenty four species, nine liverworts and 15 mosses, previously classified in the European Red List of Bryophytes (ECCB, 1995; Dierssen, 2001), four of which (*Acanthocoleus aberrans*, *Jamesoniella rubricaulis*, *Fissidens azoricus* and *Neckera cephalonica*) also suggested by Sjögren (1995) to become protected species in the Azores, could not be evaluated in this analysis. All of these 24 species are scarce (rare by abundance) and none had the necessary number of collections to allow a full assessment of their ecological tolerance. Among them there are five restricted species, two Azorean endemics (*Fissidens azoricus* and *Trematodon perssoniorum*) and three Macaronesian endemics (*Leucodon canariensis*, *Neckera cephalonica* and *Tortula bogosica*). *Trematodon perssoniorum* which, so far, was only found in São Miguel Island seems to prefer aquatic habitats, and was collected mostly around Lagoa das Furnas and Ribeira Quente (seven records at different times), while *Riccia ligula* was only recorded in intensive pastures (six records) and *Jamesoniella rubricaulis* was only collected above 1000 m (five records).

DISCUSSION

Only about half (265) of all Azorean bryophytes species and subspecies (480) could be classified using the three rarity categories proposed by Rabinowitz (1981). In itself, this exposes a serious lack of information, regarding mostly abundance and ecological tolerance, which thwarts the design of a comprehensive conservation policy for bryophytes. Without appropriate knowledge of the biology of the species, it is not possible to understand why a bryophyte is rare or threatened and it is very difficult to propose measures that would induce its recovery.

The data presented in Figure 1 and Appendix 2, shows that most of the analyzed bryophytes that may be considered rare have wide range distributions (247 species), which is not surprising, considering that bryophytes successfully disperse by spores. Actually some authors such as Medina, Draper & Lara (2011), have argued that due to their high dispersal ability, bryophytes would tend to ubiquity. The hypothesis "*Everything is everywhere, but the environment selects*" (EiE) has generally been accepted by microbiologists (ex.

O'Malley, 2007) and is being considered for larger organisms with microscopic dispersing stages (e.g. spores), such as ferns or bryophytes (ex. Fontaneto, 2011). An indirect evidence of this wide distribution ability is the low endemism value found among Azorean bryophytes (n=7; 1,5%), much lower those found among native vascular species or arthropods (Borges *et al.*, 2010b). Moreover, according to the study of Söderström & Séneca (2008), the liverwort flora of Europe and Macaronesia consists of mainly widespread species, and, unlike what happens with vascular species, the rarest species occur in oceanic areas (and not in the Mediterranean region).

Eight of the 17 Macaronesian and Azorean endemic bryophytes evaluated, exhibited restricted distributions (Appendix 2, "vulnerability index 4"), while not appearing to be scarce or restricted in their habitat requirements. Interestingly enough, all of these eight species have been reported to the three geographical groups of islands and are presently known of six (*Breutelia azorica*) or more, of the nine Azorean islands (other seven species). Although the

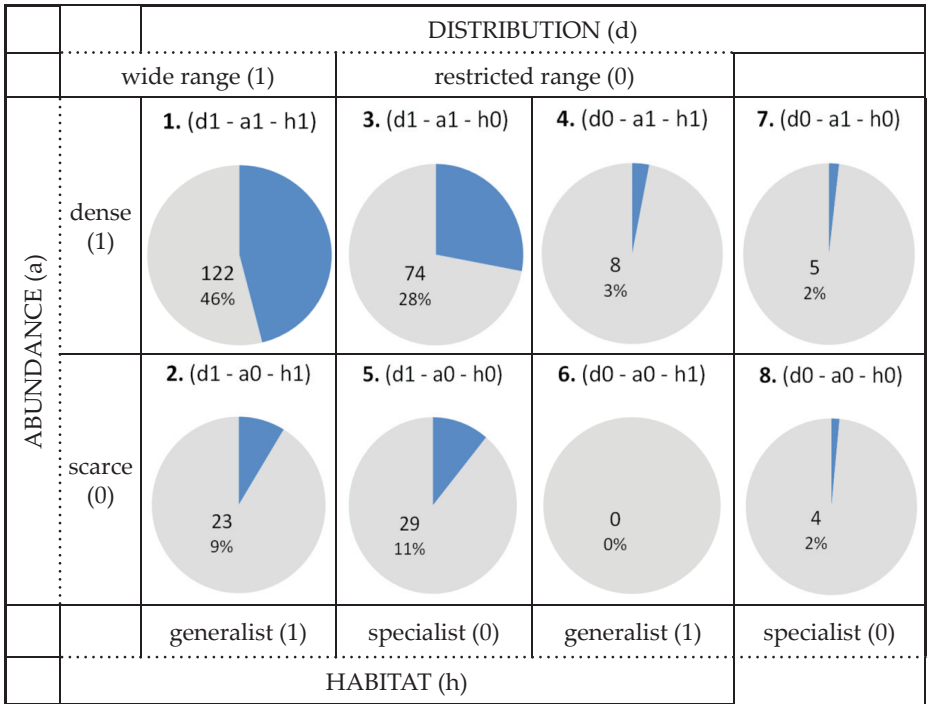


FIGURE 1. Distribution of rarity types within the evaluated bryophyte species (n=265) in the Azores. Numbers indicate number of species per category; dark areas of pie charts indicate the percent of the dataset each rarity type represents. 1, Species that are not rare; 2, Scarce species (rare by abundance); 3, Species with narrow ecological tolerance; 4, Restricted species (rare by range); 5, Scarce species with narrow ecological tolerance; 6, Restricted and scarce species; 7, Restricted species with narrow ecological range; 8, Restricted and scarce species with narrow ecological tolerance.

Chi-square tests indicated a significant association among distribution, rarity and abundance, endemism is not always associated with narrow ecological tolerance or with scarcity; species such as *Andoa berthelotiana* and *Leucodon treleasei* have been

abundantly collected in different types of habitats and all islands of the Azores (eg. González-Mancebo *et al.*, 2009). If these species evolved in Macaronesia (neoendemics), or survived only in Macaronesia (paleoendemics), they should indeed

be well adapted to the Azorean ecosystems. Notwithstanding, *Echinodium renauldii*, which was recently confirmed as a true endemic species (Stech *et al.*, 2008), is considered vulnerable by the IUCN (BSG, 2010), on account of its decreasing population trend and occurrence in less than ten localities in five islands of the Azores; this view is shared by Sjögren (1995). Fortunately, the number of places where this species has been collected is now known to be higher (more than 40 locations) and its presence was confirmed in two more islands (Corvo and Terceira) since 1995.

Almost half (n=112; 42,3%) of all the analyzed bryophytes were considered specialists in their habitat requirements, as referred by their high Lloyd index values, achieved when a high proportion of the total number of collections are grouped into one, or mostly two, habitats. Man-made habitats, such as exotic forests, grasslands or urban habitats do not seem to harbour specialist bryophyte species. This in itself has sobering implications for conservation, because of the historical decrease and fragmentation of native habitats (Triantis *et al.*, 2010; Gaspar *et al.*, 2011).

Forty liverworts and 24 mosses, more than half (!) of the specialist bryophyte species evaluated in this study (n=112) and about a quarter of all evaluated species show preference for natural forests (n=64; 24.2%). This is not surprising in view of what we know about the original plant cover of the islands – a dense forest ecosystem (ex. Frutuoso, 1963) that is lavishly covered with bryophytes in all occurring substrata. In spite of its obvious decrease in area (Silveira, 2007), the diversity and luxuriance of the communities that may be observed in the remaining native forest fragments (ex. Gabriel & Bates, 2005; Homem, 2005) is still staggering; thus, it is understandable, that this is the single most important habitat for bryophyte conservation in the Azores. Recently it was also demonstrated that Azorean native forests are a unique habitat for the conservation of most endemic arthropods (Triantis *et al.*, 2010), and a high proportion of those species are now under threat of extinction due to its reduction. Bryophytes depending on native fragments are probably under the same pressures and would greatly benefit from an increase in the areas devoted

to natural forests and from a careful control of the quality of remaining fragments, such as the removal of invasive species.

Peat bogs are structurally very different from forests, in their openness and permanent access to water and eleven species were considered specialists from this habitat, taking advantage of these special conditions. Obviously, *Sphagnum* and *Polytrichum* species (the green and brown makers of peatlands) are prone to be found in these habitats, but the persistent presence of the rare *Isopterygium tenerum* in Furnas do Enxofre (Terceira Island), should also be noted.

Surprisingly, or not (see Gabriel *et al.*, 2006; Jennings, 2009), caves (lava tube and pit caves entrances) are an equally interesting habitat for the specialist group of bryophytes. Beyond *Asterella africana*, that has been collected specifically in such habitats, two other liverworts and eight mosses find refuge in these harsh environments, where competition from vascular species is certainly lower. Besides the 11 species that have mostly been collected at cave entrances, some species such as *Plagiochila*

longispina, *Cyclodictyon laetevirens*, *Plagiothecium nemorale*, *Tetrastichium virens* and others, may be found both in native forest and cave entrances. This ability to colonize cave rocks is likely to expand their altitudinal range, as many of the lowest altitude records were from cave entrances. It is clear that caves are acting as refugia for some of these species. Due to the particular way abundance was inferred from the data, this is the least independent rarity dimension studied. The main issue is the lack of standardized data from where to take sound information (but see Gabriel & Bates, 2005 and Homem, 2005). However as showed by Couto (2010), standardized data on abundance obtained for several sites, was well correlated with distribution at the scale of Terceira Island. Bearing this in mind, additional efforts to get standardized information for different habitats and islands should be made. A relatively high number of the evaluated species ($n=56$; 21.1%), showed low abundance values, and were thus considered scarce. Scarce species include representatives from the three taxonomic groups (hornworts, liverworts and mosses); some examples in-

clude species that have been collected in a few places and were considered specialists such as *Asterella africana* (cave entrances), *Leptoscyphus azoricus* (native forests) or *Isopterygium tenerum* (peat bogs) but also species such as *Cephalozia lunulifolia*, *Fissidens coacervatus* or *Campylopus brevopilus*.

It is important to recognize that among the species that could not be evaluated are Azorean rare bryophytes seem to be found mostly in three important habitats: native forests, peat bogs and cave entrances. While a commendatory effort has been made in order to create natural parks in all islands including most native forests fragments, no such effort has been made to encompass lava tubes (Pereira *et al.*, 2011), which are largely under private land and require adequate legislation to protect them, and peat bogs are presently very disturbed habitats.

About a third (n=43, 26 liverworts and 17 mosses; 30.1%) of all conservation dependent bryophytes (n=143) exist in five or more Island Parks. These Parks (one for each Island) have recently been created in the Azores and incorporate areas using different levels of protec-

tion, generally following IUCN criteria for protected areas (ex. Dudley, 2008). Nevertheless, there is a quarter of all conservation concern species (n=35 species, 22 liverworts and 13 mosses; 24.5%), including *Acrobolbus wilsonii*, *Adelanthus decipiens*, *Aphanolejeunea madeirensis*, *Leptoscyphus azoricus*, *Pallavicinia lyellii*, *Campylopus shawii* or *Cyclodictyon laetevirens* that exist in less than five Island Parks. While some of these species have a restricted range in the archipelago, occurring also in few islands (ex. *Kurzia pauciflora*, *Cheilolejeunea cedercreutzii*), others, such as *Plagiochila punctata* (7 Islands – 3 Island Parks), *Calypogeia azorica* (6 – 3), *Cyclodictyon laetevirens* (6 – 3), *Pallavicinia lyellii* (6 – 2) or *Trichocolea tomentella* (4 – 1) are not adequately protected by the current design of the Island Parks.

This work illustrates that even among relatively well studied groups of organisms – bryophytes, in a very confined region – the Azores, where a continuing collection, identification and reporting effort has been made through time, it was not possible to have a clear picture of the general rarity patterns of all species, and only about half of the reported taxa (n=265; 55.2%)

could be assessed using a simple method of categorization. This hinders conservation efforts, as only a fraction of knowledge is available to managers and decision makers, while enlightening the way forward. It is clear that better floristic knowledge and expertise on bryophytes is necessary in the Azores, if we are to preserve the wealth of species and the natural communities where they occur. As Knapp & Monterrosa Salomón have stated: “[this] method is not a substitute for a quantitative conservation assessment...” (2010: 527), however it is a way of setting priorities for further study or monitoring. Some suggestions follow:

1. The 143 species selected at least by one of Rabinowitz’s dimension of rarity should be followed and all efforts should be made to adequately conserve their habitats.
2. The 24 species previously selected by IUCN criteria (ECCB, 1995; Dierssen, 2001), that could not be evaluated in this study for lack of collection records, should be very carefully prospected in the field and their evolution monitored, especially the four species that were also mentioned by the experts Erik Sjögren (1995) and / or René Schumacker (2001): *Acanthocoleus aberrans*, *Jamesoniella rubricaulis*, *Fissidens azoricus* and *Neckera cephalonica*.
3. One liverwort (*Aphanolejeunea madeirensis*) and three mosses (*Fissidens coacervatus*, *Sphagnum nitidulum*, *Thamnobryum rudolphianum*) have come out as restricted, scarce and with a narrow ecological tolerance, which means they were considered rare in the three dimensions considered. While it is obvious that their conservation in the Azores should be carefully planned, the taxonomic status of *S. nitidulum* and *F. coacervatus*, should be clarified.
4. Island Parks are acting as “safe areas” for a number of bryophyte species however, other conservation concern species would benefit from a reshape, sometimes quite straightforward, of those protected areas.
5. Some species that are not routinely included in red lists have nonetheless come up as rare in one or two

dimensions, an aspect already discussed for mosses by Sjögren (2006). This enlightens the scale problem of conservation: it is important to acknowledge that regional, as well as global, conservation plans should be enforced.

ACKNOWLEDGEMENTS

We are grateful for the careful text revision and suggestions given by Simone Fattorini. We wish to thank Eva Sousa Borges, Berta Martins for their careful feeding of the ATLANTIS database and Enésima Mendonça for her help throughout the project and Fernando Pereira for his help with old names of localities and general information on their habitats. RG and PAVB worked on this project under the EU projects INTERREGIII B "ATLÂNTICO" (2004-2006) and BIONATURA (2006-2008). NH has a short grant from CITA-A. SCA was funded by the Azorean Fundo Regional da Ciência e Tecnologia (M311/I009A/2005). Field work was partly funded by FCT - PTDC/AMB/70801/2006 - Understanding Underground Biodiversity: Studies of Azorean Lava Tubes.

LITERATURE CITED

- AIGOIN, D.A., N. DEVOS, S. HUTTUNEN, M.S. IGNATOV, J.M. GONZALEZ-MANCEBO & A. VANDERPOORTEN, 2009. And if Engler was not completely wrong? Evidence for multiple evolutionary origins in the moss flora of Macaronesia. *Evolution*, 63: 3248-3257.
- ARANDA, S.C., R. GABRIEL, P.A.V. BORGES & J.M. LOBO, 2010. Assessing the completeness of bryophytes inventories: an oceanic island as a case study (Terceira, Azorean archipelago). *Biodiversity and Conservation*, 19: 2469-2484.
- BASSET, Y., 1999. Diversity and abundance of insect herbivores foraging on seedlings in a rainforest in Guyana. *Ecological Entomology*, 24: 245-259.
- BORGES, P.A.V., 2005. *Introduction*. In: BORGES, P.A.V., R. CUNHA, R. GABRIEL, A.M.F. MARTINS, L. SILVA & V. VIEIRA (eds.), *A list of the terrestrial fauna (Mollusca and Arthropoda) and flora (Bryophyta, Pteridophyta and Spermatophyta) from the Azores*, pp. 11-20. Direcção Regional de Ambiente and Universidade dos Açores, Horta, Angra do Heroísmo and Ponta Delgada.
- BORGES, P.A.V., A.R.M., SERRANO & J.A. QUARTAU, 2000. Ranking the

- Azorean Natural Forest Reserves for conservation using their endemic arthropods. *Journal of Insect Conservation*, 4: 129-147.
- BORGES, P.A.V., C. ABREU, A.M. AGUIAR, P. CARVALHO, R. JARDIM, I. MELO, P. OLIVEIRA, C. SÉRGIO, A.R.M. SERRANO & P. VIEIRA, 2008. *Listagem dos fungos, flora e fauna terrestres dos arquipélagos da Madeira e Selvagens*, 1ª ed., 438 pp. Funchal: Direcção Regional do Ambiente do Governo Regional da Madeira.
- BORGES, P.A.V., E.B. AZEVEDO, A. BORBA, F.O. DINIS, R. GABRIEL & E. SILVA, 2009. *Ilhas Oceânicas*. In: PEREIRA, H.M., T. DOMINGOS & L. VICENTE (eds.), *Portugal Millenium Ecosystem Assessment*, pp. 461-508. Escolar Editora, Lisboa.
- BORGES, P.A.V., A. COSTA, R. CUNHA, R. GABRIEL, V. GONÇALVES, A.M.F. MARTINS, I. MELO, M. PARENTE, P. RAPOSEIRO, R.S. SANTOS, L. SILVA, P. VIEIRA & V. VIEIRA, 2010a. *Listagem dos organismos terrestres e marinhos dos Açores*. *Biologia*, 1ª ed., 432 pp. Príncipeia, Cascais.
- BORGES, P.A.V., A. COSTA, R. CUNHA, R. GABRIEL, V. GONÇALVES, A.M.F. MARTINS, I. MELO, M. PARENTE, P. RAPOSEIRO, P. RODRIGUES, R.S. SANTOS, L. SILVA, P. VIEIRA, V. VIEIRA, E. MENDONÇA & M. BOEIRO, 2010b. *Description of the Terrestrial and marine biodiversity of the Azores*. In: BORGES, P.A.V., A. COSTA, R. CUNHA, R. GABRIEL, V. GONÇALVES, A.M.F. MARTINS, I. MELO, M. PARENTE, P. RAPOSEIRO, P. RODRIGUES, R.S. SANTOS, L. SILVA, P. VIEIRA & V. VIEIRA (eds.), *A list of the terrestrial and marine biota from the Azores*, pp. 9-33. Príncipeia, Cascais.
- BORGES, P.A.V., R. GABRIEL, A.M. ARROZ, A. COSTA, R.T. CUNHA, L. SILVA, E. MENDONÇA, A.M.F. MARTINS, F. REIS & P. CARDOSO, 2010c. The Azorean Biodiversity Portal: An internet database for regional biodiversity outreach. *Systematics and Biodiversity*, 8: 423-434.
- BRUMMITT, N., S.P. BACHMAN & J. MOAT, 2008. Applications of the IUCN Red List: towards a global barometer for plant diversity. *Endangered Species Research*, 6: 127-135.
- BSG – Bryophyte Specialist Group 2000,2010. *Echinodium renauldii*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>. [Accessed in May 2011].
- CARDOSO, P., M.A. ARNEDO, K.A. TRIANTIS & P.A.V. BORGES, 2010. Drivers of diversity in Macaronesian spiders and the role of species extinctions. *Journal of Biogeography*, 37: 1034-1046.

