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# On the mend of bryophyte conservation in Spain: preparing a proposal for the inclusion of bryophytes in national species protection catalogues

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**Abstract.** The Spanish bryoflora contains 1291 taxa, 272 of them included in the Spanish Red List under any threat category. Although bryophytes show a low rate of endemism compared to vascular flora, Spanish administration's responsibility for the conservation of these plants is very high, since the country has 63 exclusive or rare species on a European or world scale. However, the representation of this group of plants in the Spanish legislation on species conservation is merely anecdotal. Royal Decree 139/2011 of 4 February develops a list of wild protected species (LESRPE and CEEA, Spanish abbreviations) and includes only 10 species of bryophytes, all of them from the Directive Habitats and the Bern Convention. The legal protection of endangered species of bryophytes is needed, not only to ensure the integrity of the most sensitive bryophyte populations, but also because it will result in the overall protection of their habitats and other species that coexist with them. Their inclusion in LESRPE and CEEA will allow a periodical monitoring of the species and a better assessment of the success or failure of commonly used management measures. The criteria for the incorporation of species into national protection catalogues are rather restrictive and inclusion of species without specific studies is not easy. During the work developed for the Atlas and Red Data Book of the threatened bryophytes of Spain, valuable information was obtained in this sense, although it covered only a fraction of the total number of species on the Red List (74 species were evaluated). Based on the available information, a list of species has been drawn to elaborate a proposal that should be raised to the Spanish Ministry of Agriculture and Fisheries, Food and the Environment, which would imply a qualitative leap in the level of protection of this neglected group of plants and a new impetus to the necessary work started at the first phase of the Bryophyte Atlas.

**Keywords:** Threatened species; protection; mosses; liverworts; Spain.

## Mejorando la conservación de los briófitos en España: elaboración de una propuesta de inclusión de briófitos en los catálogos nacionales de protección de especies

**Resumen.** La lista española de briófitos está formada por 1291 táxones y la lista roja española menciona 272 de ellos bajo alguna categoría de amenaza. A pesar de que presentan una baja tasa de endemismo en comparación con la flora vascular, la responsabilidad de la administración española en la conservación de los briófitos es muy elevada, ya que el país alberga 63 especies exclusivas o raras a escala europea o mundial. Sin embargo, la representación de este grupo de plantas en la legislación española de conservación de especies es meramente anecdótica. El Real Decreto 139/2011, de 4 de febrero desarrolla una lista de especies silvestres protegidas (LESRPE y CEEA) y tan solo recoge 10 especies de briófitos, todas ellas procedentes de la Directiva de Hábitats y el Convenio de Berna. La protección legal de las especies amenazadas de briófitos es una necesidad, no solo por garantizar la integridad de las poblaciones más sensibles de briófitos, sino porque redundará en la protección global de sus hábitats y de otras especies que con ellos conviven. Su inclusión en LESRPE y CEEA permitirá un seguimiento periódico de las especies y una mejor valoración del éxito o fracaso de las medidas de gestión comúnmente utilizadas. Los criterios existentes para la incorporación de especies a los catálogos de protección nacionales son bastante restrictivos y no es sencilla la inclusión de especies sin estudios específicos. Durante los trabajos desarrollados para el Atlas y Libro Rojo de los briófitos amenazados de España, se obtuvo información valiosa en este sentido, aunque solo cubrió una fracción del total de especies de la lista roja (74 especies evaluadas). Con la información disponible se ha realizado una lista de especies para elaborar una propuesta para elevar al Ministerio español de Agricultura y Pesca, Alimentación y Medio Ambiente, que puede suponer un salto cualitativo en el nivel de protección de este desatendido grupo de plantas y un nuevo impulso a los necesarios trabajos iniciados en la primera fase del Atlas.

**Palabras clave:** Especies amenazadas; protección; musgos; hepáticas; España.

### Introduction

The Spanish Red List of bryophytes (Brugués & González-Mancebo, 2014) includes 272 out of 1291 species living in Spain (data after Hodgetts, 2016a,b). Although they have a low rate of endemism compared to vascular flora (Aedo & *al.*, 2013), Spanish administration's

responsibility for bryophyte conservation is very high (Table 1), since there are 8 exclusive species, 41 Iberian, Macaronesian, Mediterranean or European endemics, and 14 rare species at European or world scale in Spain (Infante & *al.*, 2017). However, the representation of this plant group in the Spanish legislation of species conservation is merely anecdotal.

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Table 1. Endemic or rare bryophytes present in Spanish territory. Species marked (\*) are not included in the proposal due to insufficient information or because they are not considered as threatened. *Syntrichia abranchesii* (\*\*) is considered extinct (Gallego & al., 2012) and therefore does not qualify for its inclusion in official national catalogues.

