

A Vascular Plant Red List for Iceland

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ABSTRACT: The Vascular Plant Red List for Iceland reviews the status of plant species according to IUCN red listing guidelines. It was compiled in order to identify species that are threatened with extinction in Iceland and thus facilitate conservation efforts that should be undertaken to improve their status and prevent further decline. Of 436 species assessed, one was considered extinct (EX), eight were classified as critically endangered (CR), seven as endangered (EN) and 31 as vulnerable (VU). According to our assessment ten species can be treated as near threatened (NT). Due to the lack of sufficient data ten species were classified in data deficient category (DD).

KEY WORDS: red list, endangered species, vascular flora, Iceland, IUCN

INTRODUCTION

The loss of biodiversity has been considered as an urgent environmental issue on a global scale (WOOD et al. 2000). This led scientists and environmentalists to the construction of the first systems to document the status of rare species. Such a system was first developed by IUCN in 1950 to document data on threatened mammals and birds. Then, in 1964, the first comprehensive red lists of mammals and birds were compiled and published by the same institution (IUCN 2014). With the passage of time, as available data grew and criteria for assessing rare species have been refined, new red lists covering the remaining groups of animals and plants have been published. Apart from global Red Lists published and regularly updated by IUCN regional red list have also been developed on different spatial scales spanning from strictly regional treatments (WITKOWSKI et al. 2003), to national (KÁLÁS et al. 2010) or even supranational levels (EEA 2017).

In Iceland, the first red list of vascular plants was compiled in 1996 (NÁTTÚRUFRAÐISTOFNUN 1996), and then updated in 2008. The present edition of the Vascular Plant Red List for Iceland constitutes the second update of the list from 1996 and it is based on refined data on species distribution, new information on species biology and ecology as well as new observations made during monitoring activities by the Icelandic Institute of Natural History (KRISTINSSON et al. 2007). This time, apart from the list itself, we intend to publish more information on the species included in the Red List. We aim to provide the reader with a short discussion showing the development of the status of individual species, numbers summarising the content of the present and past editions of the Icelandic Red List and additional information that is

relevant to the red-listing process of individual taxa.

Coverage

Taxonomic coverage

During the present assessment, the scope of the project was to cover all vascular plants, comprising “pteridophytes” (ferns, horsetails and the lycophytes) and flowering plants (gymnosperms and angiosperms). However, there were some plant groups that we excluded from the ICUN threat analysis based on conservation priorities. These questions are discussed below in this section.

Native vs. non-native taxa

Recently, some attempts have been made to distinguish between native (present in Iceland due to natural dispersal) and non-native, alien species (those that are known to be imported by man or are thought to be brought to Iceland by man either intentionally or unintentionally). This research has resulted in a publication of a comprehensive summary of our knowledge on more recent introductions – neophytes (WASOWICZ et al. 2013). However, only a little is known about the status of species that were brought to Iceland by man during the time of settlement and later (up to 1770). These species (often called archaeophytes) were treated as native in the last edition of the Icelandic Checklist of Vascular Plants (KRISTINSSON 2008). Since that time, some progress has been made in the field and a group of 19 archaeophytic taxa has been identified (WASOWICZ 2018).

From the very beginning of the process of preparing this new edition of the Icelandic Red List, it was quite clear to us that conservation efforts should be focused on native species. Therefore, all the species that were proven beyond any reasonable doubt to be non-native (mostly neophytes) were excluded from the treatment. Following the last edition of the checklist we have also excluded species that are most probably adventive but lacking exact data to classify them as neo- or archaeophytes (e.g. *Knautia arvensis*).

New species assessed

There are several species in the present edition of the Icelandic Red List that can fall into the category of “new native” species. These include taxa that have been recently described from Iceland or have been recently discovered (even though their residence time most probably predates the arrival of man on the island). All these taxa were included in the threat analysis in a normal way. The distribution and conservation data available for some of these taxa are so scarce that most of them were placed in data deficient (DD) category. We hope that field studies and monitoring activities that will be carried out regularly in the coming years will help us to resolve the status of at least some of these taxa.

Geographical coverage

The present assessment is focused on mainland Iceland as well as all smaller islands (e.g. Grímsey, Hrísey etc.), island archipelagos (Vestmannaeyjar archipelago) and small islets (e.g. numerous small islets in Breiðafjörður) being in close proximity to Iceland and thus closely connected biogeographically.