- COUTO, A.B., 2010. *Padrões de distribuição dos briófitos dos Açores em diferentes escalas: Contributo para a conservação de espécies ameaçadas*. Mestrado em Gestão e Conservação da Natureza. Universidade dos Açores, Angra do Heroísmo.
- DIERSSEN, K., 2001. *Distribution, ecological amplitude and phytosociological characterization of European bryophytes*. J. Cramer, Berlin.
- DUDLEY, N., (ed.) 2008. *Guidelines for applying protected area management categories*. IUCN, Gland, Switzerland.
- FATTORINI, S., 2011. Insect rarity, extinction and conservation in urban Rome (Italy): a 120-year-long study of tenebrionid beetles. *Insect Conservation and Diversity*, 4: 307-315.
- FERNÁNDEZ-PALACIOS, J.M., L. NASCIMENTO, O. RÜDIGER, J.D. DELGADO, E. GARCÍA-DEL-REY, J.R. AREVALO & R.J. WHITTAKER, 2011. A reconstruction of Palaeo-Macaronesia, with particular reference to the long-term biogeography of the Atlantic island laurel forests. *Journal of Biogeography*, 38: 224-246.
- FONTANETO, D., (ed.) 2011. *Biogeography of microscopic organisms, is everything small everywhere?* Systematics Association & Cambridge University Press, Cambridge, UK.
- FREGO, K.A., 2007. Bryophytes as potential indicators of forest integrity. *Forest Ecology and Management*, 242: 65-75.
- FRUTUOSO, G., 1963. *Livro sexto das saudades da terra*. Ponta Delgada: Instituto Cultural de Ponta Delgada.
- GABRIEL, R., & J.W. BATES, 2005. Bryophyte community composition and habitat specificity in the natural forests of Terceira, Azores. *Plant Ecology*, 177: 125-144.
- GABRIEL, R., F. PEREIRA, S. CÂMARA, N. HOMEM, E. SOUSA & M.I. HENRIQUES, 2006. Bryophytes of lava tubes and volcanic pits from Graciosa Island (Azores, Portugal). *Proceedings of the XI International Symposium on Vulcanospeleology (Tepóztlan, Morelos, Mexico, July 2006)*. *Association for Mexican Cave Studies*, 119: 260-263.
- GABRIEL, R., E. SJÖGREN, R. SCHUMACKER, C. SÉRGIO, S.C. ARANDA, D. CLARO, N. HOMEM & B. MARTINS, 2010. *List of bryophytes (Anthocerotophyta, Marchantiophyta, Bryophyta)*. In: BORGES, P.A.V., A. COSTA, R. CUNHA, R. GABRIEL, V. GONÇALVES, A.M.F. MARTINS, I. MELO, M. PARENTE, P. RAPOSEIRO, P. RODRIGUES, R.S. SANTOS, L. SILVA, P. VIEIRA & V. VIEIRA (eds.), *A list of the terrestrial and marine fungi, flora and fauna from the Azores*, pp. 99-115. Princípiã, Cascais.
- GASPAR, C., K.J. GASTON, P.A.V.

- BORGES & P. CARDOSO, 2011. Selection of priority areas for arthropod conservation in the Azores archipelago. *Journal of Insect Conservation*, 15: 671–684.
- GASTON, K.J., 1994. *Rarity*. Chapman & Hall, London.
- GASTON, K.J., 1996. The multiple forms of the interspecific abundance-distribution relationship. *Oikos*, 76: 211–220.
- GASTON, K.J., 2010. Valuing common species. *Science*, 327: 154–155.
- GIGNAC, L.D., 2010. Bryophytes as Indicators of Climate Change. *The Bryologist*, 104: 410–420.
- GOERCK, J.M., 1997. Patterns of rarity in the birds of the Atlantic Forest of Brazil. *Conservation Biology*, 11: 112–118.
- GONZÁLEZ-MANCEBO, J.M., F. ROMAGUERA R.M. ROS, J. PATIÑO & O. WERNER, 2008. Bryophyte flora of the Canary Islands: an updated compilation of the species list with an analysis of distribution patterns in the context of the Macaronesian Region. *Cryptogamie Bryologie*, 29: 315–357.
- GONZALEZ-MANCEBO, J., J. PATIÑO, O. WERNER, R. GABRIEL & R.M. RÓS, 2009. Distribution patterns of *Leucodon* species in Macaronesia, with special reference to the Canary Islands. *Cryptogamie, Bryologie*, 30: 185–197.
- HALLINGBÄCK, T., 2007. Working with Swedish cryptogam conservation. *Biological Conservation*, 135: 334–340.
- HALLINGBÄCK, T., N. HODGETTS, G. RAEYMAEKERS, R. SCHUMACKER, C. SÉRGIO, L. SÖDERSTRÖM, N. STEWART & J. VANA, 1998. Guidelines for application of the revised IUCN threat categories to bryophytes. *Lindbergia*, 23: 6–12.
- HARTLEY, S., & W.E. KUNIN, 2003. Scale dependency of rarity, extinction risk, and conservation priority. *Conservation Biology*, 17: 1559–1570.
- HODGETTS, N., 2009. The Threatened Bryophyte Database. *Field Bryology*, 97: 35.
- HOMEM, N., 2005. *Biodiversidade de briófitos nas florestas naturais dos Açores – Ilhas Terceira e Pico*. Mestrado em Gestão e Conservação da Natureza. Universidade dos Açores, Angra do Heroísmo.
- HOMEM, N., & R. GABRIEL, 2008. *Briófitos Raros dos Açores / Azorean Rare Bryophytes* (1ª ed.), 96 pp. Princípa Editora, Estoril.
- IUCN, 2010. IUCN Red List of Threatened Species v. 2010. Version 3.1. <http://www.iucnredlist.org/> [accessed May 2011].
- IZQUIERDO, I., J.L. MARTÍN, N. ZURITA & M. ARECHAVALETA, 2004. *Lista de Especies Silvestres de Canarias (Hongos, Plantas y Animales*

- Terrestres*), (1ª ed.), 500 pp. Santa Cruz de Tenerife: Consejería de Medio Ambiente y Ordenación Territorial del Gobierno de Canarias & Gesplan S.A.
- JENNINGS, L., 2009. *Azorean cave bryophytes: the conservation of an understudied group in an underprotected habitat*. Master Degree in Biodiversity, Conservation and Management. Centre for the Environment, University of Oxford, Oxford.
- KATTAN, G.H., 1992. Rarity and vulnerability: the birds of the Cordillera Central Colombia. *Conservation Biology*, 6: 64-70.
- KNAPP, S., & J. MONTERROSA SALOMÓN, 2010. A simple method for assessing preliminary conservation status of plants at a national level: a case study using the ferns of El Salvador. *Oryx*, 44: 523-528.
- KRUPNICK, G.A., W. KRESS & W.L. WAGNER, 2008. Using data from museum specimens to build a preliminary conservation assessment of species. *Annual Meeting of the International Congress for Conservation Biology*, Convention Center, Chattanooga, TN.
- MARTÍN, J.L., P. CARDOSO, M. ARECHAVALETA, P.A.V. BORGES, B.F. FARIA, C. ABREU, A.F. AGUIAR, J.A. CARVALHO, A.C. COSTA, R.T. CUNHA, R. GABRIEL, R. JARDIM, C. LOBO, A.M.F. MARTINS, P. OLIVEIRA, P. RODRIGUES, L. SILVA, D. TEIXEIRA, I.R. AMORIM, F. FERNANDES, N. HOMEM, B. MARTINS, M. MARTINS & E. MENDONÇA, 2010. Using taxonomically unbiased criteria to prioritize resource allocation for oceanic island species conservation. *Biodiversity and Conservation*, 19: 1659-1682.
- MEDINA, N.G., I. DRAPER & F. LARA, 2011. Biogeography of mosses and allies: does size matter? In: F. ONTANETO, D. (ed.), *Biogeography of microscopic organisms, is everything small everywhere?*. pp. 209-233. Systematics Association & Cambridge University Press, Cambridge, UK.
- McINTYRE, S., 1992. Risks associated with the setting of conservation priorities from rare plant species lists. *Biological Conservation*, 60: 31-37.
- MONTEIRO, R., & S. FURTADO, 2010. Situação Geográfica. http://siaram.azores.gov.pt/geografia/_informacao-generica.html. [accessed May 2011].
- O'MALLEY, M.A., 2007. The nineteenth century roots of 'everything is everywhere'. *Nature Reviews Microbiology*, 5: 647-651.
- PEREIRA, F., P.A.V. BORGES, M.P. COSTA, J.P. CONSTÂNCIA, J.C. NUNES, P. BARCELOS, T. BRAGA, R. GABRIEL & I. AMORIM, 2011. *Catálogo das cavidades vulcânicas dos Açores (grutas lávicas, algares e grutas*

- de erosão marinha*), 286 pp. Direcção Regional do Ambiente, Horta (in press).
- RABINOWITZ, D., 1981. Seven forms of rarity. In: SYNGE, H. (ed.), *The Biological Aspects of Rare Plant Conservation*, pp. 205-17. Wiley, Chichester.
- RABINOWITZ, D., S. CAIRNS & T. DILLON, 1986. Seven forms of rarity and their frequency in the flora of the British Isles. In: SOULÉ, M.E. (ed.), *Conservation biology. The science of scarcity and diversity*, pp. 182-204. Sinauer, Sunderland, Massachusetts.
- RAMAS, 2007. RAMAS Rapid List: Preliminary Red List Assessment Tool. <http://www.ramas.com/RapidList.htm>. [accessed May 2011].
- RYDIN, H., 2008. Population and community ecology of bryophytes. In: GOFFINET, B., & A.J. SHAW, *Bryophyte Biology* (2nd ed.), pp. 393-444. Cambridge University Press, Cambridge.
- SAX, D.F., & S.D. GAINES, 2008. Species invasions and extinctions. The future of native biodiversity on islands. *Proceedings of the National Academy of Sciences*, 105, Suppl. 1: 11490-11497.
- SCHUMACKER, R., 2001. The hepatic flora of the Azores: brief historical outline, present knowledge, endemics and phytogeographical aspects. *Belgian Journal of Botany*, 134: 51-63.
- SÉRGIO, C., R. SCHUMACKER, S. FONTINHA & M. SIM-SIM, 1992. Evaluation of the status of bryophyte flora of Madeira with reference to endemic and threatened European species. *Biological Conservation*, 59: 223-231.
- SÉRGIO, C., M. SIM-SIM, S. FONTINHA & R. FIGUEIRA, 2008. List of bryophytes (Bryophyta). In: BORGES, P.A.V., C. ABREU, A.M.F. AGUIAR, P. CARVALHO, R. JARDIM, I. MELO, P. OLIVEIRA, C. SÉRGIO, A.R.M. SERRANO & E.P. VIEIRA (eds.), *A list of the terrestrial fungi, flora and fauna of Madeira and Selvagens archipelagos*, pp. 143-156. Direcção Regional do Ambiente da Madeira and Universidade dos Açores, Funchal and Angra do Heroísmo.
- SILVEIRA, L.M.A., 2007. *Aprender com a história: interacção com a natureza durante a ocupação humana da ilha Terceira*. Tese de Mestrado em Educação Ambiental. Universidade dos Açores, Angra do Heroísmo.
- SJÖGREN, E., 1995. *Report on investigations of the bryoflora and bryovegetation in 1995 on the Azorean Islands of Faial, S. Jorge, Pico and Flores*. LIFE Project. Angra do Heroísmo: Departamento de Ciências Agrárias, Universidade dos Açores.
- SJÖGREN, E., 2006. Bryophytes (musci) unexpectedly rare or absent in the

- Azores. *Arquipélago, Life and Marine Sciences*, 23A: 1-17.
- SÖDERSTRÖM, L., 1995. Bryophyte conservation – input from population ecology and metapopulation dynamics. *Cryptogamica Helvetica*, 18: 17-24.
- SÖDERSTRÖM, L., & A. SÉNECA, 2008. Species richness and range restricted species of liverworts in Europe and Macaronesia. *Folia Cryptogamica Estonica*, 44: 143-149.
- STECH, M., M. SIM-SIM, G. ESQUÍVEL, S. FONTINHA, R. TANGNEY, C. LOBO, R. GABRIEL & D. QUANDT, 2008. Explaining the “anomalous” distribution of *Echinodium* Jur. (Bryopsida): independent evolution in Macaronesia and Australasia. *Organisms Diversity & Evolution*, 8: 282-292.
- TRIANSTIS, K.A., P.A.V. BORGES, R.J. LADLE, J. HORTAL, P. CARDOSO, C. GASPAR, F. DINIS, E. MENDONÇA, L.M.A. SILVEIRA, R. GABRIEL, C. MELO, A.M.C. SANTOS, I.R. AMORIM, S.P. RIBEIRO, A.R.M. SERRANO, J.A. QUARTAU & R.J. WHITTAKER, 2010. Extinction debt on oceanic islands. *Ecography*, 33: 285-294.
- UNEP (United Nations Environment Program), 2002. *Global strategy for plant conservation*. Sixth Meeting of the Conference of the Parties to the Convention on Biological Diversity. The Hague, 7-19 April 2002. <http://www.cbd.int/decision/cop/?id=7183> [accessed May 2011].
- VANDERPOORTEN, A., & T. HALLINGBACK, 2008. Conservation biology of bryophytes. In: GOFFINET, B., & A.J. SHAW, *Bryophyte Biology* (2nd ed.), pp. 487-533. Cambridge University Press, Cambridge.
- WEIBULL, H., & L. SÖDERSTRÖM, 1995. Red Data Listed hepatics of Scandinavia in a regional perspective – a preliminary study. *Cryptogamica Helvetica*, 18: 57-66.

APPENDIX 1. List of references used in this bryophyte survey.

N°	Citation
1	ADE, A., & F. KOPPE, 1942. Beiträge zur Kenntnis der Moosflora der atlantischen Inseln und der pyrenaischen Halbinsel. <i>Hedwigia</i> , 81: 1-34.
2	ALLORGE, P., & V. ALLORGE, 1946. Les étages de la végétation muscinale aux îles Açores et leurs éléments. <i>Mémoires de la Société de Biogéographie</i> , 8: 369-386.
3	ALLORGE, P., & V. ALLORGE, 1950. Hépatiques récoltées par P. et V. Allorge aux îles Açores en 1937. <i>Revue Bryologique et Lichénologique</i> , 19: 90-118.
4	ALLORGE, P., & V. ALLORGE, 1952. Mousses récoltées par P. et V. Allorge aux îles Açores en 1937. <i>Revue Bryologique et Lichénologique</i> , 21: 50-95.
5	ALLORGE, P., & H. PERSSON, 1938a. Contribution à la flore hepaticologique des îles Açores. <i>Annales Bryologici</i> , 11: 6-14.
6	ALLORGE, P., & H. PERSSON, 1938b. Mousses nouvelles pour les Açores. <i>Le Monde des Plantes</i> , 39 (232): 25-26.
7	ALLORGE, V., & P. ALLORGE, 1938. Sur la répartition et l'écologie des hépatiques épiphyllées aux Açores. <i>Boletim da Sociedade Broteriana</i> , 2 ^a série, 13: 211-236.
8	ALLORGE, V., & P. ALLORGE, 1944. Le <i>Telaranea nematodes</i> (Gottsche) Howe dans le domaine ibéro-atlantique. <i>Compte Rendu Sommaire des Séances de la Société de Biogéographie</i> , 182-184: 58-60.
9	ALLORGE, V., & P. ALLORGE, 1948. Végétation bryologique de l'île de Flores (Açores). <i>Revue Bryologique et Lichénologique</i> , 17: 126-164.
10	ALLORGE, V., & S. JOVET-AST, 1950. <i>Aphanolejeunea teotonii</i> nov.sp., hépatique des Açores. <i>Revue Bryologique et Lichénologique</i> , 19: 19-24.
11	ALLORGE, V., & S. JOVET-AST, 1955. <i>Cololejeunea azorica</i> V.A. et S.J.-A., Lejeunéacée nouvelle de l'île San Miguel. <i>Mitteilungen der Thüringischen Botanischen Gesellschaft</i> , 1 (2/3): 17-22.
12	ALLORGE, V., & S. JOVET-AST, 1956. <i>Targionia lorbeeriana</i> K.M. dans la Péninsule Ibérique, aux Açores et aux Canaries. <i>Revue Bryologique et Lichénologique</i> , 25: 134-135.
13	ALLORGE, V., 1951. <i>Trematodon perssonorum</i> Allorge et Theriot espèce nouvelle des Açores. <i>Revue Bryologique et Lichénologique</i> , 20: 179-181.
14	ANDO, H., 1973. Révision des espèces africaines de <i>Gollania</i> (Hypnaceae). <i>Revue Bryologique et Lichénologique</i> , 39: 529-538.
15	ARMITAGE, E., 1931. Some bryophytes of the Açores. <i>Journal of Botany</i> , 69: 75-76.
16	ARTS, T., 1989. <i>Rhamphidium purpuratum</i> Mitt.: its vegetative propagation and distribution. <i>Lindbergia</i> , 15: 106-108.
17	BARROS, G., 1942. Notas briológicas, II. <i>Agronomia Lusitana</i> , 4(1): 155-166.
18	BATES, J., 2000. Introduction to the Azores and its Bryophytes. <i>Bulletin of the British Bryological Society</i> , 76: 21-23.
19	BATES, J.W., & R. GABRIEL, 1997. <i>Sphagnum cuspidatum</i> and <i>S. imbricatum</i> ssp. affine new to Macaronesia, and other new island records for Terceira, Azores. <i>Journal of Bryology</i> , 19(3): 645-648.
20	BISCHLER-CAUSSE, H., 1993. <i>Marchantia</i> L. The European and African taxa. <i>Bryophytorum Bibliotheca</i> , 45: 1-129.
21	BISCHLER, H., 1970. Les espèces du genre <i>Calypogeia</i> sur le continent africain et les îles africaines. <i>Revue Bryologique et Lichénologique</i> , 37: 63-134.