Taxon	Spanish endemisms	Other endemisms	Rare species
* <i>Acaulon dertosense</i> Casas & al.	Peninsular Spain		
<i>Aschisma cuynetii</i> (Bizot & R.B. Pierrot) J. Guerra & Cano	Peninsular Spain		
* <i>Cinclidotus vivesii</i> Ederra & J. Guerra	Peninsular Spain		
<i>Exsertotheca baetica</i> (J. Guerra, J.F. Jiménez & J.A. Jiménez) Draper & al.	Peninsular Spain		
<i>Grimmia curviseta</i> Bouman	Canary Islands		
<i>Orthotrichum casasianum</i> F. Lara, Garilleti & Mazimpaka	Peninsular Spain		
<i>Orthotrichum handiense</i> F. Lara, Garilleti & Mazimpaka	Canary Islands		
** <i>Syntrichia abranchesii</i> (Luisier) Ochyra	Peninsular Spain		
<i>Andoa berthelotiana</i> (Mont.) Ochyra		Macaronesian	
<i>Anomobryum lusitanicum</i> (I. Hagen in Luisier) Thér.		Iberian	
<i>Bryum minii</i> Podp.		Iberian	
* <i>Dicranum crassifolium</i> Sérgio, Ochyra & Séneca		European	
* <i>Didymodon erosus</i> J.A. Jiménez & J. Guerra		European	
<i>Entosthodon commutatus</i> Durieu & Mont.		Mediterranean- Canary Islands	
* <i>Entosthodon kroonkurk</i> Dirkse & Brugués		Iberian-Macaronesian	
* <i>Exormotheca welwitschii</i> Steph.		Iberian	
<i>Fissidens coacervatus</i> Brugg.-Nann.		Macaronesian	
* <i>Fossombronina mittenii</i> Tind.		Mediterranean	
<i>Goniomitrium seroi</i> Casas		Iberian-Macaronesian	
* <i>Grimmia horrida</i> J. Muñoz & H. Hespanhol		Iberian	
<i>Gymnomitrium crenulatum</i> Gottsche ex Carrington		European	
<i>Isothecium algarvicum</i> W.E. Nicholson & Dixon		Iberian-Macaronesian	
<i>Microbryum longipes</i> (J. Guerra, J.J. Martínez & Ros) R.H. Zander		Iberian	
* <i>Lewinskya iberica</i> (F. Lara & Mazimpaka) F. Lara, Garilleti & Goffinet		European+Rif (Morocco)	
* <i>Orthotrichum comosum</i> F. Lara, Medina & Garilleti		Mediterranean- Macaronesian	
* <i>Orthotrichum macrocephalum</i> F. Lara, Garilleti & Mazimpaka		Mediterranean	
* <i>Lewinskya tortidontia</i> (F. Lara, Garilleti & Mazimpaka) F. Lara, Garilleti & Goffinet		Mediterranean	
* <i>Orthotrichum vittii</i> F. Lara, Garilleti & Mazimpaka		Mediterranean	
<i>Plagiochila maderensis</i> Gottsche ex Steph.		Macaronesian	
<i>Pseudotaxiphyllum laetevirens</i> (Dixon & Luisier ex F. Koppe & Düll) Hedenäs		Iberian-Macaronesian	
* <i>Pterygoneurum sampaiianum</i> (Mach.) Mach.		European	
* <i>Racomitrium hespericum</i> Sérgio, J. Muñoz & Ochyra		Iberian	
<i>Radula holtii</i> Spruce		European	
<i>Radula jonesii</i> Bouman & al.		Macaronesian	
<i>Radula wichurae</i> Steph.		Macaronesian	
<i>Rhynchostegiella bourgaeana</i> (Mitt.) Broth.		Macaronesian	
* <i>Rhynchostegium confusum</i> K. Cezón & al.		Iberian	
<i>Riella bialata</i> Trab.		Mediterranean	

