

Short communication

Threatened tree and shrub species in Hungary

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Abstract

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Red Lists of the Hungarian dendroflora were compiled two: in 1989 and in 2003. They have also been provided with information about the threat levels of the Hungarian dendrotaxa and the endangering factors as well. The threat levels and categories were determined on the background of the recommendations by the IUCN. During the last fifteen years, 50 species of the dendroflora have become endangered; on the contrary, the levels of threat of 5 taxa have increased, and only one species could have been cancelled from the Red List. At present, there are 86 endangered tree and shrub species in Hungary. There are 21 stress factors endangering the Hungarian dendrotaxa, from which the proportion of habitat endangering factors is 76.8% and factors directly endangering the plants make 23.2%. This paper presents the whole list of the currently endangered species with the level of threat and the sources of danger, and a list of species possibly endangered in the near future. These lists provide an opportunity to follow the changing levels of threat in the future.

Keywords

Red List, dendroflora, Hungary, endangering factors, threat category

Introduction

Red Lists and Red Data Books concerning either distribution areas or taxonomic groups have been compiled over the whole Earth since the mid-sixties. The purpose of these documents was to give a survey of the level of threat as well as to draw the attention of conservationists to the endangered species. The Red Book of the Hungarian Flora and Fauna was published in 1989 (RAKONCZAY ed., 1989), and the endangered tree and shrub species (BARTHA, 1991, 1992) were also given account of in a separate book.

The threat categories applied in these books are based on the international recommendations, but also certain national characteristics were considered. In 1994, there was a revision by the World Conservation Union Species Survival Commission (IUCN, 1994) with the aim to standardize the categories. The existing terms these were revised and the criteria were completed with quantitative characteristics. On the basis of the new categories, two global scale lists were assembled: The Red List of Threatened Plants (WALTERS, GILLET, 1998) and The World List of Threatened Trees (OLDFIELD et al., 1998). The review of the threat

categories and the criteria has been completed (IUCN/SCC Criteria Review Working Group, 1999) and the recommendations for their adaptation at regional and national levels have been prepared (GÄRDENFORS et al., 1999) recently. The present paper was drafted with the focus of a new aspect. As the extinction of a species is considered to be a stochastic process, classification into the categories corresponds to estimation of the extinction risk. The threat category corresponds to the probability of the extinction of the species in the given area.

Material and methods

The applied threat categories (IUCN, 1994 modified by IUCN/SCC Criteria Review Working Group, 1999) are:

Extinct (EX): A taxon is extinct if there is no reasonable doubt about whether the last individual has already died.

Regionally extinct (RE): A taxon is regionally extinct if there is no reasonable doubt about whether the last individual potentially capable of reproduction has died or disappeared from the region.

Extinct in the wild (EW): A taxon is extinct in the wild if it is only confirmed to survive in cultivation, in captivity or as a naturalised population (or populations) outside its original distribution range. A taxon is supposed to be extinct in the wild if exhaustive, appropriately timed (diurnal, seasonal, annual) surveys carried out in formerly confirmed or expected habitats within its historic range have failed to record even one individual. The timing of such surveys should correspond to the taxon's life cycle and life form.

Critically endangered (CR): A taxon is critically endangered if it is facing an extremely high risk of extinction in the wild in the immediate future.

Endangered (EN): A taxon is endangered if it is not critically endangered but is facing a very high risk of extinction in the wild in the near future.

Vulnerable (VU): A taxon is vulnerable if it is not critically endangered or endangered but is facing a high risk of extinction in the wild in the medium-term future.

Lower risk (LR): A taxon has lower risk status if – according to the evaluation it does not satisfy the

criteria for any of the categories critically endangered, endangered or vulnerable. Taxa included in the lower risk category can be specified into three subcategories:

‡ **Conservation dependent (CD):** A taxon focused by a continual taxon-specific or habitat-specific conservation programme. To stop the care would result in the taxon belonging to one of the above described threatened categories within five years.

‡ **Near threatened (NT):** A taxon not qualified as conservation dependent, but close to being qualified as vulnerable.

‡ **Least concern (LC):** A taxon which is not qualified as conservation dependent or near threatened.

Data deficient (DD): A taxon for which there is lacking appropriate information for a direct or indirect assessment of its extinction risk based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate information on abundance and/or distribution is lacking.