Nº	Citation
22	BISCHLER, H., 1976. <i>Exormotheca pustulosa</i> Mitten. Distribution, écologie, caryotype, spores, parois sporales, germination. <i>Revue Bryologique et Lichénologique</i> , 42(3): 769-783.
23	BISCHLER-CAUSSE, H., 1993. <i>Marchantia L. The European and African Taxa</i> . J. Cramer, Berlin.
24	BOUMAN, A.C., & G.M. DIRKSE, 1990. The genus <i>Radula</i> in Macaronesia. <i>Lindbergia</i> , 16: 119-127.
25	BROWN, C.E., & E.V. WATSON, 1963. A note on a small collection of bryophytes from São Miguel, Azores. <i>Révue Bryologique et Lichénologique</i> , 32: 181-182.
26	BRUGGEMAN-NANNENGA, M.A., 1982. The section <i>Pachylomidium</i> (genus <i>Fissidens</i>). III. The <i>F. crassipes</i> -subcomplex (<i>F. bryoides</i> -complex), <i>F. sublineaeifolius</i> (Pot. Varde) Brugg.- Nann. and <i>F. fluitans</i> (Pot. Varde) Brugg.- Nann. <i>Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen</i> , Series C, 85(1): 59-104.
27	BRUGGEMAN-NANNENGA, M.A., 1985. The section <i>Pachylomidium</i> (genus <i>Fissidens</i>). IV. Further species from Europe, the Mediterranean and the Atlantic African islands. <i>Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen</i> , Series C, 88(2): 183-207.
28	BUCH, H., & H. PERSSON, 1941. Bryophyten von den Azoren und Madeira. <i>Societas Scientiarum Fennica. Commentationes Biologicae</i> , 8(7): 1-15.
29	CARDOT, J., 1897. The mosses of the Azores. <i>Annual Report of the Missouri Botanical Garden</i> , 8: 51-72.
30	CARDOT, J., 1905. Nouvelle contribution a la flore bryologique des Îles Atlantiques. <i>Bulletin du Herbar Boissier</i> , Série 2, 5: 201-215.
31	CASAS, C., M. BRUGUES, R.M. CROS & C. SÉRGIO, 1985. <i>Cartografia de Briófitos. Península Ibérica i les Illes Balears, Canàries, Açores i Madeira. I</i> . Institut d'estudis Catalans, Barcelona.
32	CASAS, C., M. BRUGUES, R.M. CROS & C. SÉRGIO, 1989. <i>Cartografia de Briófitos. Península Ibérica i les Illes Balears, Canàries, Açores i Madeira. II</i> . Institut d'estudis Catalans, Barcelona.
33	CASAS, C., M. BRUGUES, R.M. CROS & C. SÉRGIO, 1992. <i>Cartografia de Briófitos. Península Ibérica i les Illes Balears, Canàries, Açores i Madeira. III</i> . Institut d'estudis Catalans, Barcelona.
34	CASAS, C., M. BRUGUES, R.M. CROS & C. SÉRGIO, 1996. <i>Cartografia de Briófitos. Península Ibérica i les Illes Balears, Canàries, Açores i Madeira. IV</i> . Institut d'estudis Catalans, Barcelona.
35	CHURCHILL, S.P., 1986. A revision of <i>Echinodium</i> Jur. (Echinodiaceae: Hypnobryales). <i>Journal of Bryology</i> , 14: 117-133.
36	CHURCHILL, S.P., 1989. Transfer of <i>Lepidopilum virens</i> Cardot to <i>Tetrastichium</i> (Leucomiaceae). <i>Journal of Bryology</i> , 15: 537-541.
37	CLARO, D., C. SÉRGIO & R. SCHUMACKER, 2009. Bryophytes of S. Jorge Island (Azores, Portugal). Conservation and biogeographic characterization. <i>Portugaliae Acta Biologica</i> , 23: 147-223.
38	CLARO, G.D., 2008. <i>Briófitos da Ilha de S. Jorge: Conservação e caracterização biogeográfica</i> . Mestrado em Biologia da Conservação. Faculdade de Ciências da Universidade de Lisboa. Lisboa.
39	CRUNDWELL, A.C., H.C. GREVEN & R.C. STERN, 1994. Some additions to the bryophyte flora of the Azores. <i>Journal of Bryology</i> , 18: 329-337.
40	CRUNDWELL, A.C., 1981. Reproduction in <i>Myurium hochstetteri</i> . <i>Journal of Bryology</i> , 11: 715-717.
41	CUNHA, A.G., & G. BARROS, 1942. Algumas espécies de Musgos da Terceira novas para os Açores ou para a ilha. <i>Boletim da Sociedade Portuguesa de Ciências Naturais</i> , 13: 156-157.

Nº	Citation
42	DIAS, E., & R. GABRIEL, 1994. Distribuição das Comunidades vegetais no Algar do Carvão (Terceira, Açores). In: <i>Actas do 3º Congresso Nacional de Espeleologia e do 1º Encontro Internacional de Vulcano-espeleologia das Ilhas Atlânticas</i> , 214-226 pp. (30 de Setembro a 4 de Outubro de 1992). Angra do Heroísmo.
43	DIAS, E., & C. MENDES, 2007. Characterisation of a basin mire in the Azores archipelago. <i>Mires and Peat</i> , 2: 1-11. http://www.mires-and-peat.net/ .
44	DIAS, E., 1986. Estudo Bio-Ecológico da Bacia da Lagoa do Negro. <i>Relatórios e Comunicações do Departamento de Biologia</i> , 16: 1-131. Ponta Delgada.
45	DIAS, E., 1989. <i>Métodos de estudo e análise da vegetação. Comunidades herbáceas</i> . M. Sc. thesis. Departamento de Ciências Agrárias, Universidade dos Açores, Angra do Heroísmo.
46	DIAS, E., 1996. <i>Vegetação natural dos Açores. Ecologia e sintaxonomia das florestas naturais</i> . Ph.D. thesis. Departamento de Ciências Agrárias, Universidade dos Açores, Angra do Heroísmo.
47	DIAS, E., C. MENDES & A.J. SHAW, 2009. <i>Sphagnum recurvum</i> P. Beauv. on Terceira, Azores, new to Macaronesia-Europe. <i>Journal of Bryology</i> , 31: 1999-201.
48	DIXON, H.N., 1909. Contributions to the moss flora of the Atlantic islands. <i>Journal of Botany</i> , 47: 365-374.
49	DUELL-HERMANN, I., 1986. Taxonomy of <i>Homalia lusitanica</i> Schimp. and <i>H. subrecta</i> (Mitt.) Jaeg: is <i>H. subrecta</i> a species or a variety? <i>Bryologische Beiträge</i> , 6: 67-84.
50	EDWARDS, S.R., 1997. <i>Key to the Fissidens species from the Azores</i> , 6 pp. Manuscript (last edited 2 August 2002)..
51	EGGERS, J., 1982. Artenliste der Moose Makaronesiens. <i>Cryptogamie, Bryologie et Lichénologie</i> , 3: 283-335.
52	ENGEL, J.J., & G.L.S. MERRILL, 2004. Austral Hepaticae. 35. A Taxonomic and Phylogenetic Study of <i>Telaranea</i> (Lepidoziaceae), with a Monograph of the Genus in Temperate Australasia and Commentary on Extra-Australasian Taxa. <i>Fieldiana</i> , 44: 149-174.
53	FELDBERG, K., H. GROTH, R. WILSON, A. SCHÄFER-VERWIMP & J. HEINRICHS, 2004. Cryptic speciation in <i>Herbertus</i> (Herbertaceae, Jungermanniopsida): Range and morphology of <i>Herbertus sendtneri</i> inferred from nrITS sequences. <i>Plant Systematics Evolution</i> , 249: 247-261.
54	FONTINHA, S., & C. SÉRGIO, 1995. 11. <i>Eucladium verticillatum</i> (Brid.) B.S.G. novo musgo para brioflora da ilha Terceira (Açores). In: <i>Notulae Bryoflorae Macaronesicae III</i> . <i>Revista de Biologia</i> (Lisboa) "1994", 15: 189.
55	FRAHM, J.-P., 1975. Taxonomische Notizen zur Gattung <i>Campylopus</i> . <i>Révue Bryologique et Lichénologique</i> , 41(3): 321-332.
56	FRAHM, J.-P., 1982. Taxonomische Notizen zur Gattung <i>Campylopus</i> . XII. <i>Cryptogamie, Bryologie et Lichénologie</i> , 3(1): 59-65.
57	FRAHM, J.-P., 2004. A Guide to Bryological Hotspots in Europe. <i>Archive for Bryology</i> , 3: 4-14.
58	FRAHM, J.-P., 2005. <i>Briófitos colhidos por Jan-Peter Frahm e colaboradores nas ilhas Terceira, Pico e Faial, em Agosto de 2004</i> . Manuscrito.
59	FRAHM, J.-P., 2005. New or interesting records of bryophytes from the Azores. <i>Tropical Bryology</i> , 26: 45-48.
60	GABRIEL, R., & J.W. BATES, 2003. Responses of photosynthesis to irradiance in bryophytes of the Azores laurel forest. <i>Journal of Bryology</i> , 25: 101-105.

Nº	Citation
61	GABRIEL, R., & E. DIAS, 1994. First approach to the study of the Algar do Carvão flora (Terceira, Azores). In: <i>Actas do 3º Congresso Nacional de Espeleologia e do 1º Encontro Internacional de Vulcano-espeleologia das Ilhas Atlânticas</i> (30 de Setembro a 4 de Outubro de 1992), 206-213 pp. Angra do Heroísmo.
62	GABRIEL, R., & C. SÉRGIO, 1991. <i>Notas acerca dos endemismos da flora briológica açoreana: Sphagnum nitidulum Warnst.</i> IX Simposio Nacional de Botânica Criptogâmica, Poster. Libro de Resúmenes. Salamanca.
63	GABRIEL, R., & C. SÉRGIO, 1995. Bryophyte survey for a first planning of conservation areas in Terceira (Açores). <i>Criptogamica Helvetica</i> , 18: 35-41.
64	GABRIEL, R., 1994a. <i>Briófitos de pastagem. Algumas noções de ecologia.</i> M.Sc. thesis. Departamento de Ciências Agrárias, Universidade dos Açores, Angra do Heroísmo.
65	GABRIEL, R., 1994b. <i>Briófitos da Ilha Terceira (Açores). Ecologia, distribuição e vulnerabilidade de espécies seleccionadas.</i> M.Sc. thesis. Departamento de Ciências Agrárias, Universidade dos Açores, Angra do Heroísmo.
66	GAUTHIER, R., & M. BRUGUÉS, 1997. Note sur la présence de <i>Sphagnum affine</i> Ren. & Card., <i>Sphagnum centrale</i> C. Jens. et <i>Sphagnum papillosum</i> Lindb. aux Açores. <i>Cryptogamie, Bryologie et Lichénologie</i> , 18(2): 121-125.
67	GEHEEB, A., 1910. <i>Bryologia atlantica - Die Laubmoose der atlantischen Inseln.</i> E. Schweizerbat'sche Verlagsbuchhandlung, Stuttgart.
68	GIESE, M., & J.-P. FRAHM, 1985. A revision of <i>Microcampylopus</i> (C.Müll.) Fleisch. <i>Lindbergia</i> , 11: 114-124.
69	GONZÁLEZ-MANCEBO, J.M., A. LOSADA-LIMA & C.D. HÉRNANDEZ-GARCIA, 1991. A contribution to the floristic knowledge of caves on the Azores. <i>Mémoires de Biospéologie</i> , 17: 219-226.
70	GROLLE, R., & H. PERSSON, 1966. Die Gattung <i>Tylimanthus</i> auf den atlantischen Inseln. <i>Svensk Botanisk Tidskrift</i> , 60(1): 164-174.
71	GROLLE, R., & R. SCHUMACKER, 1982. Zur synonymik und vebreitung von <i>Plagiochila spinulosa</i> (Dicks) Dum. und <i>P. killarniensis</i> Pears. <i>Journal of Bryology</i> , 12: 215-225.
72	GROLLE, R., 1962. Monographie der Lebermoosgattung <i>Leptoscyphus</i> Mitt. <i>Nova Acta Leopoldina</i> , 25(161): 1-143.
73	GROLLE, R., 1966. <i>Dicranolejeunea</i> auf den Atlantischen Inseln. <i>Transactions of the British Bryological Society</i> , 5: 95-99.
74	GROLLE, R., 1968. Monographie der Gattung <i>Nowellia</i> . <i>Journal of the Hattori Botanical Laboratory</i> , 31: 20-49.
75	GROLLE, R., 1970. Zur Kenntnis der Frullanien in Europa und Makaronesien. <i>Wiss. Ztschr. Friedrich-Schiller-Univ., Jena, Math.-Naturwiss. Reihe</i> , 19 (3): 307-319.
76	GROLLE, R., 1972. <i>Bazzania</i> in Europa und Makaronesien. Zur Taxonomic und Verbreitung. <i>Lindbergia</i> , 1: 193-204.
77	GUERKE, W.R., 1978. A monograph of the genus <i>Jubula</i> Dumortier. <i>Bryophytorum Bibliotheca</i> , 17: 1-119.
78	HE, S., 1997. A Revision of <i>Homalia</i> (Musci: Neckeraceae). <i>Journal of the Hattori Botanical Laboratory</i> , 81: 1-52.
79	HEDENÁS, L., 1992. Notes on Madeiran <i>Pseudotaxiphyllum</i> , <i>Brachythecium</i> and <i>Rhynchostegiella</i> species (Bryopsida). <i>Nova Hedwigia</i> , 54(3-4): 447-457.
80	HEDENÁS, L., 2006. <i>Bryoxiphium norvegicum</i> in Azores.

Nº	Citation
81	HEIRCHS, J., D.S. RYCROFT, H. GROTH & W.J. COLE, 2002. Morphological and phytochemical studies of <i>Plagiochila papillifolia</i> Steph., a Neotropical liverwort new to Europe. <i>Journal of Bryology</i> , 24: 119-126.
82	HEINRICH, J., H. ANTON, S.R. GRADSTEIN & R. MUES, 2000. Systematics of <i>Plagiochila</i> sect. Glaucescentes Carl (Hepaticae) from tropical America: a morphological and chemataxonomical approach. <i>Plant Systematics and Evolution</i> , 220: 115-138.
83	HENTSCHEL, J., H.-J. ZÜNDORF, F.H. HELLWIG, A. SCHÄFER-VERWIMP & J. HEINRICH, 2006. Taxonomic studies in <i>Chiloscyphus corda</i> (Jungermanniales: Lophocoleaceae) based on nrITS sequences and morphology. <i>Plant Systematics and Evolution</i> , 262: 125-137.
84	HÜBSCHMANN, A. von., 1974. Bryologische Studien auf der Azoreninsel São Miguel. <i>Revista da Faculdade de Ciências de Lisboa, Série 2. C</i> , 17: 627-702.
85	JOVET-AST, S., 1948. <i>Bazzania tricrenata</i> (Wahl.) Trevis. aux Açores. <i>Révue Bryologique et Lichénologique</i> , 17(1-4): 174.
86	LONG, D.G., & M.O. HILL, 1982. <i>Tortula solmsii</i> (Schimp.) Limpr. in Devon and Cornwall, newly recorded in the British Isles. <i>Journal of Bryology</i> , 12: 159-169.
87	LUISIER, A., 1937. Recherches bryologiques récentes à Madère (Deuxième Série). <i>Brotéria, Série de Ciências Naturais</i> , 6: 88-95.
88	LUISIER, A., 1938. Mosses des Açores. <i>Brotéria, Série de Ciências Naturais</i> , 7: 96-98.
89	LUISIER, A., 1938. Hepáticas dos Açores. <i>Brotéria, Série de Ciências Naturais</i> , 7: 187-189.
90	LUISIER, A., 1945. A família das Hookeriáceas na Península Ibérica e nas Ilhas da Madeira, Açores e Canárias. <i>Las Ciencias</i> , 1: 1-8.
91	LÜPNITZ, D. von, 1975. Geobotanische Studien zur natürlichen Vegetation der Azoren unter Berücksichtigung der Corologie innerhalb Makaronesiens. <i>Beiträge Biologischer Pflanzen</i> , 51: 149-319.
92	MASCHKE, J., 1976. Taxonomische Revision der Laubmoosgattung <i>Myurium</i> (Pterobryaceae). <i>Bryophytorum Bibliotheca</i> , 6: 1-219.
93	MASTRACCI, M., 2004. <i>Thamnobryum rudolphianum</i> (Neckeraceae, Musci), a new species from the Azores. <i>Lindbergia</i> , 29: 143-147.
94	MAY, R., 1986. Notes on some Macaronesian <i>Tortella</i> species. <i>Bryologische Beiträge</i> , 6: 58-66.
95	MENDES, C., 1998. <i>Contributo para a caracterização de turfeiras de Sphagnum spp. na ilha Terceira</i> . Relatório de Estágio de Licenciatura em Engenharia Agrícola. Departamento de Ciências Agrárias, Universidade dos Açores, Angra do Heroísmo.
96	MITTEN, W., 1870. Musci, Hepaticae. In: GODMAN, F. (ed.), <i>Natural history of the Azores on Western Islands</i> , 286-328 pp. John Van Voorst, London.
97	OCHYRA, R., 2005. <i>Racomitrium aquaticum</i> colhido por Frahm em 2004 no Pico, Açores. Manuscrito.
98	PERSSON, H., 1937. <i>Briófitos colhidos por H. Persson em São Miguel em 1937</i> , 1 pp. Registo de Herbário. Manuscrito.
99	PERSSON, H., 1938. <i>Account of the botanical travel to the Açores in 1937 by Dr. Herman Persson and his wife</i> , 11 pp. Manuscrito.
100	PERSSON, H., 1939. Bryophytes from Madeira. <i>Botaniska Notiser</i> , 566-590
101	PERSSON, H., 1973. The Azorean bryophytes collected by P. Dansereau and A. R. Pinto da Silva in 1964. <i>Agronomia Lusitana</i> , 35: 5-19
102	RICHARDS, P.W., 1937. A collection of bryophytes from the Azores. <i>Annales Bryologici</i> , 9: 131-138.