Taxon	Spanish endemisms	Other endemisms	Rare species
<i>Riella echinata</i> (Müll. Frib.) Segarra, Puche & Sabovl.		Mediterranean- Canary Islands	
<i>Riella helicophylla</i> (Bory & Mont.) Mont.		Mediterranean	
<i>Riella mediterranea</i> Segarra & al.		Mediterranean	
<i>Riella notarisii</i> (Mont.) Mont.		Mediterranean- Canary Islands	
<i>Schizymenium pontevedrense</i> (Luisier) Sérgio & al.		Iberian	
<i>Syntrichia minor</i> (Bizot) M.T. Gallego & al.		European	
<i>Telaranea azorica</i> (H. Buch & Perss.) Pócs ex Schumacker & Váňa		Macaronesian	
<i>Tetrastichium fontanum</i> (Mitt.) Cardot		Iberian-Macaronesian	
<i>Tetrastichium virens</i> (Cardot) S.P. Churchill		Iberian-Macaronesian	
* <i>Triquetrella arapilensis</i> Luisier		Iberian	
* <i>Zygodon catarinói</i> C.A. Garcia & al.		Mediterranean	
<i>Anthoceros caucasicus</i> Steph.			globally rare
<i>Bryoerythrophyllum inaequalifolium</i> (Taylor) R.H. Zander			only European pop.
<i>Bryum tenuisetum</i> Limpr.			rare in S Europe
<i>Calypogeia suecica</i> (Arnell & J. Perss.) Müll. Frib.			rare in S Europe
<i>Fissidens serratus</i> Müll. Hall.			only European pop.
<i>Hypnum uncinulatum</i> Jur.			rare in Europe
* <i>Orthotrichum hispanicum</i> F. Lara, Garilleti & Mazimpaka			globally rare
<i>Plagiochasma appendiculatum</i> Lehm. & Lindenb.			only European pop.
<i>Riella affinis</i> M. Howe & Underw.			globally rare
<i>Riella cossoniana</i> Trab.			globally rare
<i>Schistidium occidentale</i> (E. Lawton) Churchill			only European pop.
<i>Sphagnum pylaesii</i> Brid.			globally rare
<i>Tetralophozia filiformis</i> (Steph.) Urmi			only European pop.
<i>Tortella alpicola</i> Dixon			two European pop.

The Spanish List of Wild Species in Special Protection Regime (LESRPE) and the Spanish Catalogue of Threatened Species (CEEA) are the legal instruments for the conservation of wild species in Spain (L. 42/2007 and R.D. 139/2011). The presence of a taxon (or population) in these catalogues entails their periodic evaluation and the prohibition of negatively affecting their situation.

LESRPE includes taxa and populations under the only category of *Special Protection*, worth of attention and protection due to their scientific, ecological or cultural value or threat level, as well as taxa protected by international conventions ratified by Spain. The CEEA is considered part of LESRPE and it is reserved for species whose survival is or may become unlikely. The CEEA includes the categories *Endangered* (E), *Vulnerable* (V) and *Critical Situation* (SC). The presence in the CEEA implies consideration as a threatened species for the purposes of the Penal Code.

At present, only 10 bryophyte species are included in LESRPE or CEEA, all of them coming from the Annexes of the Habitats Directive or the Bern Convention (Table 2). Two additional species are pending incorporation: *Dicranum viride* (Sull. & Lesq.) Lindb. (Bern Convention

and Habitats Directive) and *Pyramidula tetragona* (Brid.) Brid. (Bern Convention).

Regarding the regional catalogues, it should be noted that only 9 out of the 17 autonomous communities (regional administrations with competence in management of the territory) include bryophytes in their catalogues of protected flora. In total, the regional catalogues include 75 taxa, Catalonia and Galicia being the regions with the highest number of protected bryophytes.

Considering the national and regional catalogues as a whole, the list of bryophytes with some degree of protection in at least part of the Spanish territory amounts to 80 taxa, which exhibit a very unequal geographical distribution (Infante & al., 2017).

The inclusion of bryophytes in the national catalogues is still a pending subject that would need specific population surveys, but there is room for improvement based on the available information. Therefore, a proposal will be submitted to the Spanish Ministry of Agriculture and Fisheries, Food and the Environment (MAPAMA), which could mean a qualitative leap in the level of protection of this neglected group of plants.

Table 2. Bryophytes included in the national catalogues for species protection, with their threat category in the Red Lists of Spain (Brugués & González-Mancebo, 2014), Peninsular and Balearic Spain (Brugués & *al.*, 2014) and of the Canary Islands (González-Mancebo & *al.*, 2013).

Taxa	Spain	Peninsular and Balearic Spain	Canary Islands	LESRPE/CEEA
<i>Bruchia vogesiaca</i> Schwägr.	EN	EN		Special Protection
<i>Buxbaumia viridis</i> (DC.) Moug. & Nestl.	VU	VU		Vulnerable
<i>Echinodium spinosum</i> (Mitt.) Jur.	CR		CR	Special Protection
<i>Hamatocaulis vernicosus</i> (Mitt.) Hedenäs	EN	EN		Special Protection
<i>Jungermannia handelii</i> (Schiffn.) Amakawa	CR	CR		Special Protection
<i>Marsupella profunda</i> Lindb.				Special Protection
<i>Orthotrichum rogeri</i> Brid.				Special Protection
<i>Petalophyllum ralfsii</i> (Wilson) Nees & Gottsche	VU	VU		Special Protection
<i>Riella helicophylla</i> (Bory & Mont.) Mont.	EN	EN		Special Protection
<i>Sphagnum pylaesii</i> Brid.	LC	LC		Special Protection

## Material and Methods

The process of inclusion of a species in the LESRPE or CEEA requires the contribution of information according to an official form for scientific argument established by the MAPAMA for proposals for inclusion, exclusion or change of category of taxa in both lists of protected species (Resolution 2977 on March 6th 2017). It is particularly detailed in the case of CEEA, as can be seen in Table 3, and somewhat less profuse in the case of

LESRPE (note that CEEA is a more restrictive section within the LESRPE). For the proposal of inclusion at LESRPE only fields marked with an asterisk should be filled in.