The treatment of apomictic genera and critical groups

There are at three taxonomic groups in the Icelandic flora that are very difficult to assess in terms of threat. Much of the difficulty associated with these taxa is connected with very problematic identification. Consequently, the distribution data available is very scarce and most probably incomplete which disturbs a proper threat assessment. Two apomictic genera: *Hieracium* and *Taraxacum* seem to be most problematic. There are tens or even hundreds of microspecies described from Iceland in these genera and very often, the only available distribution data is limited to *locus classicus*. Even though we made every effort to treat all the taxa equally, in these cases the scarcity of data led us to exclusion of both genera from the treatment. We hope that as more data on these taxa become available, these groups will be reassessed and the Red List reviewed.

The genus *Euphrasia* is another problematic group in the Icelandic flora. The taxonomy of the genus is very poorly known from Iceland (ELVEN et al. 2011) and the genus urgently requires a modern taxonomic treatment. Despite these well-known taxonomical difficulties, we decided to include all the taxa of *Euphrasia* known from Iceland in the treatment. However, we would like to stress that when taxonomical difficulties will be solved, and more data become available, this group of taxa will need reassessment.

In every case when some doubts and/or questions arose during the assessment of a taxon against the IUCN criteria, short comment summarising the difficulty/difficulties was always added to the list (see below).

Red List Categories and Criteria

The present assessment is based on The *IUCN Red List Categories and Criteria. Version 3.1* (IUCN SPECIES SURVIVAL COMMISSION 2012) (Figure 1) and The *Guidelines for Application of the IUCN Red List Criteria at Regional and National Levels. Version 4.0* (IUCN SPECIES SURVIVAL COMMISSION 2012).

There are eight categories whereof two indicate that species are either extinct (EX)/regionally extinct (RE) or extinct in the wild (EW), three that indicate that species assigned to that category are threatened i.e. critically endangered (CR), endangered (EN) and vulnerable (VU). Furthermore are the categories near threatened (NT), least concern (LC) and data deficient (DD)

included in the red list. For further description of the individual categories we refer to the IUCN Red List Categories and Criteria (IUCN SPECIES SURVIVAL COMMISSION 2012). Figure 1 presents a schematic overview of the different categories.

The Criteria for Critically Endangered, Endangered and Vulnerable

Most species on the Red List fulfil criteria referring to restricted geographic distribution or small population (B- and D-criteria) although few of them fulfil the C-criteria referring to small, declining population. Only one species fulfil the A-criteria, that is population decline. For a thorough explanation of the different criteria the IUCN Red List Categories and Criteria (IUCN SPECIES SURVIVAL COMMISSION 2012) can be consulted. Here below we cite the criteria specifically referred to in table 1, listing the redlisted vascular plants of Iceland and the justification for their inclusion on the list.

CRITICALLY ENDANGERED (CR)

A taxon is Critically Endangered when the best available evidence indicates that it meets any of the IUCN criteria (A to E), according to IUCN (2012) and it is therefore considered to be facing an extremely high risk of extinction in the wild: There are 10 species of vascular plants in Iceland considered to be critically endangered. Some of them fulfil several criteria, most commonly the

