

EXTINCTION RISK TO THE BRYOPHYTES IN SLOVAKIA, REASONS AND EVALUATION

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The paper is focused on the bryophytes we think are most threatened in Slovakia, all the species were red-listed according to the old IUCN categories. The specific conditions of Slovakia with respect of diaspores inflow are mentioned. The most vulnerable habitats for bryophytes are evaluated and the main anthropogenic changes with dramatic effect on bryophytes are identified. 40 species are given as examples of using the new IUCN criteria. The species are assigned to the new categories.

Key words: Bryophytes, IUCN criteria, threatened species, Slovakia.

Šoltés, R., Kubinská, A. & Janovicová, K. (2002). Risco de extinção dos briófitos na Eslováquia, razões e avaliação. *Portugaliae Acta Biol.* **20**: 57-63.

Este trabalho foca os briófitos que são considerados mais ameaçados na Eslováquia. Todas estas espécies estavam incluídas nas diferentes categorias dos antigos critérios da IUCN. São mencionadas as condições específicas da Eslováquia, no que respeita ao fluxo de diversos tipos de diásporos. São avaliados os habitats mais vulneráveis para estes briófitos, assim como são identificadas as acções antropogénicas mais importantes. São apresentadas, como exemplo, 40 espécies, e para cada uma é dado o seu estado de ameaça, de acordo com os novos critérios da IUCN.

Palavras chave: Briófitos, critérios IUCN, espécies ameaçadas, Eslováquia.

INTRODUCTION

At present 901 bryophyte species have been counted in Slovakia, 225 of which are liverworts, 2 *Anthoceros* species and 674 moss species. The Checklist of the bryophytes of Slovakia (KUBINSKÁ & JANOVICOVÁ 1998) and Protected plants and animals designated under the Act of Ministry of Environment reflect the basic knowledge on bryophytes. The Checklist of the bryophytes of Slovakia included an extensive listing of bryophytes considered threatened in Slovakia (60 species listed as endangered and 57 as vulnerable). Unfortunately, the Checklist used the original IUCN threat categories of Extinct, Endangered, Vulnerable and Rare. Since the revised threat categories are becoming more widely accepted, it is an urgent need to assign species to the new categories.

MATERIALS AND METHODS

Slovakia with its extend of 49 000 km² is a small country, so, a higher percentage of the species stock is Red Listed. The country is surrounded by other countries, but a great deal of the boundary consists of the Carpathian mountain range, so the inflow of propagules, counteracting the extinction risk, is much reduced. We think therefore that there is no point to „downgrade“ the threat categories. There is another reason. The majority of threatened bryophytes are restricted to specific habitats. A number of man-induced changes, such site destruction, affect these taxa in a negative way, and they are unable to cope with them, so decline or become extinct. Therefore, the main threat is decline in habitats, which counteract the „rescue effects“ of diaspore inflow.

The threat status has been re-assessed in the case of selected species, they were considered mostly as endangered or rare according to the old IUCN system. The species were selected subjectively to represent most endangered and retreating habitats. With respect to this, all the species are expected to be assigned as Threatened. The categories inside this group are decided by different thresholds in the four main criteria suggested by Hallingbäck (HALLINGBÄCK *et al.* 1998): (a) Large decline, (b) Small distribution area, fragmentation and decline, (c) Small population and decline, (d) Very small population or area. The criterion “Quantitative analysis” has not been used at all, since relevant data on the probability of extinction of Slovakian bryophytes are lacking.

The source of species data consists of:

- published data
- our own unpublished data
- herbaria collections

RESULTS AND DISCUSSION

The most vulnerable habitats for bryophytes are ancient forests, wet meadows and peatlands, alpine region, travertine springs, still or mild running waters, agrocoenosis and miscellaneous habitats such as walls, old roofs, animal excrements or vertical loess slopes (Tab. 1).

The bryophytes are becoming threatened mainly because of (in order of importance):

- destruction of wetlands by drainage or peatlands by mining
- air and water pollution
- forest and agricultural practices, i.e. use of fertilizers, pesticides

Three out of 40 species were selected to show the evaluation process.