With the information provided in the form, the species will be evaluated for inclusion in CEEA following the criteria published at the Resolution 2977 on March 6<sup>th</sup> 2017 summarized in Table 4. Species in LESRPE fall under the only category of *Special Protection* and there are no published criteria.

Table 3. Content of the official form for scientific argument established by the MAPAMA for proposals for inclusion, exclusion or change of category of taxa in the Spanish List of Wild Species in Special Protection Regime (LESRPE) and the Spanish Catalogue of Threatened Species (CEEA). Published at Resolution 2977 on March 6<sup>th</sup> 2017.

Official form for scientific argument
Scientific name *
Taxonomic observations
Common name
Taxonomic status
Proposal * (inclusion in LESRPE/CEEA, exclusion, modification)
Person responsible for the proposal *
Experts, Intuitions o Autonomous Communities supporting the proposal
Abstract of the proposal and supporting criteria *
National regulation status
Regional regulation status
European regulation status
Category in Red Lists and Red Data Books
Distribution. Evolution *
Population size. Evolution *
Habitat description *
Biology and ecology
Threats
Specific conservation actions needed
More information
Literature references *
Proposal date *

Table 4. Criteria for the assignment of categories SC, E and V in the Spanish Catalogue of Threatened Species (CEEA). Published at Resolution 2977 on March 6<sup>th</sup> 2017.

Criteria	Critical Situation (SC)	Endangered (E)	Vulnerable (V)
A. Population decline			
A1	≥ 90%	≥ 70%	≥ 50%
A2	≥ 80%	≥ 50%	≥ 30%
A1: Reduction of the population (observed, estimated or inferred) in the last 10 years or 3 generations, whatever longer			
A2: Reduction of the population statistically inferred for the next 10 years or 3 generations, whatever longer			
B. Area of distribution (number of 1x1 km squares)			
B1, B2	≥ 75%	≥ 50%	≥ 25%
B1: Reduction of the area of distribution (observed, estimated or inferred) in the last 30 years			
B2: Reduction of the area of distribution statistically inferred for the next 20 years or 3 generations whatever longer			
B3 (only for V): Reduction of the area of distribution ≥ 50% during the last 100 years and not having recovered 50% of its historical distribution (early XX century)			
C. Analysis of population viability			
	≥ 50%	≥ 35%	≥ 15%
Probability of extinction in 20 years or 4 generations (3 generations for SC), whatever longer			
D. Expert criterium			
Insufficient information available but scientific consensus exists			

The fulfillment of the criteria for this argumentation requires specific studies to be carried out on each species, such as those implemented for the *Atlas and Red Data Book of Threatened Bryophytes of Spain* (ABrA, Garilleti & Albertos, 2012). Thus, the selection of the species included in this proposal is limited to those species for which adequate information is available. The criteria followed for the inclusion in the proposal are explained below:

— ABrA results: the 74 species treated in ABrA have been re-evaluated following the criteria published in the Official State Bulletin (BOE, Resolution 6 of March 2017) for the incorporation of species into the LESRPE/CEEA and it is proposed to include them in the catalogues with the most appropriate category within the official frame.

— Endemic and rare species: the information available for endemic and rare species has been revised and those that are sufficiently justified by their inclusion in the red lists have been selected in the proposal (those not selected are marked in Table 1). Exceptionally, *Riella mediterranea*, *R. echinata* and *R. bialata* are not included so far in the red lists, but proposed to be so by Segarra-Moragues & al. (2014) and Puche & Segarra-Moragues (2013), and thus they have also been selected.

Additionally, and only for some species, the proposal advises the protection of populations in the peninsular and Balearic territory, but not the populations in the Canary Islands, when they are not threatened in this territory.

The inclusion in LESRPE or CEEA depends in fact not only on the degree of threat, but on the type of information available. Since inclusion in CEEA is much more exigent, only those species treated in ABrA have the information with the quality required for evaluating their inclusion in CEEA. Furthermore, the categories assigned to species in this proposal do not necessarily match with those in the red lists because the criteria and

thresholds for the inclusion in LESRPE/CEEA are not equivalent to IUCN methods generally applied (IUCN, 2012).