Nº	Citation
103	RUSSEL, J.L., 1862. Some notes on the cryptogamic vegetation of Fayal, Azores. <i>Proceedings of the Essex Institute</i> , 2: 134-137.
104	RYCROFT, D.S., W.J. COLE, N. ASLAM, Y.M. LAMONT & R. GABRIEL, 1999. Killarniensolide, methyl orsellinates and 9,10-dihydrophenanthrenes from the liverwort <i>Plagiochila killarniensis</i> from Scotland and the Azores. <i>Phytochemistry</i> , 50: 1167-1173.
105	RYCROFT, D.S., J. HEINRICH, W.J. COLE & H. ANTON, 2001. A phytochemical and morphological study of the liverwort <i>Plagiochila retrorsa</i> Gottsche, new to Europe. <i>Journal of Bryology</i> , 23: 23-34.
106	SANTOS, N., 2005. <i>Elaboração de uma ferramenta promocional da ZPEPVRG (Zona de Protecção Especial do Pico da Vara e Ribeira do Guilherme) numa perspectiva de educação ambiental</i> . Relatório de Estágio de Licenciatura em Engenharia do Ambiente. Departamento de Ciências Agrárias, Universidade dos Açores, Angra do Heroísmo.
107	SCHUMACKER, R., & R. GABRIEL, 2002. <i>Gymmocolea inflata</i> (Huds.) Dumort., on Terceira island (Azores, Portugal). <i>Portugaliae Acta Biologica</i> , 20: 101-104.
108	SCHUMACKER, R., & J. VÁNA, 1999. Two new liverworts for Europe in Macaronesia: <i>Odontoschisma prostratum</i> (Sw.) Trevis. on the Azores and <i>Jungermannia callithrix</i> Lindenb. & Gottsche on the Azores and Madeira. <i>Tropical Bryology</i> , 17: 115-127.
109	SCHUMACKER, R., 2001. The hepatic flora of the Azores: brief historical outline, present knowledge, endemics and phytogeographical aspects. <i>Belgium Journal of Botany</i> , 134(1): 51-63.
110	SCHUMACKER, R., 2002/2003. <i>Lista de espécies de briófitos da Serra do Lapaçal observados por R. Schumacker</i> , 1 p. Verão de 2000 e 2003. Manuscrito.
111	SCHUMACKER, R., 2003. New national and regional bryophyte records, 8; 2. <i>Cephalozialla dentata</i> (Raddi) Steph. <i>Journal of Bryology</i> , 25: 217-221.
112	SCHUMACKER, R., 2005. <i>Jungermannia hyalina</i> Lyell, 1 p. Manuscrito.
113	SCHUMACKER, R., 2005. <i>Lepidozia stuhlmanii</i> Steph, 1 p. Azores. Manuscrito.
114	SCHWAB, G., 1981. <i>Azoren</i> . <i>Herbar Gottfried Schwab</i> , 19 pp. Manuscrito
115	SÉRGIO, C., & R. GABRIEL, 1995. 7. Novos dados para os Açores sobre o género <i>Riccia</i> . In: <i>Notulae Bryoflorae Macaronesicae III</i> . <i>Revista de Biologia</i> (Lisboa) "1994", 15: 184-185.
116	SÉRGIO, C., & E. DIAS, 1991. 4 - Algumas Ricciaceae e Anthocerotaceae novas para ilha Terceira. In: <i>Notulae Bryoflorae Macaronesicae. II</i> . <i>Portugaliae Acta Biologica</i> , Série B, 15: 421-423.
117	SÉRGIO, C., & R. GABRIEL, 1997. 2. <i>Fissidens papillosus</i> Lac. um novo musgo para a brioflora Açoreana. In: <i>Notulae Bryoflorae Macaronesicae IV</i> . <i>Portugaliae Acta Biologica</i> , Série B, 17: 267.
118	SÉRGIO, C., & J.P. HERBRARD, 1982. <i>Orthothecium duriaei</i> (Mont.) Besch., étude systématique, écologique et phytogéographique. <i>Collectanea Botanica</i> , 13(1): 247-255.
119	SÉRGIO, C., 1974. Le genre <i>Fossombronia</i> au Portugal, à Madère et aux Açores. <i>Bulletin de la Société Botanique de France</i> , 121: 319-326.
120	SÉRGIO, C., 1976. Deux nouveautés pour la flore bryologique des Açores: <i>Kiaeria blyttii</i> (B. S. G.) Broth. et <i>Orthodicranum flagellare</i> (Hedw.). <i>Boletim da Sociedade Broteriana</i> , 2ª série, 50: 99-105.
121	SÉRGIO, C., 1978. <i>Lejeunea eckloniana</i> Lindenb. (hépatique) dans la Macaronesie. <i>Boletim da Sociedade Portuguesa de Ciências Naturais</i> , 18: 39-41.
122	SÉRGIO, C., 1983. Do liverworts really like beer? <i>The Bryological Times</i> , 19: 4.

Nº	Citation
123	SÉRGIO, C., 1985. 1. Considerações sobre a presença de <i>Frullania muscicola</i> Steph. e <i>Frullania ericoides</i> (Nees) Mont. nos Açores e Madeira. <i>Notulae Bryoflorae Macaronesicae. I. Portugaliae Acta Biologica, Série B</i> , 14: 161-168.
124	SÉRGIO, C., 1987. <i>Contribuição para o estudo taxonómico e fitogeográfico de Anthoceros caucasicus</i> Steph. na Península Ibérica e Macaronésia. Actas del VI Simpósio Nacional de Botânica Criptogâmica (1987), pp. 605-614.
125	SÉRGIO, C., 1991. 1. <i>Sphaerocarpus texanus</i> Aust. nova hepática para a flora da Macaronésia. In: <i>Notulae Bryoflorae Macaronesicae II. Portugaliae Acta Biologica, Série B</i> , 15: 419.
126	SÉRGIO, C., 1995. 5. Duas novas espécies de <i>Fossombronia</i> para a brioflora dos Açores. In: <i>Notulae Bryoflorae Macaronesicae III. Revista de Biologia (Lisboa) "1994"</i> , 15: 183.
127	SÉRGIO, C., 1995. 6. <i>Petalophyllum ralfsii</i> (Wils.) Nees et Gott ex Lehm., espécie nova para os Açores e para a Macaronésia. In: <i>Notulae Bryoflorae Macaronesicae III. Revista de Biologia (Lisboa) "1994"</i> , 15: 184.
128	SÉRGIO, C., 1995. 8. Notas sobre o género <i>Sphagnum</i> no arquipélago dos Açores. In: <i>Notulae Bryoflorae Macaronesicae III. Revista de Biologia (Lisboa) "1994"</i> , 15: 185.
129	SÉRGIO, C., 1997. 3. <i>Grimmia pulvinata</i> (Hedw.) Sm. um novo musgo para a ilha Terceira (Açores). <i>Notulae Bryoflorae Macaronesicae IV. Portugaliae Acta Biologica, Série B</i> , 17: 268.
130	SÉRGIO, C., 2005. Comunicação pessoal em 3 de Junho de 2005.
131	SÉRGIO, C., & R. SCHUMACKER, 1999. <i>Notulae Bryoflorae Macaronesicae V. 3. Acerca da presença de Campylopus introflexus</i> (Hedw.) Brid. Nos Açores. <i>Anu. Soc. Brot.</i> , 65: 90-91.
132	SÉRGIO, C., R. GABRIEL & E. DIAS, 1995. 10. Novos musgos para a flora da ilha Terceira (Açores). In: <i>Notulae Bryoflorae Macaronesicae III. Revista de Biologia (Lisboa) "1994"</i> , 15: 187-188.
133	SÉRGIO, C., R. GABRIEL & E. DIAS, 1995. 9. Hepáticas novas para a flora da ilha Terceira (Açores). In: <i>Notulae Bryoflorae Macaronesicae III. Revista de Biologia (Lisboa) "1994"</i> , 15: 186-187.
134	SÉRGIO, C., Z. IWATSUKI & A. EDERRA, 1997. <i>Fissidens luisierii</i> P. Varde (Fissidentaceae, Musci), a neglected species from Macaronesia. <i>Journal of the Hattori Botanical Laboratory</i> , 83: 237-249.
135	SILVEIRA, T., 1937. Flora briológica. Espécies novas para os Açores. <i>Açoreana</i> , 1: 240-247.
136	SIM-SIM, M., L. LUÍS & M. STECH, 2009. <i>Hygroamblystegium fluviatile</i> . In: BLOCKEEL, T. et al., <i>New national and regional bryophyte records. Journal of Bryology</i> , 31: 135.
137	SIM-SIM, M., M. STECH & G. ESQUÍVEL, 2009. <i>Southbya tophacea</i> . In: BLOCKEEL, T. et al., <i>New national and regional bryophyte records. Journal of Bryology</i> , 31: 137.
138	SIM-SIM, M., C. SÉRGIO, R. MUES & L. KRAUT, 1995. A new <i>Frullania</i> species (Trachycolea) from Portugal and Macaronesia. <i>Frullania azorica</i> sp. nov. <i>Cryptogamie, Bryologie-Lichénologie</i> , 16(2): 111-123.
140	SJÖGREN, E., 1973. Plant communities of the Natural vegetation of Madeira and the Azores. <i>Monographiae Biologicae Canariensis. Las Palmas</i> , 4: 107-111.
141	SJÖGREN, E., 1973. Recent changes in the vascular flora and vegetation of the Azores Islands. <i>Memórias da Sociedade Broteriana</i> , 22: 1-451.
143	SJÖGREN, E., 1978. Bryophyte vegetation in the Azores Islands. <i>Memórias da Sociedade Broteriana</i> , 26: 1-273.

Nº	Citation
142	SJÖGREN, E., 1990. Bryophyte flora and vegetation on the island of Graciosa (Azores), with remarks on floristic diversity of the Azorean islands. <i>Arquipélago. Life and Earth Sciences</i> , 8: 63-96.
143	SJÖGREN, E., 1993. Bryophyte flora and vegetation on the island of Corvo (Azores). <i>Arquipélago. Life and Marine Sciences</i> , 11A: 17-48.
144	SJÖGREN, E., 1995. <i>Report on investigations of the bryoflora and bryovegetation in 1995 on the Azorean islands of Faial, S. Jorge, Pico and Flores</i> , 30 pp. LIFE-project. (mimeogr.) Angra do Heroísmo.
145	SJÖGREN, E., 1996. <i>Report on investigations of the bryoflora and bryovegetation on the Azorean island of Santa Maria</i> , 24 pp. LIFE-project. (mimeogr.) Angra do Heroísmo.
146	SJÖGREN, E., 1997. <i>Report on investigations of the bryoflora and bryovegetation in 1997 on the Azorean island of Terceira</i> . LIFE project. Departamento de Ciências Agrárias, Angra do Heroísmo.
147	SJÖGREN, E., 2001. Distribution of Azorean bryophytes up to 1999, their island distribution and information on their presence elsewhere, including Madeira and the Canary Islands. <i>Boletim do Museu Municipal do Funchal, Sup. Nº 7</i> : 1-89.
148	SJÖGREN, E., 2003. Azorean Bryophyte Communities - A Revision of Diferencial Species. <i>Arquipélago. Life and Marine Sciences</i> 20A: 1-29.
149	SJÖGREN, E., 2004. <i>List of species in herbario UPSV collected in the Azores Islands</i> , 12 pp. Manuscrito.
150	SJÖGREN, E., 2005. <i>List of species in herbario UPSV collected in the Azores Islands</i> , 50 pp. Manuscrito.
151	SJÖGREN, E., 2005. <i>Revisão da coleção de briófitos recolhidos pelo casal Allorge nos Açores em 1937 e por outros autores do final do século XIX e início do século XX e depositados no Museu Carlos Machado (Ponta Delgada, São Miguel)</i> , 1 p. Manuscrito.
152	SJÖGREN, E., 2006. Bryophytes (Musci) unexpectedly rare or absent in the Azores. <i>Arquipélago</i> , 23A: 1-17.
153	SMOOKLER, M. M., 1967. <i>Bryophyte report. Chelsea College Azores Expedition, 1965</i> . Chelsea College of Science and Technology, University of London, London.
154	SOARES, P.C.M.G., 2003. <i>Avaliação de elementos vestigiais atmosféricos na Ilha de Santa Maria, por biomonitorização</i> . Relatório de Estágio de Licenciatura em Engenharia do Ambiente. Departamento de Ciências Agrárias, Universidade dos Açores, Angra do Heroísmo.
155	STECH, M., M. SIM-SIM, S. MARTINS & C. SÉRGIO, 2009. <i>Plagiomnium undulatum</i> var. <i>madeirense</i> . In: BLOCKEEL, T. et al., <i>New national and regional bryophyte records</i> . <i>Journal of Bryology</i> , 31: 136.
156	SMNH - Swedish Museum of Natural History 2006. Moss Register. (http://andor.nrm.se/fmi/xsl/kbo/publFinditems.xml?token.nav=items&view&db=kbo_mossregister&token.languagecode=en-GB).
157	TAVARES, C.N., 1956. Teotónio da Silveira Moniz: 13.X.1891-5.V.1953. <i>Revue Bryologique et Lichénologique</i> , n.s. 25: 188.
158	The New York Botanical Garden, 2007. International Plant Science Center. State/Province: Azores. (http://sciweb.nybg.org/Science2/vii2.asp)
159	THERIOT, J., 1938. <i>Campylopodioidees des Îles Açores recoltées par P. Allorge et H. Persson</i> . <i>Révue Bryologique et Lichénologique</i> , 11: 100-109.
160	TRELEASE, W., 1897. Botanical observations on the Azores. <i>Annual Report of the Missouri Botanical Garden</i> , 8: 77-220 + Plates 12 to 66.
161	UBC - University of British Columbia 2007. Herbarium Databases. (http://herbarium.botany.ubc.ca/index.html).

Nº	Citation
162	VARDE, R.P., 1945. Formes atlantiques de trois mousses des Açores. <i>Révue Bryologique et Lichénologique</i> , 15: 40-45.
163	VARDE, R.P., 1955. Nouveau <i>Fissidens</i> aux Açores. <i>Mitteilungen der Thüringischen Botanischen Gesellschaft</i> , 1(2/3): 15-16.
164	VIEIRA, B.J.H., 2002. <i>Avaliação de elementos vestigiais atmosféricos na Ilha Terceira, por biomonitorização</i> . Relatório de Estágio de Licenciatura em Engenharia do Ambiente. Departamento de Ciências Agrárias, Universidade dos Açores, Angra do Heroísmo.
165	WATSON, H.C., 1844. Notes on the botany of the Azores. <i>The London Journal of Botany</i> , 3: 582-617.

APPENDIX 2. Data on Azorean bryophyte species and subspecies as classified in the Rabinowitz (1981) rarity criteria used in this work. (Mean altitude includes all the records; dd, data deficient; na, not applicable; es, SJÖGREN, 1995; rs, Schumacker, 2001; Old IUCN Criteria: based on ECCB, 1995 and Dierssen, 2001).

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
HORNWORTS															
<i>Anthoceros caucasicus</i> Steph.		3	9	6	146	1.8	ExFor (18)	200	520.5	825	14	45	r		1. Species that are not rare
<i>Anthoceros punctatus</i> L.		3	9	7	447	1.3	NaFor (24)	100	372.3	700	49	51			1. Species that are not rare
<i>Phaeoceros carolinianus</i> (Michx.) Prosk.		1	4	1	3	dd	na (1)	350	350.0	350	0	4			
<i>Phaeoceros laevis</i> (L.) Prosk.		3	8	5	70	0.6	NaFor (6)	175	440.0	700	3	12			2. Scarce species (rare by abundance)
<i>Phymatoceros bulbiculosus</i> (Brot.) Stotler, W. T. Doyle et Crand.-Stotl.		3	4	1	67	dd	na (2)	dd	dd	dd	4	3			
LIVERWORTS															
<i>Acanthocoleus aberrans</i> (Lindenb. et Gottsche) Krümm.		1	3	2	20	dd	NaFor (4)	500	690.0	750	4	1	r	es; rs	
<i>Acrobolbus wilsonii</i> Nees		2	4	3	117	6.1	NaFor (47)	500	864.3	1050	20	32	v	es; rs	3. Species with narrow ecological tolerance
<i>Aldanthus decipiens</i> (Hook.) Mitt.		3	6	4	179	6.4	NaFor (92)	500	856.8	1500	34	65		es	3. Species with narrow ecological tolerance
<i>Anastrophyllum minutum</i> (Schreb.) R. M. Schust.		3	8	5	137	1.6	NaFor (26)	250	692.7	2300	15	33			1. Species that are not rare
<i>Aneura pinguis</i> (L.) Dumort.		3	5	4	92	dd	NaFor (5)	500	616.7	850	6	5			
<i>Apianolejeunea azorica</i> (V. Allorge et Ast) Poes. et Bernçeckler		3	9	7	198	2.0	NaFor (76)	150	592.9	1050	75	65	v		1. Species that are not rare
<i>Apianolejeunea madetrensis</i> (Schiffn.) Gröble	MAC	2	5	4	83	4.6	NaFor (36)	250	658.8	925	36	6	r	rs	8. Restricted and scarce species with narrow ecological tolerance
<i>Apianolejeunea microscopica</i> (Taylor) A. Evans		3	8	6	624	4.2	NaFor (570)	50	701.8	1100	468	185			3. Species with narrow ecological tolerance
<i>Apianolejeunea sintenisii</i> Steph.		3	9	8	390	2.4	NaFor (180)	150	549.8	975	85	195	v		1. Species that are not rare
<i>Asterella africana</i> (Mont.) A. Evans		3	7	5	79	7.9	Caves (21)	10	387.8	875	13	25	v	rs	5. Scarce species with narrow ecological tolerance