Not evaluated (NE): A taxon is not evaluated when it has not yet been assessed against the criteria.

The recommendation of the IUCN/SCC Criteria Review Working Group (1999) suggests to cancel the category 'Conservation dependent'. At the same time, GÄRDENFORS et al. (1999), suggested to append the category 'Regionally extinct'.

The classification of a species into the threatened categories (CD, EN, VU) is carried out using quantifying criteria (ranging from A to E). Each taxon must be tested with all the criteria, but it's enough to satisfy a single criterion to be assigned to the appropriate category. The list of the testing criteria is the following (IUCN, 1994):

A. Population reduction in forms 1. or 2.:

1. An observed, estimated, deduced or suspected reduction by at least 80% (CR), 50% (EN), 20% (VU) within the last 10 years or three generations. The specifying characteristics are the following (it is sufficient to comply with one of them):
 - (a) Direct observation
 - (b) An index of abundance of the taxon
 - (c) A decline in area of occupancy, extent of occurrence and/or quality of habitat

- (d) Actual or potential levels of exploitation
 (e) The effects of introduced taxa, hybridisation, pathogens, pollutants, competitors or parasites.
2. A reduction by at least 80% (CR), 50% (EN), 20% (VU) expected or estimated to be met within the next ten years or three generations, based on (and specifying) any of (b), (c), (d) or (e) above.
- B. Extent of occurrence area estimated to be less than 100 km² (CR), 5,000 km² (EN), 20,000 km² (VU) or area of occupancy estimated to be less than 10 km² (CR), 500 km² (EN), 2,000 km² (VU) and meeting (estimated) at least two of the following criteria:
1. Severely fragmented or known to exist at only a single location
 2. Proceeding decline – observed, deduced or supposed, according to any of the following items:
 - (a) Extent of occurrence
 - (b) Area of occupancy
 - (c) Area, extent and/or quality of habitat
 - (d) Number of locations or subpopulations
 - (e) Number of mature individuals.
 3. Extreme fluctuations concerning any of the following criteria:
 - (a) Extent of occurrence
 - (b) Area of occupancy
 - (c) Number of locations or subpopulations
 - (d) Number of mature individuals.
- C. Population number estimated to be less than 250 (CR), 2,500 (EN), 10,000 (VU) mature individuals and moreover compliance with 1. or 2.:
1. A proceeding continual decline estimated to be at least of 25% (CR), 20% (EN), 10% (VU) within 3 years or one generation, whichever is longer or
 2. A continual decline, observed, suspected, or deduced, in numbers of mature individuals and population structure in the form of:
 - (a) Severely fragmented (i.e. no subpopulation estimated to contain more than 50 (CR), 250 (EN), 1,000 (VU) mature individuals)
 - (b) All individuals are in a single subpopulation.
- D. Population number estimated to be less than 50 (CR), 250 (EN), 1,000 (VU) mature individuals.
- E. Quantitative analysis showing the probability of extinction in the wild resulted at least at 50% within 10 years or 3 generations (CR), 20% within 20 years or 5 generations (EN), 10% within 100 years (VU).
- Regional and national Red Lists must contain the proportion of the regional (national) population, which means the percentage of the individuals of the taxon living in a given place – in this case in Hungary, from the global population – the total number of individuals of the taxon living in the wild worldwide. After the recommendations by GÄRDENFORS et al. (1999) there are five categories based on the ratio of the regional (national) population to the global:
- I. < 2.5%
 - II. 2.6–10.0%
 - III. 10.1–25.0%
 - IV. 25.1–50.1%
 - V. > 50.1%
- In the Red List of the Hungarian tree and shrub species are specified the following features (See Appendix):
- ♣ The threatened categories applied at national level – Hungary (HU 2003),
 - ♣ Current ratio of the national (regional) to the global population (nP/gP),
 - ♣ The threatened categories of the former Red Data Book (RAKONCZAY ed., 1989) (HU 1988),
 - ♣ Sources of danger, endangering factors.
- Sources of danger, endangering factors*
- A. Factors endangering the habitats
- I. Changes in the cultivation methods
 1. Mining, raw material exploitation
 2. Grassland ploughing
 3. Orchard, vineyard planting
 4. Afforestation
 5. Land fragmentation, road construction.
 - II. Changes in the habitat conditions
 6. Drainage, turf-cutting
 7. Clear cutting, rough forest management methods