Helodium blandowii

This species occurs in minerotrophic fens and survives in wooded fens. All the seven old sites were checked, only three locations were confirmed. Intensive searching during last five years has resulted in seven new locations being found, which were certainly overlooked in the past. The main threats to this species are wetlands destruction and natural afforestation.

A. Large decline

Over 40 years the number of sites has declined by 24%, i.e. the current decline is 6% per 10 yr.

B. Small distribution area, fragmentation and decline

The population is severely fragmented. Using the 10-km mesh size, the current area of occupancy is eight 10x10 km squares, creating isolated subpopulations (distance more than 120 km) with a reduced probability of recolonization (usually sterile plants, fertile observed in 1997), which meets the criteria for Vulnerable B1 status.

C. Small population and decline

Based on the assumption that the number of sites known at present is 10, the number of individuals is probably more than 10 000. The decline rate is 6% in 10 yr.

D. Very small population or area

The number of individuals is estimated to be more than 10 000, the number of location is more than 5.

Conclusion: *Helodium blandowii* was considered as Endangered according to the old IUCN system. It meets now the criteria for Vulnerable B1 status.

Oreas martiana

The species was discovered in the Tatra Mts. in 1999. The species grows here in a snow bed (snow cover persists to late spring), on mylonite rocks, with a slight humus layer and percolating water. The population is small and only four tufts were seen, the largest being 8 cm in diameter, covering an area of 50 cm². All the plants were sterile.

A. Large decline

Not applicable. No decline observed.

B. Small distribution area, fragmentation and decline

Not applicable. No decline observed.

- C. Small population and decline
Not applicable. No decline observed.
- D. Very small population or area.
Applicable. Fewer than 50 mature individuals counted as tufts. Critically Endangered D1.

Conclusion. Despite the fact that the population is thought to be currently stable and the legal protection of the national park is approved, Critically Endangered D1 status is the most appropriate assessment for *Oreas martiana*, since the population is extremely small and at the high altitude of 2240 m asl. is exposed to air pollutants.

Paludella squarrosa

Paludella squarrosa is confined to minerotrophic fens, requires habitats with lower level of underground water (-10 cm), and does not endure any overflowing. Its requirement in respect of the acidity and content of bivalent bases is wide compared to other rare species confined to the fens. In Slovakia, poor populations confined to the remnants of fens apparently tend towards extinction, and the process is accelerated due to natural succession.

All the twelve locations reported in the literature were checked. The species was confirmed in four locations. Searching possible habitats, only one new location has been found.

- A. Large decline
Declined, during 60 years the number of sites has declined by 50%, e.g. the current decline is 8% per 10 yr.
- B. Small distribution area, fragmentation and decline
Applicable. Declined from 14 localities in 9 10 x 10 km squares to seven localities in six 10 x 10 km squares, this qualifies for Vulnerable B1 status.
- C. Small population and decline
Applicable. The number of mature individuals certainly more than 2 500, less than 10 000, since all the populations are poor. Decline 10% in 10 yr meets the criteria for Vulnerable C1 status.
- D. Very small population or area
The number of individuals is estimated to be more than 1 000, the number of location is more than 5.

Conclusion. *Paludella squarrosa* was considered as Endangered according to the old IUCN system. The taxon meets now the criteria for Vulnerable B1 and C1 status.

The rarity criterion (D) was often used, reflecting the fact, that mainly rare species were selected. All A, B, C criteria were used for declining species, but most frequently was used the B criterion, since we know more about the distribution of species. In some cases detailed historical data are available, e.g. *Paludella squarrosa*, *Helodium blandowii*, *Calliergon trifarium*. These were published, or, more often, given by personal contact with the finder.

Tabela 1. Threatened species in Slovakia.