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Barbilophozia attenuata</i> (Mart.) Loeske		2	6	5	195	2,8	NaFor (42) : 400	400	656,1	1000	19	33			1. Species that are not rare
<i>Bazzania azorica</i> H. Buch et H. Perss.	AZ	3	6	6	376	7,8	NaFor (320)	350	766,4	1050	112	232	r	rs	7. Restricted species with narrow ecological range
<i>Blepharostoma trichophyllum</i> (L.) Dumort.		3	9	5	167	2,0	NaFor (35)	150	700,0	1050	12	40			1. Species that are not rare
<i>Calypogeia arguta</i> Nees et Mont.		3	9	8	245	2,8	NaFor (57)	100	501,3	975	35	102			1. Species that are not rare
<i>Calypogeia azorica</i> Bischl.	MAC	3	6	3	116	3,3	NaFor (21)	150	555,2	750	8	26	r	es; rs	7. Restricted species with narrow ecological range
<i>Calypogeia fissus</i> (L.) Raddi		3	9	9	455	3,3	NaFor (181)	200	601,8	1050	65	279			3. Species with narrow ecological tolerance
<i>Calypogeia integristipula</i> Steph.		3	4	4	16	dd	NaFor (8)	800	808,3	825	11	1			3. Species with narrow ecological tolerance
<i>Calypogeia melleriana</i> (Schiffn.) Müll. Frib.		3	8	7	468	3,1	NaFor (242)	150	667,5	1050	105	228			3. Species with narrow ecological tolerance
<i>Calypogeia neesiana</i> (C. Massal. et Caresia) Müll. Frib.		3	5	3	64	3,9	NaFor (22)	500	636,5	825	15	13			5. Scarce species with narrow ecological tolerance
<i>Calypogeia sphagnicola</i> (Arnell et J. Perss.) Warnst. et Loeske		3	6	2	15	3,0	NaFor (13)	650	750,0	925	12	4		rs	5. Scarce species with narrow ecological tolerance
<i>Calypogeia suetica</i> (Arnell et J. Perss.) Müll. Frib.		3	4	3	58	1,7	ExFor (6)	350	425,0	550	7	9			2. Scarce species (rare by abundance)
<i>Cephalozia bicuspidata</i> (L.) Dumort.		3	8	8	334	1,9	NaFor (87)	225	637,0	1075	49	91			1. Species that are not rare
<i>Cephalozia comitensis</i> (Dicks.) Lindb.		2	3	2	50	dd	NaFor (4)	800	893,8	925	2	4			3. Species with narrow ecological tolerance
<i>Cephalozia crassifolia</i> (Lindenb. et Gottsche) Fulford		3	6	6	333	5,5	NaFor (211)	250	693,8	1000	73	178	v		3. Species with narrow ecological tolerance
<i>Cephalozia limulifolia</i> (Dumort.) Dumort.		2	5	4	65	5,2	NaFor (8)	625	805,0	1025	9	3			5. Scarce species with narrow ecological tolerance
<i>Cephalozia baungartneri</i> Schiffn.		1	2		10	dd	Mesic (3)	dd	dd	dd	3	2			
<i>Cephalozia calyculata</i> (Durieu et Mont.) Müll. Frib.		1	1	1	3	dd	na (1)	dd	dd	dd	0	1	r		
<i>Cephalozia dentata</i> (Raddi) Steph.		2	2	1	9	dd	NaFor (3)	500	539,3	650	0	7			
<i>Cephalozia divaricata</i> (Sm.) Schiffn.		3	3	3	76	dd	Mesic (6)	225	475,0	600	6	4			
<i>Cephalozia hanpiana</i> (Nees) Schiffn.		1	2	1	3	dd	na (2)	550	575,0	600	0	3			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Cephalozella rubella</i> (Nees) Warnst.		1	1	1	4	dd	na (2)	550	550,0	550	0	2			
<i>Cephalozella turneri</i> (Hook.) Müll. Frib.		1	2	1	6	dd	na (2)	dd	dd	dd	2	0			
<i>Chelolejeunea cedercreutzii</i> (H. Buch et H. Perss.) Crollé	MAC	2	4	4	105	3,0	NaFor (31)	250	786,0	1050	19	17	v	es; rs	7. Restricted species with narrow ecological range.
<i>Chiloscyphus coadunatus</i> (Sw.) J. J. Engel et R. M. Schust.		3	9	5	255	2,3	NaFor (30)	100	452,7	900	17	46			1. Species that are not rare
<i>Chiloscyphus fragrans</i> (Moris et De Not.) J. J. Engel et R. M. Schust.		3	8	7	546	2,0	NaFor (132)	25	594,2	1000	120	81			1. Species that are not rare
<i>Chiloscyphus minor</i> (Nees) J. J. Engel et R. M. Schust.		2	3		1	dd	na (2)	175	418,8	700	8	0			
<i>Chiloscyphus pallidus</i> (Ehrl. ex Hoffm.) Dumort.		3	5		dd	dd	NaFor (4)	350	633,3	850	4	3			
<i>Chiloscyphus polyanthos</i> (L.) Corda et R. M. Schust.		3	7	5	274	2,6	NaFor (14)	200	622,2	925	24	7			1. Species that are not rare
<i>Chiloscyphus profundus</i> (Nees) J. J. Engel et R. M. Schust.		3	8	5	102	2,9	NaFor (18)	10	485,6	875	27	17			1. Species that are not rare
<i>Cladopodiella francisci</i> (Hook.) Jörg.		2	2	2	19	dd	na (2)	400	508,3	575	2	3		rs	
<i>Cololejeunea minutissima</i> (Sm.) Schiffn.		3	9	9	586	2,0	NaFor (368)	10	566,6	1050	358	262			1. Species that are not rare
<i>Colla calyptrofolia</i> (Hook.) Dumort.		3	8	6	473	2,8	NaFor (221)	300	724,8	1100	165	115	rt		1. Species that are not rare
<i>Conocephalum conicum</i> (L.) Dumort.		3	9	9	426	6,2	Caves (130)	50	530,4	1400	91	210			3. Species with narrow ecological tolerance
<i>Conocephalum salebrosum</i> Szweykowski, Buczkowska et Odrzykowski		1	1		dd	dd	na (1)	dd	dd	dd	1	2			
<i>Corsinia coriandrina</i> (Spreng.) Lindb.		3	7	4	212	2,7	Mesic (16)	10	63,3	250	25	10			1. Species that are not rare
<i>Diplophyllum albicans</i> (L.) Dumort.		3	8	8	338	2,3	NaFor (106)	250	682,7	2300	64	107			1. Species that are not rare
<i>Drepanolejeunea hamatifolia</i> (Hook.) Schiffn.		3	8	8	524	4,0	NaFor (562)	10	706,9	1300	484	344			3. Species with narrow ecological tolerance
<i>Dumortiera hirsuta</i> (Sw.) Nees subsp. hirsuta		3	8	8	534	4,4	Caves (78)	10	522,0	1025	80	147	r		3. Species with narrow ecological tolerance
<i>Exormotheca pustulosa</i> Mitt.		3	5		124	2,7	Mesic (6)	25	100,0	175	9	5	r	rs	1. Species that are not rare

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>1 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Fossombronia angulosa</i> (Dicks.) Raddi		3	9	8	235	1.2	NaFor (12); Mesic; NaFor (4)	150	376.4	700	29	27			1. Species that are not rare 2. Scarce species (rare by abundance)
<i>Fossombronia caespitiformis</i> De Not. ex Rabenh. subsp. <i>caespitiformis</i>		2	4	3	82	1.8	Mesic; NaFor (4)	200	385.0	650	10	5			
<i>Fossombronia caespitiformis</i> De Not. ex Rabenh. subsp. <i>multispina</i> (Schiffn.) J. R. Bray et D. C. Cargill		2	6	3	dd	dd	Mesic; Urban (3)	100	100.0	100	4	7			
<i>Fossombronia echinata</i> Macvicar		1	1		2	dd	na (1)	150	150.0	150	0	1	k		
<i>Fossombronia pusilla</i> (L.) Nees	IB	2	4	2	20	dd	na (2)	400	400.0	400	2	2			
<i>Frullania azorica</i> Sim-Sim et al.	MAC	3	9	9	688	2.1	Coast (60)	10	154.4	800	59	164			1. Species that are not rare
<i>Frullania fragilifolia</i> (Taylor) Gottsche et al.		1	3		dd	dd	NaFor (4)	dd	dd	dd	0	8			
<i>Frullania microphylla</i> (Gottsche) Pearson	EUR	3	9	9	777	1.8	NaFor (22)	10	493.4	1100	381	307			1. Species that are not rare
<i>Frullania tamarisci</i> (L.) Dumort.		3	9	9	1016	2.1	NaFor (606)	10	588.2	1225	366	729			1. Species that are not rare
<i>Frullania teneriffae</i> (F. Weber) Nees		3	9	7	509	1.7	NaFor (243)	10	670.8	1350	283	228			1. Species that are not rare
<i>Geocalyx graveolens</i> (Schrad.) Nees		3	7	6	188	4.9	NaFor (77)	475	675.0	1000	19	68			3. Species with narrow ecological tolerance
<i>Gongylanthus ericetorum</i> (Raddi) Nees		3	7	5	199	3.2	Mesic (22)	25	350.0	700	28	12			3. Species with narrow ecological tolerance 2. Scarce species (rare by abundance)
<i>Gymnocolea inflata</i> (Huds.) Dumort.		2	2	2	43	1.8	NaFor (8)	300	837.5	950	0	13			2. Scarce species (rare by abundance)
<i>Harpalejeunea molleri</i> (Steph.) Grolle		3	9	9	638	1.5	NaFor (114)	10	474.2	1075	94	143			1. Species that are not rare
<i>Herbertus dicranus</i> (Taylor ex Gottsche et al.) Trevis.		1	1	1	79	dd	na (1)	1925	1925.0	1925	1	0			3. Species with narrow ecological tolerance
<i>Herbertus sandneri</i> (Nees) Lindb.		3	7	7	271	3.7	NaFor (94)	425	826.8	1500	39	76	r		3. Species with narrow ecological tolerance
<i>Heteroscyphus denticulatus</i> (Mitt.) Schiffn. MAC	MAC	3	8	7	369	2.6	NaFor (21)	75	384.4	900	13	34	r		4. Restricted species (rare by range)
<i>Hygrobriella laxifolia</i> (Hook.) Spruce		1	3		dd	dd	na (1)	525	525.0	525	0	1			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Jamesoniella rubricaudis</i> (Nees) Grolle		2	2	1	52	Mount (5)	1000	1133,3	1200	2	4	k	es	3. Species with narrow ecological tolerance.
<i>Jubula hutchinsiae</i> (Hook.) Dumort. subsp. <i>hutchinsiae</i>		3	7	7	594	NaFor (184)	75	604,7	1925	90	228			
<i>Jungernannia atrovenens</i> Dumort.		3	7	4	82	NaFor (3)	50	410,0	650	4	6			
<i>Jungernannia callithrix</i> Lindenb. et Gottsche		3	8	8	437	NaFor (30)	175	528,1	950	17	55			1. Species that are not rare
<i>Jungernannia gracillima</i> Sm.		3	8	5	73	Aquat (12)	350	615,4	975	12	21			2. Scarce species (rare by abundance)
<i>Jungernannia hyalina</i> Lyell		3	8	2	18	NaFor (17)	300	500,0	700	22	17			2. Scarce species (rare by abundance)
<i>Jungernannia pumila</i> With.		2	4	2	122	NaFor (5)	dd	dd	dd	5	9			1. Species that are not rare
<i>Kurzia pauciflora</i> (Dicks.) Grolle		3	4	4	106	NaFor (17)	550	690,0	925	11	17			3. Species with narrow ecological tolerance
<i>Lejaunea eckloniana</i> Lindenb.		3	9	8	321	NaFor (37)	25	386,6	925	30	77		es	1. Species that are not rare
<i>Lejaunea flava</i> (Sw.) Nees subsp. <i>moorei</i> (Lindb.) R. M. Schust.		3	8	7	269	NaFor (99)	50	511,4	950	57	123	(r)		1. Species that are not rare
<i>Lejaunea lithermica</i> Bischl. et al. ex Grolle	EUR	3	4	4	181	NaFor (11)	75	586,1	800	6	9	r	es	1. Species that are not rare
<i>Lejaunea lamacerina</i> (Steph.) Schiffn.		3	9	9	847	NaFor (547)	10	535,3	1050	481	721			1. Species that are not rare
<i>Lejaunea patens</i> Lindb.		3	9	7	565	NaFor (156)	150	785,6	1500	113	95			1. Species that are not rare
<i>Lepidozia cupressina</i> (Sw.) Lindenb. subsp. <i>pinjata</i> (Hook.) Pócs		3	6	6	375	NaFor (227)	525	756,1	1100	91	161			3. Species with narrow ecological tolerance
<i>Lepidozia pearsonii</i> Spruce		1	1	1	2	na (2)	975	975,0	975	0	2			3. Species with narrow ecological tolerance
<i>Lepidozia reptans</i> (L.) Dumort		3	7	7	428	NaFor (130)	400	690,0	1050	60	94			3. Species with narrow ecological tolerance
<i>Lepidozia stuhlmannii</i> Steph.		1	3	1	34	NaFor (8)	650	812,5	1000	0	10			5. Scarce species with narrow ecological tolerance
<i>Leptostichus azoricus</i> (H. Buch et H. Perss.) Grolle	EUR	3	5	4	80	NaFor (56)	550	797,6	1050	20	39	v	es; rs;	5. Scarce species with narrow ecological tolerance
<i>Leptosiphon cuneifolius</i> (Hook.) Mitt.		1	3	3	20	NaFor (5)	400	662,5	1000	4	8		es	
<i>Lophozia bicrenata</i> (Schmidel ex Hoffm.) Dumort.		2	5	2	31	na (2)	150	843,8	2000	3	2			

Species	Endemic groupings	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Lophozia incisa</i> (Schrad.) Dumort. subsp. <i>incisa</i>		3	7	5	97	3.1	NaFor (8)	550	685.7	800	11	3			3. Species with narrow ecological tolerance.
<i>Lophozia longiflora</i> (Nees) Schiffn.		2	5	2	7	dd	NaFor (4)	550	656.3	850	0	5			
<i>Lophozia ventricosa</i> (Dicks.) Dumort. aggr.		2	5	5	90	1.9	NaFor (20)	350	702.1	1050	25	4			1. Species that are not rare
<i>Lunularia cruciata</i> (L.) Lindb.		3	9	5	137	1.7	Mesic (11)	100	347.7	950	20	24			1. Species that are not rare
<i>Mammia androgyna</i> (L.) A. Evans		3	6	4	231	3.5	Urban (8)	25	62.5	100	18	6			3. Species with narrow ecological tolerance.
<i>Marchantia paleacea</i> Bertol.		3	8	7	249	1.4	NaFor (15)	75	458.3	875	43	16	k		1. Species that are not rare
<i>Marchantia polymorpha</i> L.		2	3			dd	na (2)	650	650.0	650	5	0			1. Species that are not rare
<i>Marchantia polymorpha</i> L. subsp. <i>montivagans</i> Bischl. et Boisselier.		1	1	1	47	dd	na (2)	dd	dd	dd	0	5			
<i>Marchantia polymorpha</i> L. subsp. <i>ruderalis</i> Bischl. et Boisselier.		2	4		dd	dd	na (2)	dd	dd	dd	1	1			
<i>Marchesinia maackii</i> (Hook.) Gray		3	9	9	812	1.8	NaFor (93)	10	386.3	825	147	173			1. Species that are not rare
<i>Marsipella adusta</i> (Nees emend. Limpr.) Spruce		2	3	2	10	dd	Mount (3)	625	1906.3	2350	6	0	k		
<i>Marsipella emarginata</i> (Ehrh.) Dumort.		3	8	7	179	1.8	NaFor (19)	50	601.9	1600	20	28			1. Species that are not rare
<i>Marsipella funckii</i> (E. Weber et D. Mohr) Dumort.		3	7	4	55	0.5	NaFor (9)	500	612.5	675	6	9			2. Scarce species (rare by abundance).
<i>Marsipella profunda</i> Lindb.		1	1	1	4	dd	na (1)	dd	dd	dd	0	1	v		
<i>Marsipella sparsifolia</i> (Lindb.) Dumort.		1	3	2	6	dd	NaFor (3)	825	862.5	900	1	2			
<i>Marsipella sphaerolata</i> (Giescke ex Lindenb.) Dumort.		2	3	3	10	dd	NaFor (5)	700	775.0	850	7	1			
<i>Metzgeria furcata</i> (L.) Dumort.		3	8	7	527	2.4	NaFor (163)	225	623.6	1050	225	83			1. Species that are not rare
<i>Metzgeria leptoneura</i> Spruce		3	6	6	309	3.6	NaFor (99)	450	732.4	1000	74	41			3. Species with narrow ecological tolerance
<i>Microlejeunea ulicina</i> (Taylor) A. Evans		3	7	7	206	1.4	NaFor (13)	100	342.0	950	19	25			1. Species that are not rare
<i>Mnioloma fuscum</i> (Lehm.) R. M. Schust.		3	6	5	198	8.7	NaFor (124)	475	801.1	1075	47	86	r	es	3. Species with narrow ecological tolerance.