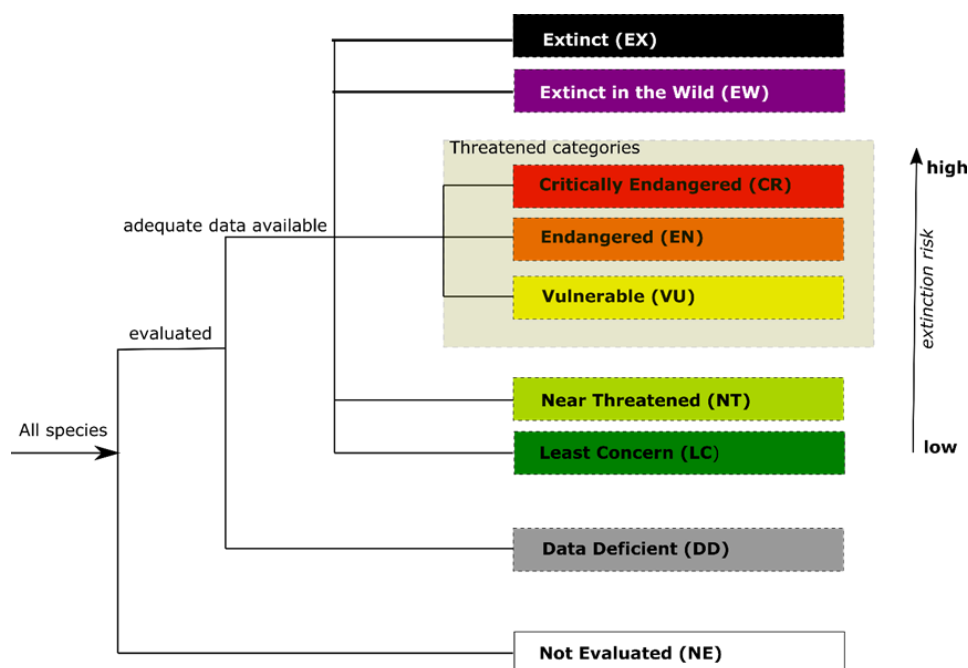


FIGURE 1. Structure of the IUCN categories (IUCN 2012).

B-criteria (6 species) while five species fulfil the D-criteria. Below are listed the relevant criteria for inclusion of the 10 species that are listed, taken from IUCN (2012).

A. Reduction in population size based on any of the following:

4. An observed, estimated, inferred, projected or suspected population size reduction of $\geq 80\%$ over any 10 year or three generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased OR may not be understood OR may not be reversible, based on (and specifying) any of (a) to (e) under A1.

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence (EOO) estimated to be less than 100 km² , and estimates indicating at least two of a-c:

- a. Severely fragmented or known to exist at only a single location.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (ii) area of occupancy
 - (iii) area, extent and/or quality of habitat
 - (iv) number of locations or subpopulations
 - (v) number of mature individuals.

2. Area of occupancy (AOO) estimated to be less than 10 km² , and estimate indicating at least two of a-c:

- a. Severely fragmented or known to exist at only a single location.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (ii) area of occupancy
 - (iii) area, extent and/or quality of habitat
 - (iv) number of locations or subpopulations
 - (v) number of mature individuals.

C. Population size estimated to number fewer than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within three years or

one generation, whichever is longer, (up to a maximum of 100 years in the future) OR

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

a. Population structure in the form of one of the following:

(i) no subpopulation estimated to contain more than 50 mature individuals, OR

D. Population size estimated to number fewer than 50 mature individuals.

ENDANGERED (EN)

A taxon is Endangered when the best available evidence indicates that it meets any of the IUCN criteria (A to E) according to IUCN (2012), and it is therefore considered to be facing a very high risk of extinction in the wild: Altogether nine species of vascular plants in Iceland are considered to be endangered. Majority of them, five species, fulfil the D-criteria, i.e. having small population size while two species fulfil the B-criteria, i.e. having limited geographic range. Below are the relevant criteria for the inclusion of the 9 species that are listed, taken from IUCN (2012).

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence (EOO) estimated to be less than 5,000 km² , and estimates indicating at least two of a-c:

a. Severely fragmented or known to exist at no more than five locations.

b. Continuing decline, observed, inferred or projected, in any of the following:

(iv) number of locations or subpopulations

2. Area of occupancy (AOO) estimated to be less than 500 km² , and estimates indicating at least two of a-c:

a. Severely fragmented or known to exist at no more than five locations.

b. Continuing decline, observed, inferred or projected, in any of the following:

(iv) number of locations or subpopulations

D. Population size estimated to number fewer than 250 mature individuals.

VULNERABLE (VU)

A taxon is Vulnerable when the best available evidence indicates that it meets any of the IUCN criteria (A to E) according to IUCN (2012), and it is therefore considered to be facing a high risk of extinction in the wild. There are 31 species of vascular plants in Iceland considered to be vulnerable. All of them, except for two species, fulfil the D-criteria, i.e. restricted population size. The only two vulnerable species not fulfilling the D-criteria do fulfil the B-criteria (*Sesleria albicans*) and the C-criteria (*Sagina cespitosa*). Below are the relevant criteria for inclusion of the 31 species that are listed, taken from IUCN (2012).