8. Intensive grassland management, over sewing
 9. Karstwater, groundwater lifting
 10. Spontaneous forestation, over scrubbing
 11. Forestation with alien species
 12. Invasion of alien weeds
 13. Overpopulated game-stock.
- III. Mechanical damage to the habitat and vegetation
14. Intensive tourism
 15. Military activity
 16. Trampling caused by motocross, hang-glider or mountain bike.
- B. Factors endangering the plants directly
17. Flower picking, plant collecting, trade
 18. Introgressive hybridization, gene pool erosion
 19. Reproduction, regeneration problems
 20. Burning, fire
 21. Shrub clearing.

Results

Comparison between the Red Lists of the Hungarian dendroflora assembled in 1988 and in 2003 enables us to obtain an overview of the changes, which have happened in the last fifteen years (Table 1).

In Table 1 we can see that in 1988 belonged 32 of the Hungarian tree and shrub species in the category 'Not evaluated', 45 species in 'Vulnerable', 8 in 'Endangered' and 4 in 'Critically endangered', 4 species were 'Regionally extinct'. On the other hand, in 2003 only 7 species were classified in the category 'Data deficient', but 45 species were 'Vulnerable', 25 'Endangered', 11 'Critically endangered', and 5 species 'Regionally extinct'. We can also evaluate the changes and trends within the individual categories over the last fifteen years. Table 2 shows the distribution of 21 endangering factors. In Table 3 are listed the species, which at

Table 1. Changes in the threat levels of the Hungarian dendroflora between 1988 and 2003

		2003					Total in 1988
		DD	VU	EN	CR	RE	
1988	NE	1	22	4	5	–	32
	VU	6	21	13	3	2	45
	EN	–	2	5	1	–	8
	CR	–	–	2	2	–	4
	RE	–	–	1	–	3	4
Total in 2003		7	45	25	11	5	

Table 2. Distributions of the factors endangering the Hungarian dendroflora

Sources of danger, endangering factors	Percentage
A. Factors endangering the habitats	76.8%
I. Changes in the cultivation methods	13.3%
II. Changes in the circumstances of forest sites	59.4%
III. Mechanical damage to the habitat and vegetation	4.1%
B. Factors endangering the plants directly	23.2%

Table 3. Pink List: Tree and shrub taxa in Hungary having high probability to be endangered in near future

<i>Alnus incana</i> (L.) Mönch	NT	<i>Rosa agrestis</i> Savi	NT
<i>Calluna vulgaris</i> (L.) Hull.	LC	<i>Rosa caesia</i> Sm. in Sow.	NT
<i>Castanea sativa</i> Mill.	NT	<i>Sambucus racemosa</i> L.	NT
<i>Cerasus fruticosa</i> Pall.	LC	<i>Ulmus glabra</i> Huds.	NT
<i>Cerasus mahaleb</i> (L.) Mill.	LC	<i>Ulmus minor</i> Mill.	NT
<i>Colutea arborescens</i> L.	LC	<i>Ulmus procera</i> Salisb.	LC
<i>Lonicera xylosteum</i> L.	LC	<i>Vaccinium myrtillus</i> L.	LC
<i>Padus avium</i> (L.) Miller	LC	<i>Viscum album</i> L.	
<i>Ribes uva-crispa</i> L.	LC	subsp. <i>abietis</i> Abrom.	NT
		subsp. <i>austriacum</i> Vollm.	LC

present are not endangered, but will probably be endangered in near future.

Discussion

Comparing between the data from the years 2003 and 1988 (RAKONCZAY ed. 1989, BARTHA 1991), we can identify changes in the threat levels to the Hungarian tree and shrub species (dendroflora). At present *Andromeda polifolia*, *Ostrya carpinifolia*, *Ribes petraeum*, *Rosa stylosa*, *Spiraea crenata* can be considered extinct from the Hungarian flora and other 11 species are in the category Critically Endangered. 25 taxa are endangered, further 45 taxa are considered vulnerable. There are 7 species whose level of threat is unknown. Compared to 86 in the year 2003, in 1988 were only 61 taxa of the 188 Hungarian tree and shrub species endangered, which means a 40% growth over the last fifteen years. Some of the 32 taxa added to the Red List in 2003 might already have been endangered in 1988, but our knowledge about them was not sufficient. Only the floristic surveys in the last years have revealed the existing threat level to these species. *Quercus frainetto* is the only species that could have been removed from the list, as its stands have increased and become more stable. Analyzing Tables 1, 4 we can see that 32 species (on the diagonal) had the same status 1988 and in 2003, that means that their level of threat has not been changed. In the case of 50 species (over the diagonal), of which 2 species (*Ribes petraeum* and *Rosa stylosa*) have been extinct from Hungary, the levels of threat have increased. On the contrary,