## Results

Most species treated in ABrA not formerly included in LESRPE/CEEA are present in the proposal. Seven species out of 74 are not included because they are not considered threatened (*Anacolia menziesii* considered NT) or because they are extinct (RE or EX), since the official catalogues do not include species not found at present in the Spanish territory. Natural Heritage Act (Law 42/2007) provides for a list of extinct species, which is still pending preparation.

The endemic and rare species shown in Table 1 are also included, except those with insufficient information or not threatened, which are marked in the table (\*). Again, species considered extinct such as *Syntrichia abanchesii* cannot be included in the proposal.

The result of the assessments carried out is a list of 84 species detailed in Table 5. In summary, 47 species are proposed for inclusion in the CEEA: 29 in the Endangered category, 17 in the Vulnerable category and 1 in the Critical Situation category. The remaining 37 species are proposed for inclusion in the LESRPE out of CEEA.

## Discussion

Even with the information provided by ABrA, data on the population reduction (criterium A) is rarely available due to the lack of information on the previous extent of the populations. Criterium B referred to the decline in the area of distribution has been used when loss of localities has been detected. The most widely used criterium is

D (expert criterium), well grounded on the detailed information provided by ABrA. Despite being considered of exceptional use by the normative, we believe that the arguments are solid and that the scientific consensus circumstance fully applies. Examples of use of this expert criterium are evident cases such as endemics with few populations despite specific searches (*Exsertotheca*

*baetica*, *Orthotrichum casasianum*, *O. handiense*, *Telaranea azorica* among others) or species with a combination of rarity, small and fragmented populations and clear exposition to threats (e.g. *Brachythecium turgidum*, *Mannia fragrans* or *Sphagnum fuscum*). Criterium C based on the analysis of population viability is obviously not applicable at the present state of art.

Table 5. List of bryophyte species proposed for inclusion in the national catalogues for species protection LESRPE and CEEA. Species marked (\*) are those for which only peninsular and Balearic populations are proposed to protect —not the populations in the Canary Islands, as in this territory they are not threatened—. Categories at CEEA are E (Endangered), V (Vulnerable) and SC (Critical Situation). Criteria used for assignment of categories are in brackets. IUCN categories according to Red List of Spain (Brugués & González-Mancebo, 2014), Red List of peninsular Spain and Balearic Islands (Brugués & *al.*, 2014) and Red List of the Canary Islands (González-Mancebo & *al.*, 2013).

Taxa	Spain	Peninsular and Balearic Spain	Canary Islands	LESRPE/CEEA (CEEA Criteria)
* <i>Acaulon fontiquerianum</i> Casas & Sérgio	NT	VU	LC	LESRPE
<i>Anastrepta orcadensis</i> (Hook.) Schiffn.	EN	EN		E (D)
<i>Andoa berthelotiana</i> (Mont.) Ochyra	EN		EN	E (D)
<i>Anomobryum lusitanicum</i> (I. Hagen in Luisier) Thér.	VU	VU		LESRPE
* <i>Anthoceros caucasicus</i> Steph.	NT	CR	LC	LESRPE
<i>Aschisma cuynetii</i> (Bizot & R.B. Pierrot) J. Guerra & Cano	VU	VU		LESRPE
<i>Barbilophozia binsteadii</i> (Kaal.) Loeske	CR	CR		E (D)
<i>Brachythecium cirrosum</i> (Schwägr.) Schimp.	CR	CR		E (A1/B1)
<i>Brachythecium laetum</i> (Brid.) Schimp.	EN	EN		E (D)
<i>Brachythecium turgidum</i> (Hartm.) Kindb.	VU	VU		V (D)
<i>Breutelia chrysocoma</i> (Hedw.) Lindb.	CR	CR		V (B1)
* <i>Bryoerythrophyllum inaequalifolium</i> (Taylor) R.H. Zander	NT	EN	LC	LESRPE
<i>Bryum minii</i> Podp.	VU	VU		LESRPE
* <i>Bryum tenuisetum</i> Limpr.	DD	EN	DD	LESRPE
* <i>Calypogeia suecica</i> (Arnell & J. Perss.) Müll. Frib.	DD	EN	DD	LESRPE
<i>Cyclodictyon laete-virens</i> (Hook. & Taylor) Mitt.	EN	EN	CR	V (B1)
<i>Dichelyma falcatum</i> (Hedw.) Myrin	CR	CR		LESRPE
<i>Dicranum viride</i> (Sull. & Lesq.) Lindb.	VU	VU		V (D)
<i>Didymodon asperifolius</i> (Mitt.) H.A. Crum, Steere & L.E. Anderson	VU	VU		V (D)
<i>Didymodon bistratosus</i> Hebr. & R.B. Pierrot	VU	VU		LESRPE
<i>Didymodon eckeliae</i> R.H. Zander	VU	VU		LESRPE
<i>Didymodon erosus</i> J.A. Jiménez & J. Guerra	EN	EN		LESRPE
<i>Exsertotheca baetica</i> (J. Guerra, J.F. Jiménez & J.A. Jiménez) Draper & <i>al.</i>	VU	VU		V (D)
<i>Fissidens coacervatus</i> Brugg.-Nann.	VU		VU	V (D)
<i>Fissidens serratus</i> Müll. Hall.	EN		EN	E (D)
* <i>Goniomitrium seroi</i> Casas	NT	EN	LC	LESRPE
<i>Grimmia capillata</i> De Not.	VU	VU		LESRPE
<i>Grimmia curviseta</i> Bouman	VU		VU	V (D)
<i>Gymnomitrium crenulatum</i> Gottsche ex Carrington	CR	CR		SC (A1)
* <i>Hypnum uncinatum</i> Jur.	NT	CR	LC	LESRPE
<i>Isothecium algarvicum</i> W.E. Nicholson & Dixon	VU	VU	VU	LESRPE
<i>Lepidozia cupressina</i> (Sw.) Lindenb.	EN	EN	VU	E (D)
<i>Lewinskya shawii</i> (Wilson) F. Lara, Garilleti & Goffinet	VU	VU		LESRPE
<i>Mannia fragrans</i> (Balbis) Frye & L. Clark	CR	CR		E (D)
<i>Meesia triquetra</i> (Richter) Ångstr.	CR	CR		E (A1/B1)
<i>Microbryum fosbergii</i> (E.B. Bartram) Ros, O. Werner & Rams	VU	VU		LESRPE