B. Geographic range in the form of either B1 (extent of occurrence) OR B2 (area of occupancy) OR both:

1. Extent of occurrence (EOO) estimated to be less than 20,000 km² , and estimates indicating at least two of a-c:

- a. Severely fragmented or known to exist at no more than 10 locations.
- b. Continuing decline, observed, inferred or projected, in any of the following:
 - (ii) area of occupancy (AOO)
 - (iii) area, extent and/or quality of habitat
 - (iv) number of locations or subpopulations

C. Population size estimated to number fewer than 10,000 mature individuals and either:

2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals AND at least one of the following (a-b):

- a. Population structure in the form of one of the following:
 - (i) no subpopulation estimated to contain more than 1,000 mature individuals, OR

D. Population very small or restricted in the form of either of the following:

1. Population size estimated to number fewer than 1,000 mature individuals.
2. Population with a very restricted area of occupancy (AOO) (typically less than 20 km²) or number of locations (typically five or fewer) such that it is prone to the effects of human activities or stochastic events within a very short time period in an uncertain future, and is thus capable of becoming Critically Endangered or even Extinct in a very short time period.

TABLE 1. The Red List of Vascular Plants of Iceland¹. LP – legally protected

Taxon name	Category	A Criteria	B Criteria	C Criteria	D Criteria	Endemic	2007 assessment	1996 assessment	Protection status	Comments
<i>Primula egáitkensis</i> Wormsk. ex Hornem.	RE						EW	EW	LP	
<i>Asplenium septentrionale</i> (L.) Hoffm.	CR				D		CR	CR	LP	
<i>Carex pallescens</i> L.	CR		B1; B2 a+b(iv)				VU			
<i>Galium palustre</i> L.	CR		B1; B2b(ii, iii, v)	C2a(i)	D		CR	CR	LP	
<i>Hymenophyllum wilsonii</i> Hook.	CR	A4	B1; B2a+b(ii,v)	C1+2a(i)	D		CR	CR	LP	
<i>Rosa dumalis</i> Bechst.	CR				D		CR	CR	LP	
<i>Crassula aquatica</i> (L.) Schönland	CR		B1; B2 b (ii,v)				CR	CR	LP	
<i>Lycopodium clavatum</i> L.	CR		B1; B2 a+b(iii)		D		EN	CR	LP	
<i>Melampyrum pratense</i> L.	CR		B1; B2 a+b(iii)							²

¹All native species from Icelandic flora were assessed against the IUCN criteria, but only a list of threatened species is being published.²*Melampyrum pratense* has been recently discovered in Iceland (WASOWICZ et al. 2018) and thus not included in the previous editions of the Icelandic Red List.

Taxon name	Category	A Criteria	B Criteria	C Criteria	D Criteria	Endemic	2007 assessment	1996 assessment	Protection status	Comments
<i>Asplenium trichomanes</i> L.	EN				D		EN	EN	LP	
<i>Carex caryophylllea</i> Latourr.	EN				D		EN	EN		
<i>Carex flava</i> L.	EN				D		EN	EN	LP	
<i>Danthonia decumbens</i> (L.) DC.	EN				D		EN	CR	LP	
<i>Persicaria amphibia</i> (L.) Gray	EN		B1; B2a+b(iv)				EN	EN	LP	
<i>Primula stricta</i> Hornem.	EN		B1; B2b(iv)				VU	VU		
<i>Struthiopteris fallax</i> (Lange) S. Molino, Gabriel y Galán & Wasowicz	EN				D	X	EN	EN	LP	
<i>Ajuga pyramidalis</i> L.	VU				D1		VU	VU	LP	
<i>Andromeda polifolia</i> L.	VU				D2		VU	LR		
<i>Arrhenatherum elatius</i> (L.) P. Beauv. ex J. Presl & C. Presl	VU				D2		VU	EN		
<i>Asplenium viride</i> Huds.	VU				D1,2		VU	LR	LP	
<i>Botrychium boreale</i> Milde	VU				D1		NT			
<i>Campanula uniflora</i> L.	VU				D2		NT			

Taxon name	Category	A Criteria	B Criteria	C Criteria	D Criteria	Endemic	2007 assessment	1996 assessment	Protection status	Comments
<i>Carex adelostoma</i> V.I. Krecz.	VU				D2		VU	VU		
<i>Carex helmonastes</i> Ehrh. ex L. f.	VU				D1,2		VU	VU	LP	
<i>Cryptogramma crispa</i> (L.) R. Br. ex Hook.	VU				D2		VU	EN	LP	
<i>Equisetum sylvaticum</i> L.	VU				D2		VU	VU		
<i>Hippuris tetraphylla</i> L. f.	VU				D2		VU	VU		
<i>Juncus gerardii</i> Loisel.	VU				D2		VU	CR	LP	
<i>Juncus squarrosus</i> L.	VU				D2		VU			
<i>Lychnis flos-cuculi</i> L.	VU				D2		VU			
<i>Lysimachia maritima</i> (L.) Galasso, Banfi & Soldano	VU				D2		VU	VU		
<i>Micranthes foliolosa</i> (R. Br.) Gornall	VU				D2		VU	LR	LP	
<i>Ophioglossum azoricum</i> C. Presl	VU				D2		VU	LR		
<i>Oxalis acetosella</i> L.	VU				D1,2		VU	VU	LP	
<i>Papaver radiculatum</i> subsp. <i>stefanssonii</i> (Å. Löve) Jonsell & Ö. Nilsson	VU				D2	X	VU	VU	LP	

