

The first experience with the IUCN criteria and the first evaluated 190 bryophyte species for the Latvian Red Data Book

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Historical background

In Latvia, the terms are strictly separated – legally protected species versus rare or endangered species. Not only linguistically, but also in principle, the treatment towards species included in either the first or second group (but often both) is different. One can be fined for destroying a site of a protected species, but there is almost no liability for destroying a "simply" rare species. At the political level, in modern society, species in Latvia have been protected since 1957, then in 1977 and 1987, the species lists were repeatedly revised. During the 16th-18th century, the emphasis was placed only on the protection of game animals and birds, then since the 20th century it has been extended to other vulnerable groups of organisms as well, like bats, reptiles, rare species of plants and insects, etc. After regaining independence, a new list of especially protected species of Latvia was issued in 2000, and it included 129 bryophyte species for the first time. The selection of bryophytes was based on the work by A. Āboliņa (1994), which includes 203 rare and endangered or extinct bryophyte species. In the Āboliņa's list, each species was assigned to one of 5 categories (0 – Extinct; 1 – Endangered; 2 – Vulnerable; 3 – Rare; 4 – Indeterminate).

In parallel with the legal protection of species, lists of rare and endangered species were also prepared and included in the Latvian Red Data Book, which serves more to inform the public about nature values. It was published twice - in 1980 (1st edition) and in 1996-2003 (2nd edition). However, for various reasons, bryophytes, unlike fungi or lichens, were not included in the volumes of the Latvian Red Data Books and remained only as a working version of the project. Draft materials contained descriptions and distribution maps of almost 100 bryophyte species. Since 2020, this topic is back on agenda, and work is underway on the 3rd edition of the Latvian Red Data Book, which will finally include a volume on bryophytes.

The new upcoming Latvian Red Data Book according to IUCN criteria

The material is being prepared within the LIFE project "Threatened species in Latvia: improved knowledge, capacity, data and awareness" (LIFE19GIE/LV/000857, LIFE FOR SPECIES, duration 2020-2024). For the first time in Latvia, the threat category of all organisms is assessed according to IUCN criteria, and cryptogams are also included – bryophytes, charophytes, fungi, lichens.

In the first stage of the work, 308 rare or endangered species were selected from the current taxon list with 648 bryophyte species (Bambe et al., 2023). Further in the work process, after analyzing the available information about the known records, the number of species to be evaluated was reduced to 190 bryophytes, focusing on rare, especially protected, economically important species, as well as 30 extinct species in the region. The information of the records has been limited to the period after 1970 (i.e. no older than 50 years) and the available data from herbariums and databases, as well as personal observations, have been taken. Mainly, two digital databases were used – the "OZOLS" system of the Nature Conservation Agency, which stores results of national monitoring, the species records obtained during the development of nature

protection plans or environmental impact assessments by certified habitat experts, data of the "Nature Census" project, etc. The second most important source was the nature observation portal Dabasdati.lv, where the general public submits their observations of the species and supplements them with a photograph so that the administrators can make sure of the correctness. It is estimated that 13,400 records of bryophyte species have been revised during the project. 12 Latvian experts participated in the evaluation of bryophyte species – both directly working in the project and volunteers invited from outside, mainly from the Bryologists Group of the Latvian Botanical Society. The rules claim that evaluation result of each species should be checked by an independent reviewer, and thus three foreign bryologists with experience in IUCN evaluation of bryophytes were recruited - N. Ingerpuu, K. Vellak from Estonia and I. Jukoniene from Lithuania. Thanks to foreign experts, the approach to species assessment fundamentally changed.

Since bryophyte population studies have hardly been carried out in Latvia, it was almost impossible to apply the IUCN evaluation criteria A and C, which are based on long-term and repeated observations of the species, in order to conclude about the population decline or stability (IUCN, 2012). Except for several bryophyte species of the European Directive, which are included in the national monitoring and are surveyed every 6 years, there are almost no such data available for other species. Therefore, for most species (similar to other countries), criteria B (estimation of the geographical distribution of the species) and D (used for rare species with limited populations) were applied.

The biggest misconception was about understanding what a fragmented population is. It was problematic for the Latvian collective to accept that the case of fragmentation according to the IUCN criteria occurs only in case of a significantly large distance between populations, i.e. 50 km for species with vegetative propagation and 100 km with sexual reproduction. This basically means that all metapopulations of a species located, for example, in Courland (a region of about 150x200 km in the western part of Latvia) would almost never correspond to this parameter. As a result of misinterpretation, several species were initially assessed with a higher threat category than meets the conditions. But after re-evaluation, this "defect" has been eliminated.

The terminology used to define each find, observation or report also caused relatively big problems, as only the term "location" is used according to the IUCN criteria. It assumes that all individuals of the species may perish due to a greater or lesser natural or artificial disturbance. A single "location" can include a group of several geographically separated records and this can significantly change the assigned category (1 "location" is sufficient for the CR category, ≤ 5 for the EN category, while ≤ 10 for the VU). Due to misinterpretation, there were cases where a species was wrongly assessed as less threatened, but its actual number of locations was significantly lower than the total number of finds.

In bryology in general we have to face the problem of how to interpret the individual. Literature research was helpful, explaining how to count individuals of bryophytes with different growth forms (Hallingbäck et al., 1998). All specimens of the same species growing on a single log (e.g. *Odontoschisma denudatum* mat) or on a living tree (e.g. each cushion of *Ulota* species) are assumed to be one individual.