Habitat	Main threats	Protection	Threatened species	Threat category	References
Old, deep forests	Inappropriate forest practices, acid rains	Liaison between foresters and conservationists	<i>Buxbaumia viridis</i> <i>Neckera pennata</i> <i>Antitricha curtipendula</i>	VU,C2a EN,A1 VU,A1	Soldán 1992a
Wetlands	Drainage activities, peat cutting, mining, natural afforestation, air pollution	Selective removal of invading scrubs, keeping conservation orders	<i>Calliergon trifarium</i> <i>Helodium blandowii</i> <i>Paludella squarrosa</i> <i>Scorpidium scorpioides</i> <i>Drepanocladus lycopodioides</i>	CR,D1 VU,B1 VU,B1 CR,D1 CR,D1	Šoltés & Novák 1999 Kubinská & Janovicová 1998
Salt rich soils	Agricultural practices	Keeping conservation orders	<i>Desmatodon heimii</i> <i>Entosthodon hungaricus</i> <i>Pterygoneurum kozlovii</i>	CR,C2 CR,C2 CR,D1	Peciar 1966
Alpine habitats	Air pollution, global environmental change, rarity	Global environmental protection	<i>Oreas martiana</i> <i>Bryum wrightii</i> <i>Oreoweissia torquescens</i> <i>Schistidium boreale</i>	CR,D1 CR,D1 CR,D1 CR,D1	Pilous & Šoltés 2000, 2001
Fast running alpine streams	Air pollution, overcollecting	Global environmental protection	<i>Ochyraea tatrensis</i> <i>Hygrohypnum styriacum</i> <i>Hygrohypnum polare</i>	CR,D1 CR,D1 CR,D1	Váňa 1986 Somogyi 1999 Šoltés 1999
Still waters, mild running rivers	Water pollution, water table fall	Protection of the remaining sites by law	<i>Riccia cavernosa</i> <i>Riccia fluitans</i> <i>Riccia rhenana</i> <i>Ricciocarpos natans</i> <i>Physcomitrium eurystomum</i>	NT,B1 NT,B1 EN,B1 VU,B1 VU,B1	Kubinská & Janovicová 2000
Wooded fens	Natural succession	Keeping conservation orders	<i>Pseudobryum cinclidioides</i>	CR,D1	Soldán 1992b
Travertine springs	Commercial exploitation of the sources	Keeping conservation orders	<i>Bryum marratii</i> <i>Campylium elodes</i> <i>Didymodon tophaceus</i> <i>Riccardia incurvata</i>	CR,D1 EN,B1 NT,B1 CR,B1	Šmarda 1953; Pilous 1964

Tab. 1 (cont.)

Habitat	Main threats	Protection	Threatened species	Threat category	References
Arable fields	Agricultural practices	Preservation of the fields lying fallow at present	<i>Anthoceros agrestis</i>	NT,B1	Kubinská & Janovicová 2000
			<i>Entosthodon fascicularis</i>	NT,B1	
			<i>Ephemerum cohaerens</i>	VU,B1	
			<i>Phaeoceros carolinianus</i>	VU,B1	
			<i>Phascum curvicolle</i>	VU,B1	
			<i>Pyramidula tetragona</i>	CR,B1	
Old walls, ruins of castles	Site sanitation	Preservation of castle ruins, cultural monuments etc.	<i>Rhynchostegium rotundifolium</i>	EN,B1	Kubinská & Janovicová 2000
			<i>Orthotrichum urnigerum</i>	CR,B1	
Animals' dung	Grazing prohibition in the protected areas	Preservation of extensive grazing, preservation of secondary habitats (decaying stumps in virgin forests, peatlands, etc.)	<i>Splachnum ampullaceum</i>	CR,B1	Kubinská & Janovicová 2000
			<i>Splachnum sphaericum</i>	CR,B1	
			<i>Tayloria splachnoides</i>	CR,B1	
			<i>Tayloria tenuis</i>	CR,B1	

One important factor has not been taken into consideration. We cannot estimate the effects from the load of air pollution within the high altitude alpine region, e.g. affecting the alpine species like *Bryum wrightii*, *Oreas martiana*, *Oreoweissia torquescens*, *Ochryraea tatrensis* and others. Newertheless, all the species met the highest criterion Critically Endangered.

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