Taxon name	Category	A Criteria	B Criteria	C Criteria	D Criteria	Endemic	2007 assessment	1996 assessment	Protection status	Comments
<i>Persicaria maculosa</i> Gray	VU				D2		VU	VU		
<i>Populus tremula</i> L.	VU				D2		VU			
<i>Ranunculus islandicus</i> (Fagerstr. & Kvist) Ericsson	VU				D2	X	NT			
<i>Rosa spinosissima</i> L.	VU				D2		VU	VU	LP	
<i>Ruppia cirrhosa</i> (Petagna) Grande	VU				D2		VU			
<i>Sagina caespitosa</i> (J. Vahl) Lange	VU			C2a(i)			VU	LR		
<i>Sesleria albicans</i> Kit. in J.A.Schultes	VU		B1,B2a+b(ii,iii,iv)				VU	VU		
<i>Spergularia salina</i> J. Presl & C. Presl	VU				D2		EN	EN	LP	
<i>Stellaria borealis</i> subsp. <i>borealis</i> Bigelow	VU				D2		VU	LR	LP	
<i>Vaccinium vitis-idaea</i> L.	VU				D2		VU			
<i>Veronica anagallis-aquatica</i> L.	VU				D2		VU	VU		
<i>Vicia sepium</i> L.	VU				D2		VU	LR		

Taxon name	Category	A Criteria	B Criteria	C Criteria	D Criteria	Endemic	2007 assessment	1996 assessment	Protection status	Comments
<i>Botrychium lunaria</i> var. <i>melzeri</i> Stensvold & Farrar	DD									³
<i>Botrychium minganense</i> Vict.	DD						DD			
<i>Botrychium nordicum</i> Stensvold & Farrar	DD									⁴
<i>Callitriche brutia</i> Petagna	DD						DD	DD	LP	
<i>Carex buxbaumii</i> Wahlenberg	DD									⁵
<i>Euphrasia calida</i> Yeo	DD						DD	EN	LP	
<i>Huperzia arctica</i> (Grossh. ex Tolm.) Sipliv.	DD									⁶
<i>Potamogeton compressus</i> L.	DD									⁷

³ *Botrychium lunaria* var. *melzeri* has been newly described from Iceland (STENSVOLD & FARRAR 2017) and only a little is known on its distribution.

⁴ *Botrychium nordicum* has recently been described from Iceland (STENSVOLD & FARRAR 2017) and only a little is known about its distribution.

⁵ *Carex buxbaumii* is known only from one locality in E Iceland. More research on its distribution is needed to evaluate the species against IUCN criteria.

⁶ Distribution of *Huperzia arctica* (*Huperzia selago* subsp. *arctica*) in Iceland is very poorly known. It is highly likely that the taxon might be quite widespread, but more research is needed for a valid evaluation against IUCN criteria.

⁷ *Potamogeton compressus* is a newly discovered species (2012) and it is currently known only from one lake in Iceland. More research is needed to assess it accurately against the IUCN criteria.

Taxon name	Category	A Criteria	B Criteria	C Criteria	D Criteria	Endemic	2007 assessment	1996 assessment	Protection status	Comments
<i>Ruppia maritima</i> L.	DD									⁸
<i>Valeriana sambucifolia</i> J.C. Mikan ex Pohl	DD						DD	DD		⁹
<i>Botrychium tenebrosus</i> A.A. Eaton	NT						NT			
<i>Carex diantra</i> Schrank	NT						VU			
<i>Carex nardina</i> Fr.	NT						NT			
<i>Crepis paludosa</i> (L.) Moench	NT						NT	LR		
<i>Gnaphalium uliginosum</i> L.	NT						NT			
<i>Holcus lanatus</i> L.	NT						LC	VU		
<i>Hydrocotyle vulgaris</i> L.	NT						NT	VU		
<i>Isoetes lacustris</i> L.	NT						NT	VU		

⁸*Ruppia maritima* is currently known only from one locality in SE Iceland, but its distribution in very poorly known. It is likely that the taxon is more widespread but more research is needed for a valid evaluation against IUCN criteria.