the threat levels of only five species have been decreased. *Salix nigricans* was considered extinct at the end of the eighteenth century, but in the recent years, a new locality was found. Four other species – *Clematis alpina*, *Spiraea salicifolia*, *Ribes nigrum*, *Vaccinium oxycoccos* show an improved status – not due to the active management but to the finding of new localities. In Table 4 we can see that there are 21 factors endangering the tree and shrub species. Factors endangering the habitats are three times more frequent than the factors endangering the plants directly (Table 2). Factors causing changes to the cultivation methods have the strongest impact; their percentage is 13.3%. The proportion of factors causing changes in the habitat conditions is the highest, nearly 60%. On the basis of these figures and the new research results in botany, a prediction for near future can be submitted. There are 18 taxa currently not endangered but having a high probability to become endangered soon (Table 3). Eight of them perhaps immediately, other 10 somewhat later.

Conclusion

Analyzing the results it can be stated, that in the last one and a half decades the number of endangered tree and shrub species has increased by 40% in Hungary. While in 1988, 61 taxa were classed into any of the categories, in the year 2003, 86. The level of threat has increased in case of the greater part of the endangered species (approximately 50 species). Appraising the endangering fac-

tors it was found, that factors being connected with changes in the circumstances of forest sites had the largest effects in these processes.

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Appendix

Table 4. Threatened tree and shrub species in Hungary, and their endangering factors

Taxa	HU 2003	nP/ gP	HU 1988	Endangering factors
<i>GYMNOSPERMAE</i>				
<i>Ephedra distachya</i> L.	EN	I	VU	1–4, 8, 10, 12, 15, 17, 19, 20
<i>Taxus baccata</i> L.	EN	II	VU	11, 13, 17, 19
<i>ANGIOSPERMAE</i>				
<i>Acer acuminatilobum</i> J. Papp	CR	V	NE	19
<i>Alnus viridis</i> (Chaix in Vill.) Dc.	VU	I	VU	1, 7, 10, 15, 21
<i>Amelanchier ovalis</i> Medik.	VU	I	VU	1, 10, 11, 13, 15, 20
<i>Amygdalus nana</i> L.	EN	I	VU	1, 10, 11, 13, 15, 17, 20, 21
<i>Andromeda polifolia</i> L.	RE		RE	(6)
<i>Betula pubescens</i> Ehrh.	EN	I	NE	4, 6, 7, 9, 10, 18
<i>Carpinus orientalis</i> Mill.	EN	I	VU	13, 19
<i>Clematis alpina</i> (L.) Mill.	VU	II	EN	7, 11, 17, 21
<i>Cornus sanguinea</i> L. subsp. <i>hungarica</i> (Kárp.) Soó	DD	?	VU	?
<i>Coronilla emerus</i> L.	VU	I	VU	1, 7, 13, 21
<i>Cotoneaster integerrimus</i> Medik.	VU	I	VU	7, 11, 13
<i>Cotoneaster niger</i> (WAHLBG.) Fries	VU	I	NE	7, 11, 13
<i>Cotoneaster tomentosus</i> (AIT.) Lindley	VU	II	NE	7, 11, 13
<i>Crataegus monogyna</i> Jacq. subsp. <i>curvisepala</i> (Lindm.) Soó	DD	?	VU	?
<i>Crataegus nigra</i> W. et K.	EN	II	EN	7, 11, 13, 18, 21
<i>Daphne cneorum</i> L. subsp. <i>cneorum</i> subsp. <i>arbusculoides</i> (Tuzson) Soó	VU VU	II V	VU	7, 10, 11, 12, 13, 14, 16, 17, 20
<i>Daphne laureola</i> L.	VU	I	VU	1, 7, 11, 13