Using geographic distribution criteria, the Area of Occupancy (AOO) and Extent of Occurrence (EOO) of each species were calculated with the GeoCAT computer program. Due to the specific shape of Latvia's border, the EOO value was often higher than in reality, as the Gulf of Riga is not a suitable environment for any of the described bryophyte species. As a result, the

calculated EOO value and automatically proposed category were not always taken into account because the correct category was higher.

When all species were evaluated, we realized that several natural forest habitat indicator species, which are better known and receive more attention from habitat experts, generally obtained a higher number of records than other less known species. As a result, these valuable species got the misleading effect that they are not rare, although in fact their ecology is specific with habitat, substrate and microniche dependence. It has also been observed that several such species were strictly associated with Natura 2000 areas or nature reserves but were almost never found outside them. This was explained in two ways – because there are actually fewer suitable habitats outside protected areas, however, the fact that more experienced bryologists surveyed the nature reserves more often has a more significant effect. Therefore, even species exist outside these areas, they are simply not listed. Because of this, it was assumed that species outside nature reserves are at greater risk of being destroyed, as they are almost impossible to protect. We conducted literature studies and used as an example the approach of Swedish bryologists to estimate population size of individual species (Hallingbäck et al., 2020). As a result, the C criterion was used for seven species – *Calypogeia suecica*, *Hylocomiastrum umbratum*, *Lophozia ascendens*, *Plagiothecium latebricola*, *Scapania apiculata*, *Scapania nemorea*, and *Riccardia palmata*. Populations are assumed to be declining (based on deforestation tendency outside protected areas and concrete evidence that habitat has already been cleared) and these species were moved from the originally assigned NT category to VU C1C2a(i).

Results

In total, 190 bryophyte species have been evaluated during the project. A form with a detailed morphological description and information on the species' population, ecology, habitats, distribution map has been prepared for 160 species; the remaining 30 species are regionally extinct without detailed information. In general, the assigned categories according to the number of species are as follows: RE, regionally extinct – 30; CR, critically endangered – 12; EN, endangered – 29; VU, vulnerable – 39; NT, near threatened – 45; LC, least concern – 20; DD, data deficient – DD 15 (Figure 1). The most frequently used was criterion B – for 55 species, as well as for 2 species in combination with criterion A and for 4 species in combination with criterion D; criterion C was used for 7 species and criterion D for 12 (no criteria are assigned to categories such as NT, LC and DD, so the reported number of species here differs from the total number of assessed species).

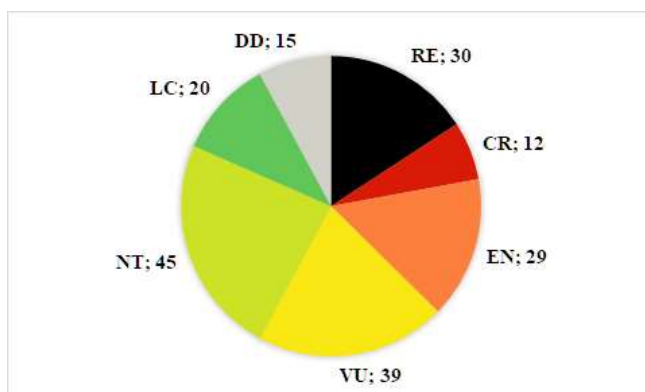


Figure 1. Assigned IUCN categories for the 190 bryophyte species of new Latvian Red Book.

Most of the species assessed as threatened in Latvia correspond to the LC category on a European scale. For example, *Amblyodon dealbatus* is assessed as CR B1B2ab(i,ii,iii), 4 now extinct locations were known in Latvia and only 1 population is left on Rauna's Staburags. The species is associated with calcareous fens and spring fens, as well as limestone quarries, which in general are rarely found in our country. On the other hand, in Europe, especially in mountain regions, the species is in better state, and although a decline has been observed, the category is LC (Campisi et al., 2019). There are also other examples of such species from similar habitats (*Bartramia ithyphylla*, *Cinclidotus danubicus*, *Encalypta ciliata*, etc.), which are assessed as CR in Latvia, but stable in Europe (Bergamini & Schröck, 2019; Sabovljevic & Schröck, 2019; Sabovljevic et al., 2019). The opposite is the case with some peatland species such as *Helodium blandowii* – In Latvia with 105 deposits it is assessed as LC, but on a European scale it corresponds to NT (Hodgetts, 2019), because its typical habitat – the rich fen – is rapidly decreasing. In Latvia, the species is more plastic, it is also found in transitional mires, lake shores and wet forests, and feels stable. A similar example is *Geocalyx graveolens* – a swamp forests species, for which 344 deposits are known in Latvia, and assessed as LC. In Europe, it is assessed as NT due to threats posed by logging (Konstantinova, 2019). Cases of such species show the importance of national nature conservation, as we can never be sure where a species may disappear and where it will survive as the last viable population. From this point of view, we can be very proud of *Tortula lingulata* (NT in Latvia and in Estonia (Vellak et al., 2023)), VU in Europe (Baisheva et al., 2019)). The species is found in the valleys of large rivers on outcrops in Latvia, and its main distribution range is Latvia and Estonia with 2/3 of the species' world population (Figure 2), with only isolated locations in Czechia, Germany and the Leningrad region of Russia.



Figure 2. The main distribution range of *Tortula lingulata* in the world.

These are the first Latvian results on the evaluation of bryophyte species according to IUCN criteria, however, we understand that the work is not finished yet. There are still 458 remaining species of bryophytes, which should also be assigned a threatened category in the near future, similar to what our northern neighbours have already done (Ingerpuu et al. 2018 Vellak et al., 2023).

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