⁹It is still unclear what the taxonomical identity of the taxon (taxa?) present in Iceland is. There are conflicting views on this problem (LÖVE 1970; LÖVE 1983; KRISTINSSON 2008; ELVEN et al. 2011). It is also unclear whether the species is an old adventive (LÖVE 1983; ELVEN et al. 2011).

Taxon name	Category	A Criteria	B Criteria	C Criteria	D Criteria	Endemic	2007 assessment	1996 assessment	Protection status	Comments
<i>Neottia ovata</i> (L.) Bluff & Fingerh.	NT						NT	LR	LP	
<i>Paris quadrifolia</i> L.	NT						NT	LR	LP	
<i>Allium oleraceum</i> L.	NA							VU	LP	¹⁰
<i>Knautia arvensis</i> (L.) Coult.	NA						VU	VU		¹¹
<i>Mentha aquatica</i> L.	NA							CR		¹²
<i>Potentilla erecta</i> (L.) Rauschel	NA							CR	LP	¹³

¹⁰*Allium oleraceum* is now considered to be an archaeophyte (WASOWICZ 2018), it was classified as VU during the 1996 assessment.

¹¹*Knautia arvensis* is now classified as a non-native of unknown age (WASOWICZ 2018), classified as VU during the 1996 assessment.

¹²*Mentha aquatica* is currently considered to be a neophyte (WASOWICZ et al. 2013) but it was classified as CR during the 1996 assessment.

¹³*Potentilla erecta* is now classified as an adventive (WASOWICZ et al. 2013), but during the 1996 assessment it was classified as CR.

Summary of findings

There are 436 native taxa of vascular plants in the Icelandic flora. During the present assessment, one (0.2%) species has been classified as extinct, 47 species (11%) have been classified as threatened and 10 species (2%) as near threatened. Ten species (2%) have been assigned to DD category. Comparing to the previous edition the number of species assigned to threatened categories increased from 44 to 47. The group of species classified as DD increased significantly, while the number of extinct species remained stable (Figure 2).

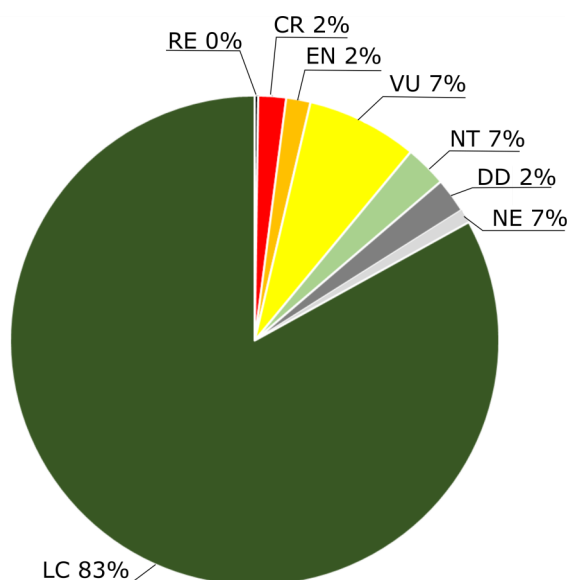


FIGURE 2. The percent share of taxa assigned to different IUCN categories in the total native flora.

Most of the threatened taxa met the criterion of the very small and restricted population (criterion D) – 39 taxa. The criterion based on a reduction in population size (A) was met just by one species – *Hymenophyllum wilsonii*. Limited geographic range (EEO and/or AOO) and decline criterion (B) was met by 9 taxa. Three taxa fulfilled the criterion based on low population size and decline (criterion C).

The present edition is not merely a repetition of previous assessments. Many species have been reassessed and their classification changed (Table 2). Also, the number of “new native species” (newly described or discovered) that had to be assessed against the IUCN criteria was unprecedented. The most important changes are discussed below.