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Mylia taylorii</i> (Hook.) Gray		2	2	1	4	dd	na (1)	775	775,0	775	1	1			2. Scarce species (rare by abundance).
<i>Nardia geoscyplius</i> (De Not.) Lindb.		3	7	4	68	1,7	NaFor (7)	325	614,3	925	5	13			1. Species that are not rare
<i>Nardia scalaris</i> Gray		3	9	9	415	1,7	NaFor (67)	150	563,2	1000	49	138			3. Species with narrow ecological tolerance
<i>Novellia curvifolia</i> (Dicks.) Mitt.		3	6	5	318	4,5	NaFor (145)	250	721,7	1075	81	84			3. Species with narrow ecological tolerance
<i>Odontoschisma denudatum</i> (Mart.) Dumort.		3	6	4	154	3,3	NaFor (28)	300	659,2	1000	19	17			3. Species with narrow ecological tolerance
<i>Odontoschisma prostratum</i> (Sw.) Trevis.		3	8	8	485	3,0	NaFor (154)	225	608,9	1025	88	175			3. Species with narrow ecological tolerance
<i>Pallavicinia lyellii</i> (Hook.) Carruth.		3	6	2	197	6,6	NaFor (46)	450	733,0	1100	8	41	v	es	3. Species with narrow ecological tolerance
<i>Pellia epiphylla</i> (L.) Corda s.l.		3	7	5	218	4,6	NaFor (125)	50	650,8	1000	52	193			3. Species with narrow ecological tolerance
<i>Plagiochasma rupestre</i> (J. R. Forst. et G. Forst.) Steph.		2	4	1	2	dd	na (2)	dd	dd	dd	5	1			
<i>Plagiochila bifaria</i> (Sw.) Lindenb.		3	9	9	729	4,2	NaFor (569)	100	676,2	1500	179	586			3. Species with narrow ecological tolerance
<i>Plagiochila exigua</i> (Taylor) Taylor		3	9	7	351	3,5	NaFor (185)	225	739,5	1100	100	117			3. Species with narrow ecological tolerance
<i>Plagiochila longispina</i> Lindenb. et Gotsche.		3	9	7	114	4,0	NaFor (20)	300	635,5	975	17	24	v	es	3. Species with narrow ecological tolerance
<i>Plagiochila papillifolia</i> Steph.		1	1		dd	dd	na (2)	800	800,0	800	0	2			
<i>Plagiochila punctata</i> (Taylor) Taylor		3	7	3	122	6,9	NaFor (7)	525	847,5	1050	7	5			3. Species with narrow ecological tolerance
<i>Plagiochila retrorsa</i> Gotsche		1	2	1	1	dd	na (1)	650	650,0	650	0	3			
<i>Porella canariensis</i> (F. Weber) Bryhn		3	9	9	456	1,2	NaFor (53)	10	406,2	950	57	100	t		1. Species that are not rare
<i>Porella obtusata</i> (Taylor) Trevis.		3	8	5	130	2,6	NaFor (60)	25	501,5	1000	7	101			1. Species that are not rare
<i>Radiata aquilegia</i> (Hook. F. et Taylor) Gotsche et al.		3	7	7	537	2,7	NaFor (263)	150	692,8	1075	134	203			1. Species that are not rare
<i>Radiata carringtonii</i> J. B. Jack		3	9	9	673	1,4	NaFor (170)	25	499,5	1500	104	264	r		1. Species that are not rare

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Radula complanata</i> (L.) Dumort.		3	6	3	110	1.8	Mesic (6)	25	450.0	825	29	4			1. Species that are not rare
<i>Radula holtrii</i> Spruce	EUR	3	8	7	190	1.7	NaFor (52)	75	558.4	1050	56	31	r	es	1. Species that are not rare
<i>Radula lindenbergiana</i> Gottsche ex C. Hartman		3	8	7	413	2.5	Parks (16)	25	303.1	925	57	41			1. Species that are not rare
<i>Radula nudicaulis</i> Steph.		2	5	3	79	3.9	NaFor (25)	550	795.6	1500	10	18	r	es	5. Scarce species with narrow ecological tolerance
<i>Radula vichuruae</i> Steph.	MAC	3	9	9	282	1.8	NaFor (42)	10	267.4	950	38	154	v	es	4. Restricted species (rare by range)
<i>Reboulia hemisphaerica</i> (L.) Raddi s.l.		3	9	7	295	1.7	Mesic (24)	50	370.8	925	33	41			1. Species that are not rare
<i>Riccardia chamaedryfolia</i> (With.) Grolle		3	8	8	443	4.2	NaFor (76)	150	606.3	1000	61	109			3. Species with narrow ecological tolerance
<i>Riccardia latifrons</i> (Lindb.) Lindb.		3	9	7	274	2.1	NaFor (28)	100	478.2	900	29	26			1. Species that are not rare
<i>Riccardia multifida</i> (L.) Gray		3	8	8	338	1.9	NaFor (51)	175	615.3	1000	38	58			1. Species that are not rare
<i>Riccardia palmata</i> (Hedw.) Carruth.		3	6	5	73	3.3	NaFor (15)	450	727.5	950	11	9			5. Scarce species with narrow ecological tolerance
<i>Riccia beyrichiana</i> Hampe ex Lehm. et Lindenb.		1	1	1	44	dd	na (1)	dd	dd	dd	0	2			
<i>Riccia bifurca</i> Hoffm.		2	2	2	48	dd	na (1)	525	525.0	525	1	4			
<i>Riccia crozalsii</i> Levier		3	6	4	167	1.8	Mesic (6)	25	178.6	475	4	12			1. Species that are not rare
<i>Riccia crystallina</i> L. emend. Raddi		2	2	2	24	dd	na (2)	dd	dd	dd	2	0			
<i>Riccia glauca</i> L.		2	3	2	57	dd	Mesic (9)	dd	dd	dd	2	5			
<i>Riccia huabeneriana</i> Lindenb.		1	1	1	2	dd	Aquat (3)	550	550.0	550	0	3	r		
<i>Riccia ligula</i> Steph.		1	1	1	1	dd	InPas (6)	325	325.0	325	0	6	r		
<i>Riccia nigrella</i> DC		3	6	4	224	2.9	Mesic (7)	475	500.0	550	12	8			1. Species that are not rare
<i>Riccia sorocarpa</i> Bischl.		2	5	1	37	dd	Mesic (4)	325	375.0	475	3	8			
<i>Riccia subbifurca</i> Warnst. ex Croz.		1	1	1	1	dd	na (2)	525	525.0	525	0	2			
<i>Riccia trahutiana</i> Steph.		1	1	1	dd	dd	na (1)	dd	dd	dd	0	1	r		
<i>Riccia warnstorffii</i> Limpr. ex Warnst.		2	2	1	29	dd	na (1)	dd	dd	dd	2	1			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Saccogyna viticulosa</i> (L.) Dumort.	EUR	3	9	9	778	2.0	NaFor (317)	10	598.6	1050	142	364			1. Species that are not rare
<i>Scapania compacta</i> (A. Roth.) Dumort.		2	4	3	15	2.1	NaFor (3)	200	697.2	975	5	9			2. Scarce species (rare by abundance)
<i>Scapania curta</i> (Mart.) Dumort.		2	6	4	41	2.5	NaFor (14)	475	769.0	1075	19	4			2. Scarce species (rare by abundance) 3. Species with narrow ecological tolerance
<i>Scapania gracilis</i> Lindb.		3	8	8	555	3.5	NaFor (290)	125	739.0	1500	110	244			
<i>Scapania nemorea</i> (L.) Grolle		3	6	3	166	1.9	NaFor (31)	400	653.8	1000	19	39			1. Species that are not rare
<i>Scapania paludosa</i> (Müll. Frib.) Müll. Frib.		1	1		dd	dd	na (2)	dd	dd	dd	2	0			
<i>Scapania scanatica</i> (Arnell et H. Burch) Mácviçar		1	1	1	1	dd	na (1)	2350	2350.0	2350	1	0			
<i>Scapania undulata</i> (L.) Dumort.		3	8	7	336	2.6	NaFor (69)	250	696.4	1100	63	47			1. Species that are not rare
<i>Southbya topiacea</i> (Spruce) Spruce		2	2		dd	dd	na (1)	500	500.0	500	0	1			
<i>Sphaerocarpos texanus</i> Austin		1	1	1	1	dd	na (1)	dd	dd	dd	0	1			
<i>Taraxia hypophylla</i> L.		3	9	6	236	2.3	Mesic (19)	50	318.8	950	29	14			1. Species that are not rare
<i>Taraxia lorbeeriana</i> Müll. Frib.		1	1		dd	dd	na (1)	dd	dd	dd	0	1			
<i>Telaranea azorica</i> (H. Buch et H. Perss.) Pocs ex Schumacker et Vána	MAC	3	6	5	265	6.9	NaFor (105)	250	784.1	1075	69	46	v	es; rs	7. Restricted species with narrow ecological range
<i>Telaranea europaea</i> Engel et Merr.		3	9	9	404	3.0	NaFor (271)	150	645.9	1025	101	265	r		3. Species with narrow ecological tolerance
<i>Trichoclea tomentella</i> (Ehrh.) Dumort.		2	4	1	133	3.8	NaFor (17)	550	712.5	1000	18	6			3. Species with narrow ecological tolerance
<i>Tylinanthus laxus</i> (Lehm. et Lindenb.) Spruce		3	6	6	245	1.9	NaFor (48)	10	706.6	1500	31	55	v	es; rs	1. Species that are not rare
MOSSSES															
<i>Aloina ambigua</i> (Bruch et Schimp.) Limpr.		1	2		21	dd	Mesic (6)	dd	dd	dd	7	1			
<i>Aloina rigida</i> (Hedw.) Limpr.		1	1		12	dd	na (1)	dd	dd	dd	0	1			
<i>Allophosia azorica</i> (Renaud et Cardot) Cardot	MAC	3	7	5	363	1.3	NaFor (60)	100	576.2	1000	31	93	r		4. Restricted species (rare by range)

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Amblystegium confervoides</i> (Brid.) Schimp.		2	2		dd	dd	Caves (3)	50	150,0	250	0	3			
<i>Amblystegium serpens</i> (Hedw.) Schimp.		3	3	1	38	dd	na (1)	50	75,0	125	5	1			
<i>Amphidium mongeoti</i> (Bruch et Schimp.) Schimp.		2	5	3	41	dd	NaFor (5)	250	942,9	2350	5	4			
<i>Andoa berthelotiana</i> (Mont.) Ochyra	MAC	3	9	9	1068	1,6	NaFor (233)	10	498,6	1550	203	461	r		-4. Restricted species (rare by range)
<i>Andraea rupestris</i> Hedw.		1	2	1	39	dd	Mount (5)	1500	1612,5	1750	5	0			
<i>Anoetangium aestroium</i> (Hedw.) Mitt.		1	1	1	44	dd	na (1)	dd	dd	dd	2	0			
<i>Anomobryum julaceum</i> (P. Gaertn., B. Mey. et Scherb.) Schimp.		3	8	8	291	1,3	NaFor (19)	10	447,9	950	25	42			1. Species that are not rare
<i>Archidium alternifolium</i> (Hedw.) Schimp.		3	4	1	107	dd	na (2)	300	450,0	600	5	3			
<i>Archidium angustatum</i> (Brid.) Bruch et Schimp.		3	8	6	236	1,1	Mescic (11)	150	468,3	900	18	30			1. Species that are not rare
<i>Atrichium tenellum</i> (Köhl.) Bruch et Schimp.		1	1	1	1	dd	Aquat (3)	550	550,0	550	0	3			1. Species that are not rare
<i>Atrichium undulatum</i> (Hedw.) P. Beauv.		3	8	4	176	1,3	NaFor (31)	300	556,8	800	26	45			1. Species that are not rare
<i>Aulacomnium pulstre</i> (Hedw.) Schwägr.		2	3	1	16	dd	NaFor (5)	700	850,0	950	6	2			es
<i>Barbula concolata</i> Hedw.		2	3	2	26	dd	na (1)	50	50,0	50	1	1			
<i>Barbula unguiculata</i> Hedw.		3	9	6	189	1,9	Mescic (7)	50	267,5	575	7	16			1. Species that are not rare
<i>Bartramia pomiformis</i> Hedw.		1	1	1	4	dd	na (2)	dd	dd	dd	1	0			
<i>Bartramia stricta</i> Brid.		3	6	3	117	3,1	Coast (7)	25	240,6	800	12	4			3. Species with narrow ecological tolerance
<i>Blechna acuta</i> (Hedw.) Bruch et Schimp.		3	5	5	92	1,6	NaFor (15)	450	725,0	950	14	7			1. Species that are not rare
<i>Brachymerium notarisii</i> (Mitt.) A. J. Shaw		3	4	3	27	dd	na (2)	150	325,0	500	4	2	r		
<i>Brachyphlegmastrum velutinum</i> (Hedw.) Ignatov et Hüftünen		3	8	4	49	2,5	ExFor (10)	25	450,0	1500	10	17			2. Scarce species (rare by abundance)
<i>Brachyphlegmum albicans</i> (Hedw.) Schimp.		2	3	1	2	dd	na (2)	200	416,7	525	1	2			
<i>Brachyphlegmum mildcanum</i> (Schimp.) Mildé		2	3	2	32	dd	NaFor (4)	50	528,1	875	10	0			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Brachythecium rivulare</i> Schimp.		3	8	5	102	2,3	NaFor (7)	275	430,6	650	8	11			1. Species that are not rare
<i>Brachythecium rutibulum</i> (Hedw.) Schimp.		3	8	5	125	2,0	InPas (14)	125	419,2	975	9	39			1. Species that are not rare
<i>Brachythecium salebrosum</i> (Hoffm. ex F. Weber et D. Mohr) Schimp.		3	9	6	202	1,7	ExFor (5)	100	209,4	350	10	6			1. Species that are not rare
<i>Breutelia azorica</i> (Mitt.) Cardot	AZ	3	6	5	220	1,7	NaFor (54)	250	719,1	1200	62	30	r		4. Restricted species (rare by range)
<i>Bryocryptobryum inaequalifolium</i> (Taylor) K. H. Zander		1	2	1	40	dd	na(2)	dd	dd	dd	0	2	r		
<i>Bryoxiphium norvegicum</i> (Brid.) Mitt.		1	1	1	1	dd	na(1)	325	325,0	325	0	1			
<i>Bryum argenteum</i> Hedw.		3	8	3	153	2,9	Mesic (9)	50	215,0	525	18	14			1. Species that are not rare
<i>Bryum canariense</i> Brid.		3	8	7	251	1,9	Mesic (15)	10	161,4	575	21	20			1. Species that are not rare
<i>Bryum creberrimum</i> Taylor		3	4		dd	dd	na(0)	dd	dd	dd	0	0			
<i>Bryum gemmiparum</i> De Not.		2	3	1	5	dd	na(1)	dd	dd	dd	2	0			
<i>Bryum kintzei</i> Hornsch.		1	1		dd	dd	na(2)	dd	dd	dd	2	0			
<i>Bryum mildeanum</i> Jur.		3	4	3	68	dd	Aquat (4)	150	150,0	150	5	1			
<i>Bryum radicosum</i> Brid.		2	3	1	8	dd	na(2)	dd	dd	dd	2	2			
<i>Bryum ruderale</i> Crundw. et Nyholm		2	3	2	103	dd	na(2)	dd	dd	dd	0	4			
<i>Bryum sauteri</i> Bruch et Schimp.		1	2	1	15	dd	na(1)	dd	dd	dd	0	2			
<i>Bryum suboptulatum</i> Hampe		2	2	2	10	dd	na(1)	200	200,0	200	1	2			
<i>Bryum tenacitatum</i> Limpr.		2	2	2	22	dd	na(1)	10	10,0	10	0	2	k		
<i>Bryum torquescens</i> Bruch et Schimp.		3	7	5	75	1,9	Mesic (10)	10	268,6	600	8	18			2. Scarce species (rare by abundance)
<i>Calliergonella cuspidata</i> (Hedw.) Loeske		3	6	3	239	3,4	InPas (24)	225	536,3	800	24	32			3. Species with narrow ecological tolerance
<i>Campylopus atrocens</i> De Not.		2	3		dd	dd	na(1)	dd	dd	dd	0	1			
<i>Campylopus brevifolius</i> Bruch et Schimp.		3	8	6	59	4,8	PeBog (9)	250	511,8	900	4	23			5. Scarce species with narrow ecological tolerance

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Campylopus cugnatus</i> (Hedw.) Brid.		3	8	8	430	2.3	NaFor (90); 200	682.7	1200	1200	63	117	k		1. Species that are not rare
<i>Campylopus flaccidus</i> Renauld et Cardot		2	2	1	1	dd	na (0)						k		
<i>Campylopus flexuosus</i> (Hedw.) Brid.		3	9	8	277	1.6	NaFor (47); 250	615.4	1000	1000	57	64			1. Species that are not rare
<i>Campylopus fragilis</i> (Brid.) Bruch et Schimp.		3	9	8	344	1.5	NaFor (19); 150	573.8	900	900	24	34			1. Species that are not rare
<i>Campylopus incrassatus</i> Müll. Hal.		3	6	2	25	dd	FeBog (4); 550	771.4	1200	1200	0	8			
<i>Campylopus introflexus</i> (Hedw.) Brid.		3	9	1	40	dd	na (2); 325	400.0	475	475	1	7			
<i>Campylopus pilifer</i> Brid.	1	3	9	9	1112	1.3	Mesc (51); 10	411.2	1500	144	148				1. Species that are not rare
<i>Campylopus pyriformis</i> (Schultz) Brid.		3	8	7	148	2.4	NaFor (37); 10	578.4	1025	12	96				1. Species that are not rare
<i>Campylopus sharwii</i> Wilson		3	6	4	133	3.9	NaFor (33); 525	788.0	1500	15	40	40	r		3. Species with narrow ecological tolerance
<i>Campylopus subulatus</i> Schimp. ex J. Müll.		1	1	1	1	dd	na (1); 775	775.0	775	0	1				1. Species that are not rare
<i>Ceratodon purpureus</i> (Hedw.) Brid. subsp. <i>purpureus</i>		3	9	6	249	1.2	ExFor (11); 10	484.7	1450	27	30				1. Species that are not rare
<i>Ceratodon purpureus</i> (Hedw.) Brid. subsp. <i>stenocarpus</i> (Bruch. et Schimp. ex Müll. Hal.) Dixon		1	1	1	1	dd	na (1); 875	875.0	875	0	1				
<i>Cheilothea chloropus</i> (Brid.) Lindb.		1	1	1	7	dd	na (1); dd	dd	dd	dd	2	0			
<i>Cirriophyllum piliferum</i> (Hedw.) Groul.		3	9	2	12	dd	na (2); 625	680.0	800	800	1	5			
<i>Cryphaea heteromalla</i> (Hedw.) D. Mohr		1	1	1	1	dd	na (1); dd	dd	dd	dd	1	0			es
<i>Ctenidium molluscum</i> (Hedw.) Warnst.		2	2	1	49	dd	Aquat (4); 200	237.5	325	6	1				
<i>Cyclodictyon laetevirens</i> (Hook. et Taylor) Mitt.		2	6	3	205	6.5	NaFor (85); 350	636.8	1000	25	114		r		3. Species with narrow ecological tolerance
<i>Cynodontium bruntonii</i> (Sm.) Bruch et Schimp.		1	1		dd	dd	na (0); dd	dd	dd	dd	0	0			
<i>Daltonia stenophylla</i> Mitt.		2	5	5	166	3.0	NaFor (42); 550	804.5	1000	25	27		v		3. Species with narrow ecological tolerance
<i>Dialytrichia mucronata</i> (Brid.) Broth.		2	2		11	dd	na (1); dd	dd	dd	dd	1	0			
<i>Dicranella heteromalla</i> (Hedw.) Schimp.		3	7	4	94	2.3	ExFor (10); 150	513.6	900	15	12				1. Species that are not rare