Continued Table 4

Taxa	HU 2003	nP/ gP	HU 1988	Endangering factors
<i>Daphne mezereum</i> L.	VU	I	NE	7, 11, 17
<i>Hippophaë rhamnoides</i> L.	CR	I	CR	1, 6, 10, 11, 15
<i>Lonicera caprifolium</i> L.	VU	I	NE	7, 11, 14, 17, 21
<i>Lonicera nigra</i> L.	CR	I	VU	1, 7, 13
<i>Malus dasycphylla</i> Borkh.	VU	?	NE	7, 11, 18
<i>Myricaria germanica</i> (L.) Desv.	CR	I	VU	1, 6, 10
<i>Ostrya carpinifolia</i> Scop.	RE		RE	(3, 5, 7) ?
<i>Populus nigra</i> L.	EN	I	NE	6, 7, 11, 18
<i>Pyrus magyarica</i> Terpó	CR	V	CR	5, 18, 19
<i>Pyrus nivalis</i> Jacq.	EN	I	EN	3, 5, 18, 19, 20
<i>Pyrus austriaca</i> Kern.	EN	V?	VU	3, 5, 19
<i>Rhamnus saxatilis</i> Jacq.	EN	I	VU	4, 7, 10, 11, 18, 21
<i>Ribes alpinum</i> L.	EN	I	EN	1, 7, 13
<i>Ribes nigrum</i> L.	EN	I	CR	6, 11
<i>Ribes petraeum</i> Wulf. in Jacq.	RE		VU	(7)
<i>Ribes rubrum</i> L. agg.	VU	I	VU	7, 11, 12
<i>Rosa arvensis</i> Huds.	VU	I	NE	4, 11, 12, 21
<i>Rosa gizellae</i> Borb.	VU	I	NE	21
<i>Rosa glauca</i> Pourret	DD	I	NE	21
<i>Rosa hungarica</i> (Borb.) Degen	VU	II	NE	2, 7, 11, 21
<i>Rosa inodora</i> Fr. em. Klást.	VU	I	NE	7, 11, 21
<i>Rosa kmetiana</i> Borb.	CR	I	NE	21
<i>Rosa livescens</i> Bess.	VU	I	NE	2, 3, 4, 5, 10, 16, 21
<i>Rosa pendulina</i> L.	VU	I	VU	7, 11, 21
<i>Rosa polyacantha</i> (Borb.) Degen	VU	I	NE	2, 7, 11, 21
<i>Rosa scabriuscula</i> Sm. em. H. Br.	CR	I	NE	7, 21
<i>Rosa sherardi</i> Davies	CR	I	NE	7, 11, 21
<i>Rosa stylosa</i> Desv.	RE?	I	VU	
<i>Rosa szaboi</i> (Borb.) Facsar	EN	I	NE	7, 21
<i>Rosa tomentosa</i> Sm.	VU	I	NE	7, 11, 21
<i>Rubus senticosus</i> Koehler ex W. et Gr.	DD	?	VU	?
<i>Ruscus aculeatus</i> L.	VU	I	NE	7, 11, 17
<i>Ruscus hypoglossum</i> L.	VU	I	VU	7, 11, 13, 17
<i>Salix aurita</i> L.	VU	I	VU	6, 7, 9, 18, 21
<i>Salix elaeagnos</i> Scop.	EN	I	NE	1, 6, 21
<i>Salix nigricans</i> Sm.	EN	I	RE	5, 6, 10
<i>Salix pentandra</i> L.	EN	I	EN	6, 9, 11, 21
<i>Sorbus aria</i> (L.) Cr.	VU	I	NE	1, 7, 11, 18