Taxa	Spain	Peninsular and Balearic Spain	Canary Islands	LESRPE/CEEA (CEEA Criteria)
<i>Microbryum longipes</i> (J. Guerra, J.J. Martínez & Ros) R.H. Zander	VU	VU		LESRPE
<i>Orthotrichum casasianum</i> F. Lara, Garilleti & Mazimpaka	CR	CR		E (D)
<i>Orthotrichum consobrinum</i> Cardot	CR	CR		E (D)
<i>Orthotrichum handiense</i> F. Lara, Garilleti & Mazimpaka	EN		EN	E (D)
<i>Orthotrichum patens</i> Brid.	CR	CR		E (D)
<i>Orthotrichum pulchellum</i> Brunt.	VU	VU		LESRPE
<i>Plagiochasma appendiculatum</i> Lehm. & Lindenb.	CR	CR		LESRPE
<i>Plagiochila maderensis</i> Gottsche ex Steph.	VU		VU	V (D)
<i>Pohlia filum</i> (Schimp.) Martensson	VU	VU		LESRPE
<i>Pohlia lescuriana</i> (Sull.) Ochi	VU	VU		LESRPE
<i>Pohlia ludwigii</i> (Schwägr.) Broth.	VU	VU		V (D)
<i>Pohlia obtusifolia</i> (Brid.) L. Koch	VU	VU		V (D)
<i>Polytrichastrum longisetum</i> (Sw. ex Brid.) G.L. Sm.	CR	CR		E (D)
<i>Porella pinnata</i> L.	EN	EN		LESRPE
<i>Pseudotaxiphylum laetevirens</i> (Dixon & Luisier ex F. Koppe & Düll) Hedenäs	VU	VU		V (D)
<i>Pyramidula tetragona</i> (Brid.) Brid.	VU	VU	VU	LESRPE
<i>Racomitrium ellipticum</i> (Turner) Bruch & Schimp.	CR		CR	E (D)
<i>Radula carringtonii</i> J.B. Jack	EN		EN	E (D)
<i>Radula holtii</i> Spruce	CR	CR	EN	E (D)
<i>Radula jonesii</i> Bouman <i>et al.</i>	CR		CR	E (D)
<i>Radula wichuriae</i> Steph.	CR		CR	E (D)
<i>Rhynchostegiella bourgaeana</i> (Mitt.) Broth.	VU		VU	V (D)
<i>Ricciocarpos natans</i> (L.) Corda	EN	EN		E (B1)
<i>Riella affinis</i> M. Howe & Underw.	EN		EN	E (D)
<i>Riella bialata</i> Trab.				LESRPE
<i>Riella cossoniana</i> Trab.	DD	EN	DD	LESRPE
<i>Riella echinata</i> (Müll. Frib.) Segarra, Puche & Sabovl.				LESRPE
<i>Riella notarisii</i> (Mont.) Mont.	VU	VU		LESRPE
<i>Riella mediterranea</i> Segarra & <i>al.</i>				LESRPE
<i>Schistidium occidentale</i> (E. Lawton) Churchill	CR	CR		E (D)
<i>Schizymerium pontevedrense</i> (Luisier) Sérgio & <i>al.</i>	VU	VU		LESRPE
<i>Sphagnum centrale</i> C.O.E. Jensen	EN	EN		V (B1)
<i>Sphagnum fuscum</i> (Schimp.) H. Klinggr.	CR	CR		E (D)
<i>Sphagnum warnstorffii</i> Russow	VU	VU		LESRPE
<i>Syntrichia handelii</i> (Schiffn.) Agnew & Vondr.	EN	EN		E (D)
* <i>Syntrichia minor</i> (Bizot) M.T. Gallego & <i>al.</i>	DD	VU	DD	LESRPE
<i>Telaranea azorica</i> (H. Buch & Perss.) Pócs ex Schumacker & Váña	EN		EN	E (D)
<i>Tetralophozia filiformis</i> (Steph.) Urmi	EN	EN		E (D)
<i>Tetrastichium fontanum</i> (Mitt.) Cardot	EN	CR	VU	V (B1)
<i>Tetrastichium virens</i> (Cardot) S.P. Churchill	CR	CR	CR	V (B1)
<i>Tortella alpicola</i> Dixon	EN	EN	VU	E (D)
<i>Tortula freibergii</i> Dixon & Loeske	EN	EN		V (B1)
<i>Tortula guepinii</i> (Bruch & Schimp.) Broth.	VU	VU		LESRPE
<i>Tortula viridifolia</i> (Mitt.) Blockeel & A.J.E. Sm.	VU	VU		LESRPE
<i>Ulota coarctata</i> (P. Beauv.) Hammar	VU	VU		LESRPE
<i>Ulota phyllantha</i> Brid.	CR	CR		E (B1)
<i>Weissia perssonii</i> Kindb.	VU	VU		LESRPE
<i>Zygodon stirtonii</i> Schimp. ex Stirt.	CR	CR		E (D)