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	OID IUCN criteria	Experts' opinion	Vulnerability Index
<i>Dicranella howei</i> Renauld et Cardot		2	2	1	1	dd	na (2)	550	550,0	550	0	3			
<i>Dicranella schreberiana</i> (Hedw.) Dixon		1	2	1	10	dd	na (1)	400	475,0	550	0	2			
<i>Dicranella subulata</i> (Hedw.) Schimp.		1	1	dd	dd	na (0)	dd	dd	dd	dd	1	0			
<i>Dicranella varia</i> (Hedw.) Schimp.		3	4	2	110	dd	na (2)	700	787,5	875	11	0			
<i>Dicranoweisia cirrata</i> (Hedw.) Lindb. ex Mildé		1	2	1	7	dd	na (1)	175	175,0	175	1	1			
<i>Dicranoweisia crispula</i> (Hedw.) Lindb. ex Mildé		2	3	1	5	dd	Mount (4)	200	920,0	2350	4	7			
<i>Dicranum bonjeanii</i> De Not.		2	3	3	42	dd	NaFor (6)	550	740,0	900	5	2			
<i>Dicranum canariense</i> Hampe ex Müll. Hal.		2	3	3	66	3,9	NaFor (15)	525	662,5	925	1	20			5. Scarce species with narrow ecological tolerance.
<i>Dicranum flagellare</i> Hedw.		1	3	2	28	dd	NaFor (3)	575	650,0	800	1	3			
<i>Dicranum majus</i> Sm.		1	1	1	15	dd	NaFor (4)	675	687,5	700	0	4			
<i>Dicranum scoparium</i> Hedw.		3	6	4	83	5,6	NaFor (12)	500	860,7	1450	11	7			5. Scarce species with narrow ecological tolerance. 3. Species with narrow ecological tolerance.
<i>Dicranum scothianum</i> Turm.		3	8	8	436	4,4	NaFor (256)	175	703,1	1925	119	173			
<i>Didymodon acutus</i> (Brid.) Saito		2	2	1	2	dd	na (1)	900	900,0	900	0	1			
<i>Didymodon insularis</i> (De Not.) Hill		3	4	2	51	dd	Mesic (3)	200	212,5	225	7	2			
<i>Didymodon luridus</i> Hornsch.		2	6	1	92	dd	Mesic (4)	50	268,8	575	2	9			
<i>Didymodon rigidulus</i> Hedw.		1	1	1	1	dd	na (1)	500	500,0	500	0	1			
<i>Didymodon tophiaceus</i> (Brid.) Lisa		3	6	5	192	3,6	Urban (6)	150	225,0	375	12	5			3. Species with narrow ecological tolerance. 1. Species that are not rare
<i>Diphyscium vinalis</i> (Brid.) R. H. Zander		2	5	4	127	2,3	Mesic (6)	75	433,3	875	12	3			
<i>Diphyscium foliosum</i> (Hedw.) D. Mohr		3	9	8	257	1,3	NaFor (35)	300	617,6	1500	37	50			1. Species that are not rare
<i>Ditrichum pallidum</i> (Hedw.) Hampe		2	3	2	35	dd	na (1)	dd	dd	dd	1	3			
<i>Ditrichum punctulatum</i> Mitt.		1	1	1	2	dd	na (1)	1200	1200,0	1200	0	1			

Species	Endemic groupings	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Ditrichum subulatum</i> Hampe		2	3	2	3	dd	na (2)	900	900.0	900	2	1			
<i>Echinodium renauldii</i> (Cardot) Broth.	AZ	3	7	6	168	2.3	NaFor (15)	75	426.3	1250	18	32	v	es	4. Restricted species (rare by range)
<i>Entosthodon attenuatus</i> (Dicks.) Bryhn		3	8	7	419	1.3	NaFor (27)	150	570.0	950	45	38			1. Species that are not rare
<i>Entosthodon multenbergii</i> (Turner) Fife		1	2	1	7	dd	na (2)	dd	dd	dd	2	0			
<i>Entosthodon obtusatus</i> (Hedw.) Lindb.		3	7	6	172	1.0	NaFor (11)	275	675.0	950	17	8			1. Species that are not rare
<i>Entosthodon pulchellus</i> (H.Philip.) Bruggés		2	2	1	56	dd	Urban (3)	dd	dd	dd	3	0			
<i>Ephenerum cohaerens</i> (Hedw.) Hampe		1	1	1	1	dd	na (1)	dd	dd	dd	0	1	e		
<i>Epiphygium tozeri</i> (Grev.) Lindb.		3	9	7	466	3.2	Caves (32)	25	336.9	1000	22	88			3. Species with narrow ecological tolerance
<i>Eucladium verticillatum</i> (Brid.) Bruch et Schump.		3	4	4	122	2.7	Aquat (6)	375	487.5	650	12	3			1. Species that are not rare
<i>Eurhynchium striatum</i> (Hedw.) Schump.		1	2	1	105	2.8	Aquat; ExFor (4)	300	341.7	400	10	6			1. Species that are not rare
<i>Fissidens adiantifolius</i> Hedw.		1	2	1	13	dd	NaFor (6)	250	491.7	675	2	7			
<i>Fissidens asplenifolius</i> Hedw.		3	9	9	613	1.6	NaFor (91)	10	492.4	1000	115	225	r		1. Species that are not rare
<i>Fissidens azoricus</i> (P. de la Varde) Bizot	AZ	1	1		4	dd	na (2)	325	375.0	400	1	2	k	es	
<i>Fissidens bryioides</i> Hedw. s.l.		3	9	6	382	2.3	Aquat (16)	25	407.9	950	28	54			1. Species that are not rare
<i>Fissidens concernatus</i> Brugg.-Nann.	MAC	2	5	2	23	3.1	ExFor (11)	25	234.6	575	0	34	t		8. Restricted and scarce species with narrow ecological tolerance
<i>Fissidens crassipes</i> Wilson ex Bruch et Schump. subsp. <i>crassipes</i>		3	6	1	45	dd	na (2)	275	275.0	275	0	2			
<i>Fissidens crassipes</i> Wilson ex Bruch et Schump. subsp. <i>warnstorffii</i> (M.Fleisch.) Brugg.-Nann.		3	4	3	103	5.2	Aquat (11)	250	316.7	400	12	2			3. Species with narrow ecological tolerance
<i>Fissidens crispus</i> Mont.		3	4	2	44	dd	na (1)	dd	dd	dd	1	2			
<i>Fissidens curvatus</i> Hornsch.		1	1	1	7	dd	na (1)	dd	dd	dd	1	0	k		
<i>Fissidens dubius</i> P. Beauv.		3	6	3	92	dd	NaFor (5)	400	537.5	675	4	4			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Fissidens monguillontii</i> Thér.	1	1	1	dd	dd	dd	na (1)	dd	dd	dd	1	0	r		
<i>Fissidens pusillus</i> (Wilson) Milde	2	2	1	1	dd	dd	na (1)	100	100,0	100	0	2			3. Species with narrow ecological tolerance.
<i>Fissidens ritulatis</i> Bruch et Schimp.	3	7	1	94	3,9	Aquat (6)	500	685,7	800	800	9	11			3. Species with narrow ecological tolerance.
<i>Fissidens serratus</i> Müll. Hal.	2	4	3	28	dd	na (2)	650	650,0	650	650	4	1			3. Species with narrow ecological tolerance.
<i>Fissidens serrulatus</i> Brid.	3	9	9	566	4,5	NaFor (153)	75	557,5	1000	1000	122	262			3. Species with narrow ecological tolerance. 7. Restricted species with narrow ecological range.
<i>Fissidens sublineifolius</i> (P. de la Vardé) Brygg.-Nann.	3	6	4	163	4,9	Aquat (24)	800	800,0	800	800	37	1	r		1. Species that are not rare
<i>Fissidens taxifolius</i> Hedw. subsp. <i>pallidicaulis</i> (Mitt.) Mönk.	3	9	3	537	1,2	NaFor (23)	25	391,7	950	950	66	58			1. Species that are not rare
<i>Fissidens taxifolius</i> Hedw. subsp. <i>lazifolius</i>	3	8	6	84	4,6	Caves (48)	50	297,5	1000	1000	6	119			3. Species with narrow ecological tolerance.
<i>Fissidens viridulus</i> (Sw. ex anon.) Wahlb.	3	8	5	122	4,6	Caves (20)	25	318,5	600	600	12	32			3. Species with narrow ecological tolerance.
<i>Fontinalis antipyretica</i> Hedw.	3	3	1	27	dd	Aquat (9)	550	550,0	550	550	8	3			
<i>Funaria hygrometrica</i> Hedw.	2	2	2	107	1,6	Mesic (6)	325	360,0	500	500	10	6			1. Species that are not rare
<i>Glyphomitrium daviesii</i> (Dicks.) Brid.	2	2	1	10	dd	na (2)	200	200,0	200	200	3	0	r		
<i>Grimmia elongata</i> Kaulf.	1	1	1	40	dd	na (1)	1500	1500,0	1500	1500	1	0			
<i>Grimmia hartmannii</i> Schimp.	1	1	1	dd	dd	na (1)	dd	dd	dd	dd	0	1			
<i>Grimmia incarora</i> Schwägr.	1	1	1	15	dd	na (1)	2000	2000,0	2000	2000	1	0			
<i>Grimmia laevigata</i> (Brid.) Brid.	1	2	9	9	dd	na (2)	50	87,5	125	125	0	3			
<i>Grimmia lisae</i> De Not.	3	9	7	570	1,8	Mesic (61)	10	249,5	800	800	61	95			1. Species that are not rare
<i>Grimmia montana</i> Bruch et Schimp.	1	1	1	1	dd	na (0)	na (0)	na (0)	na (0)	na (0)	na (0)	na (0)			
<i>Grimmia pulvinata</i> (Hedw.) Sm.	3	4	13	13	dd	na (2)	25	25,0	25	25	2	2			3. Species with narrow ecological tolerance.
<i>Gymnostomum calcaearum</i> Nees et Hornsch.	3	6	5	177	7,1	Urban (6)	675	675,0	675	675	8	5			3. Species with narrow ecological tolerance.
<i>Gymnostomum viridulum</i> Brid.	1	1	1	25	dd	na (1)	dd	dd	dd	dd	0	2			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Gyrocampa tenuis</i> (Hedw.) Schimp.		1	1	1	16	dd	na (1)	300	300.0	300	0	1			
<i>Heterogiella striatella</i> (Brid.) Iwals.		1	2	2	2	dd	na (1)	150	175.0	200	0	2			
<i>Heterocladium flaccidum</i> (Schimp.) A.J.E. Sm.		2	2	1	11	12,2	Caves (24)	275	435.4	600	1	24			5. Scarce species with narrow ecological tolerance
<i>Heterocladium heteropterum</i> (Brid.) Schimp.		3	9	9	437	3,6	NaFor (61)	100	564.0	1450	65	152			3. Species with narrow ecological tolerance
<i>Heterocladium wulfbergii</i> I. Hagen		3	7	6	142	3,7	NaFor (21)	100	618.1	1925	8	40			3. Species with narrow ecological tolerance
<i>Homalia lusitanica</i> Schimp.		1	1	1	35	dd	Aquat (5)	100	166.7	300	4	3			es
<i>Homalia webbiana</i> (Mont.) Düll		3	5	3	31	3,4	Aquat (12)	50	207.8	300	6	17	r	es	5. Scarce species with narrow ecological tolerance
<i>Homalothecium soricum</i> (Hedw.) Schimp.		2	3	1	31	dd	na (1)	100	150.0	200	3	0			
<i>Hookeria lucens</i> (Hedw.) Sm.		3	4	2	32	dd	NaFor (7)	625	793.8	975	3	4			
<i>Hygroamblystegium fluviatile</i> (Hedw.) Loeske		1	1		dd	dd	na (1)	50	50.0	50	0	1			
<i>Hygroamblystegium humile</i> (P. Beauv.) Vanderp., Goffinet et Hedénäs		1	1	1	11	dd	na (1)	650	650.0	650	2	1			
<i>Hygroamblystegium tenax</i> (Hedw.) Jenn.		2	2		1	dd	na (2)	600	750.0	900	4	0			
<i>Hygroamblystegium varium</i> (Hedw.) Mönk		3	4	3	68	dd	NaFor (5)	125	491.7	600	3	6			
<i>Hygrohypnum lurridum</i> (Hedw.) Jenn.		2	2	1	32	dd	na (1)	dd	dd	dd	0	3			
<i>Hylocomium splendens</i> (Hedw.) Schimp.		3	5	3	218	2,2	NaFor (19)	75	831.3	1500	30	9			1. Species that are not rare
<i>Hylocomium armoricum</i> (Brid.) Wijk et Marg.		1	4	2	52	2,4	NaFor (22)	200	640.4	700	30	15			2. Scarce species (rare by abundance)
<i>Hypnum andot Smith</i>		2	4	1	54	dd	na (2)	225	593.8	875	1	4			
<i>Hypnum cupressiforme</i> Hedw.		3	9	8	382	1,3	Mesic (61)	10	363.6	950	104	189			1. Species that are not rare
<i>Hypnum imponens</i> Hedw.		3	4	4	50	dd	na (2)	550	730.0	1025	7	2			
<i>Hypnum jutlandicum</i> Holmen et E. Warncke		3	9	5	145	1,7	NaFor (9)	150	475.0	850	12	20			1. Species that are not rare

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Hymnum uncinatum</i> Jur.	EUR	3	9	9	696	2.0	NaFor (452)	10	624.7	1500	326	487	r		1. Species that are not rare
<i>Innabryum alpinum</i> (Huds. ex With.) N. Pedersen		3	8	5	47	0.7	NaFor (7)	450	771.9	1550	6	8			2. Scarce species (rare by abundance)
<i>Isopterygium tenerum</i> (Sw.) Mitt.		2	4	4	64	7.1	PeBog (12)	300	583.9	675	3	14	e		5. Scarce species with narrow ecological tolerance
<i>Isoethidium atopocuroides</i> (Dubois) Isov.		2	2	1	1	dd	na (1)	dd	dd	dd	1	0			
<i>Isoethidium myosuroides</i> Bnd.		3	7	4	137	4.1	NaFor (7)	275	810.4	1500	11	7			3. Species with narrow ecological tolerance
<i>Isoethidium prolixum</i> (Mitt.) Stech, Sim-Sim, Tangney et D. Quandt	MAC	3	9	8	612	2.6	NaFor (265)	200	681.7	1925	134	225	r		4. Restricted species (rare by range)
<i>Kiaeria blighii</i> (Bruch et Schimp.) Broth.		1	1	1	15	dd	na (1)	2000	2000.0	2000	1	0			
<i>Kinabergia praelonga</i> (Hedw.) Ochyra		3	9	9	581	2.6	InPas (107)	10	455.0	1050	160	340			1. Species that are not rare
<i>Leptoharbula heurica</i> (De Not.) Schimp.		2	3	2	122	dd	Urban (4)	475	475.0	475	2	4			
<i>Leptobryum pyriforme</i> (Hedw.) Wilson		1	1	1	39	dd	PeBog (3)	dd	dd	dd	5	0			
<i>Leptodictyum riparium</i> (Hedw.) Warnst.		2	2	2	65	dd	Aquat; Parks (3)	dd	dd	dd	6	2			
<i>Leptopteris leptophyllum</i> (Müll. Hal.) J. Guerra et J. M. Cano	i	3	6	2	140	dd	Mesic (4)	dd	dd	dd	0	7			
<i>Leucobryum albidum</i> (P. Beauv.) Lindb.		3	7	6	217	1.3	NaFor (18)	175	615.4	1025	35	7			1. Species that are not rare
<i>Leucobryum glaucum</i> (Hedw.) Angstr.		3	7	6	220	5.2	PeBog (62)	250	612.6	950	46	77			3. Species with narrow ecological tolerance
<i>Leucobryum juniperoidum</i> (Brid.) Müll. Hal.		3	9	9	357	2.4	NaFor (201)	100	578.4	1000	27	298			1. Species that are not rare
<i>Leucodon canariensis</i> (Brid.) Schwägr.	MAC	2	3	1	76	dd	na (1)	50	141.7	275	1	4	r		
<i>Leucodon sciuroides</i> (Hedw.) Schwägr.		2	4	2	30	dd	InPas (6)	50	100.0	150	0	8			
<i>Leucodon treleasei</i> (Cardot) Paris	MAC	3	9	5	311	2.3	Mesic (7)	25	178.1	275	13	9	k		4. Restricted species (rare by range)
<i>Loeskeobryum brevistrore</i> (Brid.) M. Fleisch.		2	4	4	56	1.4	NaFor (10)	225	637.5	850	10	7			2. Scarce species (rare by abundance)
<i>Microcanthoptopus laevigatus</i> (Ther.) Giese et Frahm		3	8	7	293	1.7	NaFor (19)	275	564.3	925	28	48	r	r	1. Species that are not rare