Continued Table 4

Taxa	HU 2003	nP/ gP	HU 1988	Endangering factors
<i>Sorbus domestica</i> L.	VU	II	NE	3, 5, 7, 11
<i>Sorbus graeca</i> (Spach) Lodd.	VU	II	NE	1, 7, 11, 18
<i>Sorbus hazslinszkyana</i> (Soó) Májovský	CR	I	EN	7, 18, 19
Transition between sections <i>Aria</i>				
<i>Sorbus buekkensis</i> Soó em. Kárp.	VU	V	NE	7, 11, 18
<i>Sorbus danubialis</i> (Jáv.) Kárp.	VU	V	NE	7, 11, 18
<i>Sorbus javorkae</i> (Soó) Kárp.	VU	V	NE	7, 11, 18
<i>Sorbus pannonica</i> Kárp.	VU	V	NE	7, 11, 18
<i>Sorbus sooi</i> (Máthé) Kárp.	VU	V	NE	7, 11, 18
<i>Sorbus aria</i> section x <i>S. torminalis</i> microspecies				
<i>Sorbus adami</i> Kárp.	EN	V	VU	7, 11
<i>Sorbus andreanszkyana</i> KÁRP.	DD	V	VU	7, 11
<i>Sorbus bakonyensis</i> Jáv. em. Kárp.	EN	V	VU	7, 11
<i>Sorbus balatonica</i> Kárp.	VU	V	VU	7, 11
<i>Sorbus barthae</i> Kárp.	EN	V	VU	7, 11
<i>Sorbus borosiana</i> Kárp.	CR	V	VU	7, 11, 13, 19
<i>Sorbus decipientiformis</i> Kárp.	DD	V	VU	7, 11
<i>Sorbus degenii</i> Jáv.	VU	V	VU	7, 11
<i>Sorbus eugenii-kelleri</i> Kárp.	VU	V	VU	7, 11
<i>Sorbus gáyeriana</i> Kárp.	DD	V	VU	7, 11
<i>Sorbus gerecseensis</i> Boros et Kárp.	EN	V	VU	7, 11
<i>Sorbus karpatii</i> Boros	VU	V	VU	7, 11
<i>Sorbus latissima</i> Kárp.	EN	V	VU	7, 11
<i>Sorbus pseudobakonyensis</i> Kárp.	VU	V	VU	7, 11
<i>Sorbus pseudolatifolia</i> Boros	VU	V	VU	7, 11
<i>Sorbus pseudosemiincisa</i> Boros	EN	V	VU	7, 11
<i>Sorbus pseudovertesensis</i> Boros	VU	V	VU	7, 11
<i>Sorbus redliana</i> Kárp.	EN	V	VU	7, 11
<i>Sorbus semiincisa</i> Borb.	VU	V	VU	7, 11
<i>Sorbus simonkaiana</i> Kárp.	VU	V	VU	7, 11
<i>Sorbus vertesensis</i> Boros	VU	V	VU	7, 11
<i>Sorbus</i> x <i>rotundifolia</i> (Bechst.) Hedl.	CR	I	NE	7, 11
<i>Spiraea crenata</i> L.	RE		RE	(3, 4, 5, 11, 21)
<i>Spiraea media</i> Fr. Schm.	VU	I	NE	10, 11, 14, 13, 17, 21
<i>Spiraea salicifolia</i> L.	VU	I	EN	6, 7, 13, 21
<i>Vaccinium oxycoccos</i> L.	EN	I	CR	6
<i>Vaccinium vitis-idaea</i> L.	VU	I	VU	1, 7, 14
<i>Vitis sylvestris</i> C. C. Gmel.	EN	I	EN	6, 7, 11, 19, 21

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Ohrozené druhy stromov a krov Maďarska

Súhrn

V rokoch 1989 až 2003 sa pripravil červený zoznam maďarskej dendroflóry. Tento zoznam obsahuje ohrozené taxóny spolu so zdrojmi ohrozenia. Posudzovanie miery ohrozenia a následné zaradenie taxónov do ohrozovaných skupín sa vykonalo v súlade s návrhmi IUCN. Za posledných 15 rokov pribudlo 50 nových ohrozených druhov, u 5 druhov sa miera ohrozenia znížila, na druhej strane, len v prípade jedného taxónu sa zrušil zápis v červenom zozname. V súčasnosti je v Maďarsku medzi ohrozenými taxónmi vedených 86 druhov stromov a krov. Z 21 činiteľov ohrozujúcich dreviny v Maďarsku 76,8 % priamo zasahuje ich biotopy. Podiel činiteľov priamo ohrozujúcich rastlinstvo je 23,2 %. V článku sa uvádza zoznam aj tých taxónov, ktoré sa v blízkej budúcnosti stanú ohrozenými, ďalej úplný zoznam doteraz ohrozených druhov i s mierou ohrozenia spolu so zdrojmi ohrozenia. Tieto zoznamy umožnia v budúcnosti sledovať zmeny miery ohrozenia.