Acceptance of this proposal would mean that the current situation would change from the present 80 protected taxa in total in Spain, 10 of them at national level and 70 protected only at regional level, with 5 present both in national and some regional catalogues; to 150 protected taxa in total, 94 at national level and 56 protected only at regional level, with 19 species present in national and some regional catalogues.

Although the management of the LESRPE and CEEA lists falls within the competence of the central national administration, the management of the territory and the species falls on the regional governments (autonomous communities), who would be responsible for assuming the impact of this proposal. The autonomous communities are therefore involved in the process of approving proposals for the inclusion of species in the Spanish catalogues through the State Commission for Natural Heritage and Biodiversity and, more specifically, through a specialized technical body created for this purpose: the Committee on Wild Animals and Plants.

The conservation actions for protected species fall within the competence of the regional administrations. For species in the national catalogues, their responsibilities

include monitoring for species in the CEEA every 3 years, the development of recovery plans for Endangered species, the designation of critical areas for conservation of Endangered species and the development of conservation plans for Vulnerable species; for species included in the LESRPE, monitoring should be undertaken every 6 years.

To show the different outlook that would arise if the proposal thrives, Figure 1 shows the distribution of the number of bryophyte species currently present in national or regional catalogues; as already mentioned, Catalonia and Galicia stand out clearly due to the number of protected species in their regional catalogues (40 and 26 species, respectively). Figure 2 shows how the distribution of bryophytes present in national or regional catalogues would look like if the proposals for inclusion in the LESRPE and CEEA were accepted. Every region would have protected bryophyte species, in a minimum number of 2 as in La Rioja, up to a maximum of 49 species as in the case of Catalonia. However, the greatest increase in protected species would occur in Andalusia and the Canary Islands, with 31 and 20 more species respectively for monitoring and protection.