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Minium laevum</i> Hedw.		3	6	4	145	1.4	NaFor (10)	375	638.0	1550	23	16			1. Species that are not rare
<i>Myurium hochstetteri</i> (Schimp.) Kindb.		3	9	9	977	1.6	NaFor (321)	10	610.5	1925	164	382			1. Species that are not rare
<i>Neckera cephalonica</i> Jur. et Unger	MAC	1	1	1	4	dd	na (1)	1500	1500.0	1500	1	0	k	es	
<i>Neckera complanata</i> (Hedw.) Huebener		1	1		dd	dd	na (0)	dd	dd	dd	0	1			
<i>Neckera crispa</i> Hedw.		3	4	2	8	dd	na (2)	625	625.0	625	2	0			
<i>Neckera intermedia</i> Brid.	IB	3	9	8	399	1.7	NaFor (31)	50	565.7	1925	60	52	rt	es	1. Species that are not rare
<i>Neckera pumila</i> Hedw.	MAC	1	1	1	dd	dd	Mount (3)	1000	1166.7	1500	3	0			
<i>Orthotrichum diaphanum</i> Schrad. ex Brid.		3	5	2	54	5.7	Urban (8)	100	100.0	100	12	2			5. Scarce species with narrow ecological tolerance
<i>Orthotrichum tenellum</i> Bruch ex Brid.		1	1	1	25	dd	na (1)	dd	dd	dd	2	0			
<i>Oxyrrhynchium hians</i> (Hedw.) Loeske		3	9	7	181	1.2	NaFor (9)	100	352.7	800	17	26			1. Species that are not rare
<i>Oxyrrhynchium pumilum</i> (Wilson) Loeske		3	9	5	231	2.0	Caves (9)	75	310.7	675	27	18			1. Species that are not rare 5. Scarce species with narrow ecological tolerance
<i>Oxyrrhynchium speciosum</i> (Brid.) Warnst.		2	5		48	9.2	Caves (20)	150	477.1	700	10	24			
<i>Philonotis arnellii</i> Husn.		1	2	1	3	dd	Aquat (3)	525	543.8	550	0	5			
<i>Philonotis caespitosa</i> Jur.		3	3	3	54	dd	na (2)	50	366.7	525	5	3			
<i>Philonotis calcarea</i> (Bruch et Schimp.) Schimp.		3	3	2	49	dd	na (2)	dd	dd	dd	3	0			
<i>Philonotis fontana</i> (Hedw.) Brid.		3	5	3	104	8.5	NaFor (8)	575	822.7	950	9	8			3. Species with narrow ecological tolerance
<i>Philonotis hastata</i> (Duby) Wijk et Margad.		3	6	4	142	1.6	Aquat (11)	50	497.2	1000	19	8	k		1. Species that are not rare
<i>Philonotis marchica</i> (Hedw.) Brid.		2	3	1	24	4.0	Aquat (10)	300	300.0	300	14	2			5. Scarce species with narrow ecological tolerance
<i>Philonotis rigida</i> Brid.		3	9	9	643	1.1	NaFor (43)	10	486.9	1050	74	86			1. Species that are not rare
<i>Philonotis tonnentella</i> Molendo		1	1		dd	dd	na (1)	dd	dd	dd	0	1			
<i>Philonotis uncinata</i> (Schwägr.) Brid.		3	8		dd	dd	na (0)	dd	dd	dd	0	2			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Physcomitrium pyriforme</i> (Hedw.) Brid.		1	2	1	19	dd	na (1)	dd	dd	dd	2	0			
<i>Plagiommium rostratum</i> (Schrad.) T. J. Kop.		2	3	1	2	dd	na (2)	450	450,0	450	2	1			
<i>Plagiommium undulatum</i> (Hedw.) T. J. Kop.		3	8	7	266	3,7	NaFor (50)	175	579,7	1000	39	81			3. Species with narrow ecological tolerance
<i>Plagiothecium nemorale</i> (Mitt.) A. Jaeger		3	8	8	352	6,0	NaFor (61)	100	543,1	1200	45	97			3. Species with narrow ecological tolerance
<i>Plagiothecium succulentum</i> (Wilson) Lindb.		2	4	3	6	dd	Aquat (6)	150	590,6	875	1	8			
<i>Plascenthyrchium meridionale</i> (Schimp.) M. Fleisch.		3	7	4	32	3,5	Parks (4)	175	325,0	550	6	7			5. Scarce species with narrow ecological tolerance
<i>Platyhypnidium riparioides</i> (Hedw.) Dixon		3	9	7	268	5,0	Aquat (40)	50	423,4	900	43	30			3. Species with narrow ecological tolerance
<i>Pleuridium acuminatum</i> Lindb.		3	5	2	75	dd	na (2)	dd	dd	dd	0	2			
<i>Pleuridium subulatum</i> (Hedw.) Rabenth.		3	4		dd	dd	Mesic (3)	dd	dd	dd	5	0			
<i>Pleurozium schreberi</i> (Brid.) Mitt.		3	6	5	63	2,1	NaFor (16)	425	786,9	1300	14	9			2. Scarce species (rare by abundance)
<i>Pogonatum aloides</i> (Hedw.) P. Beauv.		3	8	8	322	1,3	NaFor (36)	150	545,8	900	45	41			1. Species that are not rare
<i>Pogonatum nanum</i> (Hedw.) P. Beauv.		1	2	2	23	dd	NaFor (5)	750	775,0	800	8	0			
<i>Pogonatum urigerum</i> (Hedw.) P. Beauv.		2	2	1	64	3,4	NaFor (14)	350	703,6	800	17	2			5. Scarce species with narrow ecological tolerance
<i>Pohlia andalusica</i> (Höhn.) Broth.		1	1		dd	dd	na (1)	dd	dd	dd	1	0			
<i>Pohlia annotina</i> (Hedw.) Lindb.		3	7	6	76	0,9	NaFor (8)	800	885,0	1000	11	4			2. Scarce species (rare by abundance)
<i>Pohlia bulbifera</i> (Warnst.) Warnst.		2	2	2	76	dd	Aquat (3)	550	600,0	650	4	2			
<i>Pohlia cruda</i> (Hedw.) Lindb.		1	1	1	32	dd	Mount (3)	1225	1312,5	1400	3	0			
<i>Pohlia melanodon</i> (Brid.) A. J. Shaw		1	1	1	14	dd	na (1)	dd	dd	dd	2	0			
<i>Pohlia nutans</i> (Hedw.) Lindb.		1	1	1	1	dd	na (2)	1500	1500,0	1500	2	0			5. Scarce species with narrow ecological tolerance
<i>Pohlia prolifera</i> (Kindb.) Broth.		3	5	4	31	3,1	InPas (6)	550	550,0	550	5	13			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Phycostomum rubens</i> (Mitt.) D. T. Holyoak et N. Pedersen.		2	2	2	25	dd	na (2)	dd	dd	dd	0	2			
<i>Racomitrium aciculare</i> (Hedw.) Brid.		3	7	6	207	1,8	NaFor (24)	100	515,0	950	37	31			1. Species that are not rare
<i>Racomitrium aquaticum</i> (Brid. ex Schrad.) Brid.		3	6	4	52	2,5	NaFor (25)	300	633,8	850	22	15			2. Scarce species (rare by abundance)
<i>Racomitrium elongatum</i> Frisvoll		3	4	2	111	dd	NaFor (3)	800	1350,0	2200	4	4			
<i>Racomitrium ericoides</i> (Brid.) Brid.		1	1	1	dd	dd	na (1)	900	950,0	1000	3	0			
<i>Racomitrium fasciculare</i> (Hedw.) Brid.		3	7	4	104	6,1	NaFor (15)	250	1053,3	2350	16	17			3. Species with narrow ecological tolerance
<i>Racomitrium heterostichum</i> (Hedw.) Brid.		3	7	6	138	3,3	NaFor (14)	300	858,3	2300	26	6			3. Species with narrow ecological tolerance
<i>Racomitrium lanuginosum</i> (Hedw.) Brid.		2	5	5	164	3,7	NaFor (20)	100	1089,6	2350	27	32			3. Species with narrow ecological tolerance
<i>Rhabdoweisia fugax</i> (Hedw.) Bruch et Schimp.		1	1		dd	dd	na (0)	dd	dd	dd	1	1			
<i>Rhamphidium purpuratum</i> Mitt.	EUR	3	7	7	211	1,7	NaFor (38)	125	601,3	1050	23	79	v		1. Species that are not rare
<i>Rhizomnium punctatum</i> (Hedw.) T.J. Kop.		3	6	5	54	4,4	NaFor (7)	600	753,6	875	9	5			5. Scarce species with narrow ecological tolerance
<i>Rhynchosstegia bourgaeana</i> (Mitt.) Broth.		1	1		dd	dd	na (1)	75	75,0	75	2	0			
<i>Rhynchosstegia curviseta</i> (Brid.) Limpr.		3	4	3	20	dd	Mesic (3)	75	316,7	575	6	3			
<i>Rhynchosstegia duranti</i> (Mont.) P. Allorge et Perss.		3	4	2	11	dd	Mesic (3)	300	300,0	300	6	0	r		1. Species that are not rare
<i>Rhynchosstegia tenella</i> (Dicks.) Limpr.		3	8	5	226	1,3	InPas (5)	50	246,2	550	7	14			1. Species that are not rare
<i>Rhynchosstegium conjertum</i> (Dicks.) Schimp.		3	8	7	325	1,2	ExFor (17)	25	318,6	875	37	41			1. Species that are not rare
<i>Rhynchosstegium megalopolitanum</i> (E. Weber et D. Mohr) Schimp.		3	8	5	100	4,0	Urban (4)	350	666,7	900	10	10			3. Species with narrow ecological tolerance
<i>Rhytidadelphus loreus</i> (Hedw.) Warnst.		1	3	3	62	7,0	NaFor (13)	600	981,8	1500	11	12			5. Scarce species with narrow ecological tolerance
<i>Rhytidadelphus squarrosus</i> (Hedw.) Warnst.		3	8	7	281	2,6	InPas (68)	25	675,6	1200	31	142			1. Species that are not rare

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>1 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Rhytidadelphus subpinnatus</i> (Lindb.) T.J. Kop.		3	6	5	30	1.0	NaFor (8)	200	660.7	1000	9	13			2. Scarce species (rare by abundance).
<i>Schistidium aqassizii</i> Sull. et Lesq.		2	2	1	14	dd	NaFor (1)				1	4			
<i>Schistidium apocarpum</i> (Hedw.) Bruch et Schimp.		1	2	1	5	dd	na (2)	1500	1500.0	1500	2	0			
<i>Schistidium rivulare</i> (Brid.) Podp. et Huttunen		2	2		dd	dd	na (0)	dd	dd	dd	0	2			
<i>Sciro-hygnum plumosum</i> (Hedw.) Ignatov et Huttunen		3	9	9	452	1.2	NaFor (28)	25	460.4	1500	55	63			1. Species that are not rare
<i>Sciro-hygnum populneum</i> (Hedw.) Ignatov et Huttunen		3	9	7	350	1.3	Mesic (16)	75	383.2	925	31	34			1. Species that are not rare 2. Scarce species (rare by abundance).
<i>Scleropodium touretii</i> (Brid.) L. F. Koch		3	7	5	75	1.1	NaFor (9)	225	596.9	900	17	2			
<i>Scoplophila ligulata</i> (Spruce) Spruce et Loeske		1	1	1	25	dd	na (2)	400	400.0	400	0	2			
<i>Scorpiurium circinatum</i> (Brid.) M. Fleisch. et Loeske		3	9	9	409	1.9	Mesic (25)	10	184.8	550	28	49			1. Species that are not rare
<i>Senatopogon substrunulosum</i> (Hampe) Britton		3	9	9	389	1.9	NaFor (54)	10	426.4	875	51	102			1. Species that are not rare
<i>Sphagnum affine</i> Renauld et Cardot		2	3	1	17	dd	Mount (3)	550	895.0	1025	1	5			
<i>Sphagnum auriculatum</i> Schimp.		3	7	4	107	3.5	PeBog (47)	325	678.8	1025	19	116			3. Species with narrow ecological tolerance 5. Scarce species with narrow ecological tolerance
<i>Sphagnum capillifolium</i> (Ehrh.) Hedw.		2	4	3	52	9.4	PeBog (20)	550	688.3	950	0	32			5. Scarce species with narrow ecological tolerance
<i>Sphagnum centrale</i> C.E.O. Jensen		3	3	1	34	12.9	PeBog (213)	450	602.2	950	1	213			5. Scarce species with narrow ecological tolerance
<i>Sphagnum compactum</i> DC. ex Lam et DC.		2	2	1	6	dd	PeBog (10)	550	667.5	925	0	11			
<i>Sphagnum cuspidatum</i> Ehrh. ex Hoffm.		1	1	1	7	dd	NaFor, PeBog (4)	600	811.1	1025	0	11			
<i>Sphagnum girgensohnii</i> Russow		2	3	1	9	dd	NaFor (6)	dd	dd	dd	8	0			
<i>Sphagnum inundatum</i> Russow		3	3	1	dd	dd	na (2)	dd	dd	dd	3	2			
<i>Sphagnum magellanicum</i> Brid.		2	2	2	41	dd	NaFor (5)	600	668.8	1000	6	4			

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	OID IUCN criteria	Experts' opinion	Vulnerability Index
<i>Sphagnum nitidulum</i> Warnst. ex Warnst.	AZ	1	1	1	10	10.5	PeBog (14)	10	532.7	650	6	9	t		8. Restricted and scarce species with narrow ecological tolerance.
<i>Sphagnum palustre</i> L.		3	7	7	388	8.5	PeBog (350)	300	621.9	1225	53	466			3. Species with narrow ecological tolerance
<i>Sphagnum papillosum</i> Lindb.		3	7	6	106	9.1	PeBog (41)	450	558.3	725	28	44			3. Species with narrow ecological tolerance
<i>Sphagnum recurvum</i> P. Beauv.		1	1	1	22	dd	na (1)	dd	dd	dd					
<i>Sphagnum rubellum</i> Wilson		1	1	1	14	11.9	PeBog (22)	400	606.5	650	1	24			5. Scarce species with narrow ecological tolerance
<i>Sphagnum squarrosum</i> Crome		3	4	4	39	3.6	NaFor (6)	425	618.8	725	6	7			5. Scarce species with narrow ecological tolerance
<i>Sphagnum subnitens</i> Russow et Warnst.		3	7	6	408	4.1	NaFor (100)	325	706.0	1225	46	130			3. Species with narrow ecological tolerance
<i>Splachnobryum obtusum</i> (Brid.) Müll. Hal.	i	1	2	1	dd	dd	na (0)	dd	dd	dd	0	2			
<i>Syntrichia laevipila</i> Brid.		3	5	2	42	dd	Urban (5)	dd	dd	dd	6	1			
<i>Syntrichia ruralis</i> (Hedw.) F. Web. et D. Mohr		1	2		dd	dd	na (2)	100	100.0	100	2	1			
<i>Tetrastichium fontanum</i> (Mitt.) Cardot	IB-MAC	3	9	9	622	6.2	Caves (152)	50	533.4	1925	94	288	r		3. Species with narrow ecological tolerance
<i>Tetrastichium virens</i> (Cardob) S. P. Churchill	IB-MAC	3	9	8	389	3.0	NaFor (115)	75	479.9	1050	58	196	r		3. Species with narrow ecological tolerance
<i>Tiarnobryum alopecurum</i> (Hedw.) Nieuw.		3	9	9	331	2.5	NaFor (110)	75	566.1	1100	95	141			1. Species that are not rare
<i>Thamnobryum rudiophyllum</i> Mastracci	AZ	2	5	4	83	4.8	Caves (12)	500	608.3	700	10	23			8. Restricted and scarce species with narrow ecological tolerance
<i>Thuidium delicatulum</i> (Hedw.) Schimp.		1	1	1	4	dd	na (2)	800	800.0	800	0	2			
<i>Thuidium tamariscinum</i> (Hedw.) Schimp.		3	9	7	689	1.8	NaFor (402)	150	662.1	2300	185	563			1. Species that are not rare
<i>Timmella barbuloides</i> (Brid.) Mönk.		2	5	2	91	dd	na (2)	100	612.5	825	5	3			
<i>Tortella flavovirens</i> (Bruch.) Broth.		3	8	8	164	3.0	Mesic (18)	10	174.1	700	10	38			3. Species with narrow ecological tolerance
<i>Tortella fragilis</i> (Hook. et Wilson) Limpr.		1	1		dd	dd	na (1)	dd	dd	dd	0	1			

Species	Endemic groupings	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Tortella inflexa</i> (Bruch) Broth.		1	1		dd	dd	na (1)	dd	dd	dd	0	1			1. Species that are not rare
<i>Tortella nitida</i> (Lindb.) Broth.		3	8	6	197	1.4	Mesic (13)	10	245.5	550	20	22			
<i>Tortella squarrosa</i> (Brid.) Limpr.		2	3	2	37	dd	na (2)	125	308.3	400	2	4			
<i>Tortella tortuosa</i> (Hedw.) Limpr.		1	1		dd	dd	na (1)	dd	dd	dd	0	2			
<i>Tortella atrovirens</i> (Sm.) Lindb.		2	3	1	38	dd	na (2)	dd	dd	dd	4	0			
<i>Tortella bogostica</i> (Müll. Hal.) R. H. Zander	MAC	2	2	1	35	dd	na (1)	dd	dd	dd	0	2	e		
<i>Tortella canescens</i> Mont.		1	1		20	dd	na (1)	dd	dd	dd	0	1			
<i>Tortella cuneifolia</i> (Dicks.) Turner		3	6	3	96	dd	Urban (3)	350	350.0	350	8	1			3. Species with narrow ecological tolerance
<i>Tortella marginata</i> (Bruch et Schimp.) Spruce		3	5	4	182	4.2	Urban (9)	25	208.3	500	20	3			3. Species with narrow ecological tolerance 3. Species with narrow ecological tolerance
<i>Tortula muralis</i> Hedw.		3	9	7	279	3.0	Urban (9)	50	206.3	875	18	23			
<i>Tortula revolutens</i> (Schimp.) G. Roth		1	1		8	dd	na (1)	dd	dd	dd	0	1	k		
<i>Tortula solmsii</i> (Schimp.) Limpr.		3	4	2	197	4.4	Urban (5)	10	390.0	575	9	5	r		3. Species with narrow ecological tolerance 2. Scarce species (rare by abundance)
<i>Tortula truncata</i> (Hedw.) Mitt.		3	5	2	51	2.6	InPas (6)	325	392.9	800	2	11			
<i>Tortula vahliana</i> (Schultz) Mont.		1	1	1	56	dd	na (1)	150	150.0	150	0	2			
<i>Trematodon perssonorum</i> P. Allorge et Thér. ex V. Allorge	AZ	1	1	1	65	dd	Aquat (7)	150	266.7	400	8	3	k		
<i>Trichostomum brachydontium</i> Bruch		3	9	7	596	2.0	Mesic (45)	10	290.3	1500	89	91			1. Species that are not rare 3. Species with narrow ecological tolerance
<i>Trichostomum crispulum</i> Bruch		3	6	5	139	3.9	Coast (13)	25	188.8	800	21	7			3. Species with narrow ecological tolerance 5. Scarce species with narrow ecological tolerance
<i>Trichostomum triumphans</i> De Not.		2	4	3	33	3.4	Mesic (5)	10	30.0	50	12	2	k		5. Scarce species with narrow ecological tolerance
<i>Ulota catnescens</i> Wilson	EUR	3	6	3	65	5.3	NaFor (8)	600	927.3	1500	10	3			5. Scarce species with narrow ecological tolerance
<i>Ulota crispa</i> (Hedw.) Brid.		1	1	1	2	dd	na (1)	1200	1200.0	1200	0	1			5. Scarce species with narrow ecological tolerance

Species	Endemic grouping	Groups of Islands	Number of Islands	Presence in Island Parks	Number of 500 x 500 m cells	Lloyd Index (>11 records)	Habitat with highest number of records	Minimum altitude (m)	Mean altitude (m)	Maximum altitude (m)	Records <1976	Records >1975	Old IUCN criteria	Experts' opinion	Vulnerability Index
<i>Warnstorffia fluitans</i> (Hedw.) Loeske	3	6	5	5	55	1,8	Aquat (7)	525	590,0	775	5	12			2. Scarce species (rare by abundance).
<i>Weissia brachycarpa</i> (Nees et Hornsch.) Jur.	1	3	1	2	2	dd	na (2)	50	350,0	650	1	3			
<i>Weissia condensata</i> (Voit) Lindb.	1	3	2	93	1,5	ExFor (7)	10	257,1	600	600	2	26			1. Species that are not rare
<i>Weissia controversa</i> Hedw.	3	9	8	210	1,4	NaFor (13)	25	266,8	875	875	30	32			1. Species that are not rare
<i>Zigodion conoidens</i> (Dicks.) Hook. et Taylor.	2	4	2	73	dd	NaFor (5)	500	633,3	850	850	4	3			
<i>Zigodion rupestris</i> Schimp. ex Lorentz	2	4		dd	dd	Parks (3)	100	187,5	275	275	4	2			
<i>Zigodion viridissimum</i> (Dicks.) Brid.	3	9	7	301	3,0	ExFor (24)	25	242,1	800	800	38	50			3. Species with narrow ecological tolerance