Three new species have been classified in CR category: *Carex pallescens*, *Lycopodium clavatum* and *Melampyrum pratense*. *C. pallescens* has gone extinct in one of the two localities which is a clear indication of negative tendency/decline in the number of localities. The species is present only in a single locality (very low EOO and AOO). Since the last assessment, clear negative tendencies have been also observed in the only known population of *L. clavatum* that led to changing its status to CR. *M. pratense*, a new native species discovered in 2016 (WASOWICZ et al. 2018), is currently only known from one locality (a birch forest that in some parts has been heavily altered by non-native conifer plantations) and therefore further decline of area and quality of the remaining habitat is projected in the future.

Three additional taxa were classified in VU category: *Botrychium boreale*, *Campanula uniflora* and *Ranunculus islandicus*, while classification of two

TABLE 2. The comparison of the number of species falling into each IUCN category in different editions of the Icelandic Red List.

IUCN category	1996	2008	2018
EX (RE)	1	1	1
CR	10	5	8
EN	9	8	7
VU	18	31	31
DD	4	4	10
NT	0	11	10
total	42	60	67

species has been changed (*C. pallescens* moved to CR and *Carex diandra* moved to NT). A new assessment of *B. boreale* suggests that the total estimated number of individuals allows its classification as VU. Field studies, carried out since the last assessment, have shown a decline in the number of locations in case of *C. uniflora*. The species disappeared from Víkurskarð-Draflastaðafjall where it was still present in 2003 but the current data from most of other locations is lacking. Since the species belongs to an arctic element, it can be assumed that its distribution will be negatively impacted by climate change within the next 100 years. During the last assessment, *R. islandicus* was classified as NT. The data reassessed now, clearly suggest that the AOO of the species is just at the threshold limit of 20 km². Taking into account that the taxon is endemic to Iceland we argue for updating its status to VU. Since 2006 seven new localities of *C. diandra* have been discovered and increased the AOO of the species

beyond the limits for VU category. Consequently, the species has been moved to NT.

The increase in the number of species classified as DD is mainly caused by taxa that fall into the category of “new native species”. Five new taxa classified as DD (*Botrychium lunaria* var. *melzeri*, *Botrychium nordicum*, *Carex buxbaumii* s.s., *Potamogeton compressus* and *Ruppia maritima*) were recently discovered or described from Iceland, but the data on their ecology and distribution are very scarce. *Huperzia arctica* was previously not recognised on species level and its distribution is very poorly known.

There are 31 plant species legally protected in Iceland and most of them (25 species) were assigned to a threaten category during the present

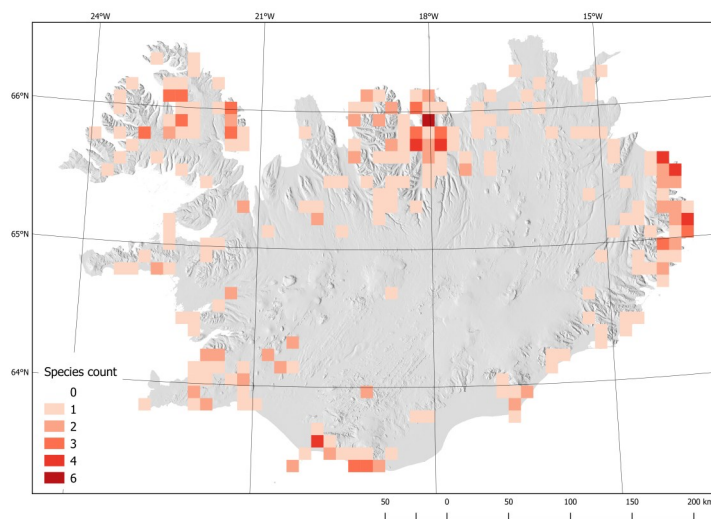


FIGURE 3. Analysis of spatial distribution of red-listed vascular plant species in Iceland (number of red-listed species was calculated in 10×10 km plots).

assessment. However, there are rare and endangered species in Iceland that are not legally protected. Two such species have been classified as Critically Endangered and two as Endangered. More than half of species classified as Vulnerable (21 out of 31) are presently not protected by law.

Species included in the present version of the red list exhibit a clear spatial pattern with several “hot-spots”, where the number of species records is relatively high. Mountainous areas around Eyjafjörður, Western Fjords and Eastern Fjords could be considered as areas, where the concentration of red-

listed plant taxa is the highest (Fig. 3). Similarly, a relatively small area in S Iceland (located south of Mýrdalsjökull and Eyjafjallajökull glaciers) can be considered as a hot-spot of the occurrence of rare and endangered plant species.

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