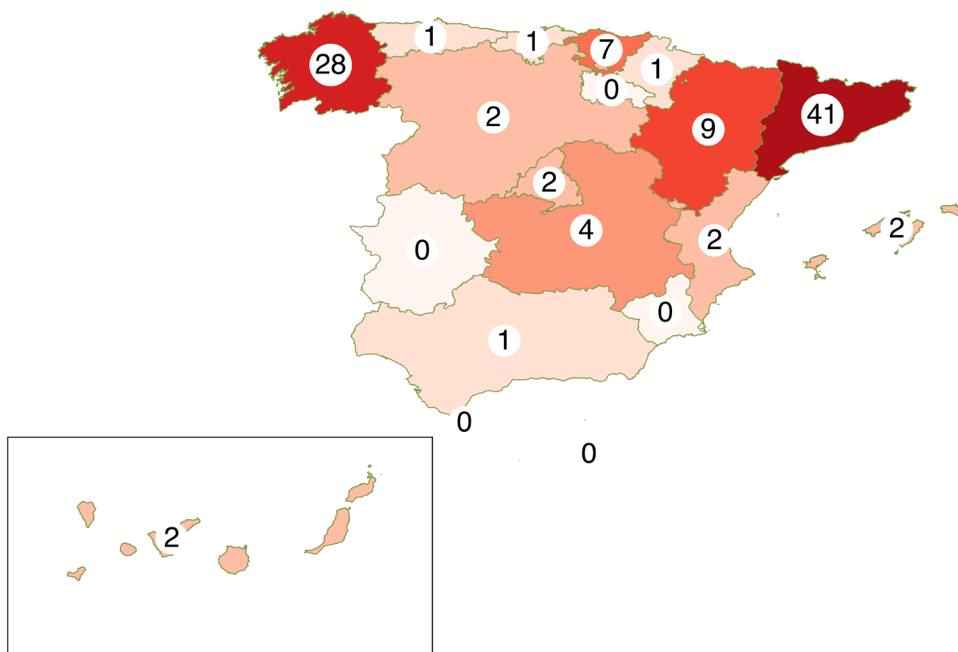


Figure 1. Number of bryophyte species currently present in national or regional catalogues with populations in the different regions (autonomous communities). Note that the figures show the sum of species present in each regional catalogue, plus the number of species nationally protected (present in LESRPE/CEEA) living in the territory.

## Conclusions

The legal protection of threatened bryophyte species is a necessity, not only to guarantee the integrity of the most sensitive bryophyte populations, but also because it will result in the global protection of their habitats and other species that coexist with them.

It should be noted that this proposal is not conceived as definitive in the protection of bryophytes in Spain, but as the only step that can be taken at this time. The list, as already mentioned, stems from the small number of species for which sufficient information is available; however, a large number of species still require specific studies to obtain the necessary information to evaluate their needs of legal protection.



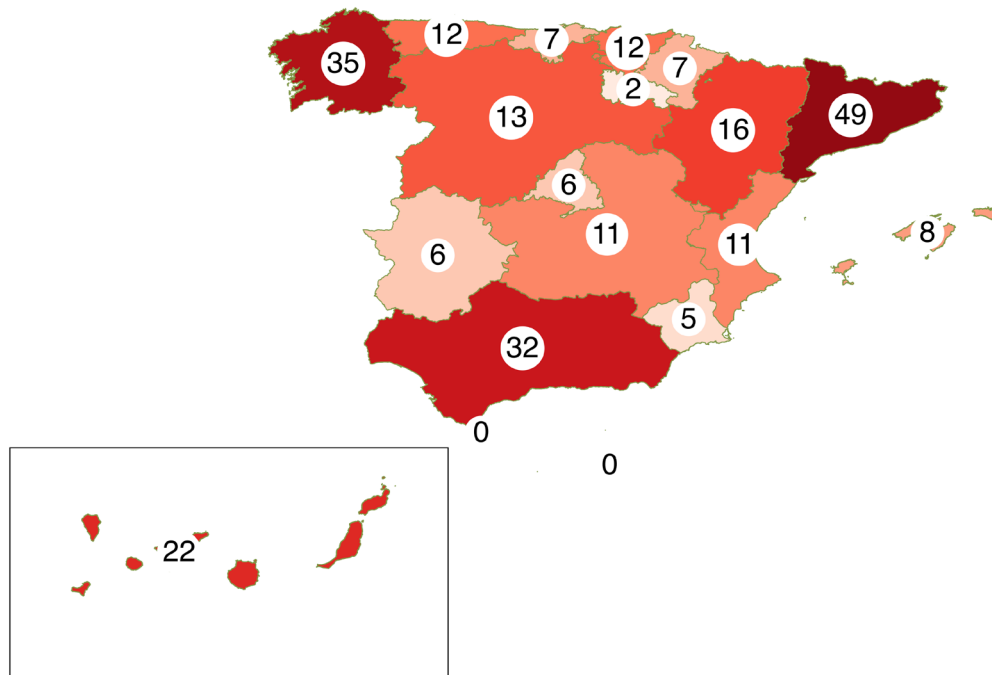


Figure 2. Number of bryophyte species present in national or regional catalogues, distributed by autonomous communities, should the proposal for incorporation into LESRPE and CEEA be accepted. Note that the figures show the sum of species present in each regional catalogue, plus the number of species nationally protected (present in LESRPE/CEEA after the proposal) living in the territory.

While seeking to improve the protection currently afforded to bryophytes, it should be emphasised that plant conservation in Spain strongly needs initiatives such as ABrA. This project has proven to be an extraordinary source of information and it needs to be encouraged to continue to completely cover the Spanish red list.

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