> Threatened Species in Switzerland

Red List Synthesis Report, Status 2010

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The Northern Lapwing *(Vanellus vanellus)* is threatened with extinction in Switzerland. Photo: Markus Jenny

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This publication is also available in German and French.

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> Abstracts

Red Lists are recognised scientific inventories which indicate the extinction risk of species. This report compiles and analyses all of the data from the existing Swiss Red Lists of threatened plants, animals and fungi. A number of specific analyses provide new insights into the status and spatial distribution of threatened species as well as into the nature of the threats they are affected by. Red List projects are coordinated by the Federal Office for the Environment (FOEN).

Keywords:
Red Lists, species diversity, biodiversity, status, extinction risk, threats, habitats

Rote Listen sind anerkannte wissenschaftliche Fachgutachten, in denen das Aussterberisiko von Arten dargestellt ist. Für den vorliegenden Bericht wurden alle Daten aus den Roten Listen der gefährdeten Pflanzen-, Tier- und Pilzarten in der Schweiz zusammengeführt und ausgewertet. Mehrere Spezialauswertungen geben neue Einsichten zum Zustand und zur räumlichen Verteilung bedrohter Arten sowie zu den Gefährdungsursachen. Die Projekte für Rote Listen werden vom Bundesamt für Umwelt (BAFU) koordiniert.

Stichwörter:
Rote Listen, Artenvielfalt, Biodiversität, Zustand, Aussterberisiko, Gefährdungsursachen, Lebensräume

Les listes rouges se basent sur une procédure d'évaluation des menaces scientifiquement reconnue pour répertorier les espèces indigènes menacées plus ou moins gravement d'extinction. Le présent rapport constitue une synthèse de l'ensemble des listes rouges suisses des espèces végétales, animales et fongiques. Plusieurs analyses ciblées apportent un nouvel éclairage sur l'état et la répartition géographique d'espèces menacées et sur les menaces elles-mêmes. Les travaux relatifs aux listes rouges sont coordonnés par l'Office fédéral de l'environnement (OFEV).

Mots-clés:
listes rouges, diversité des espèces, biodiversité, état, degré de menace, menaces, habitats

Per la classificazione delle specie indigene più o meno gravemente minacciate di estinzione, le Liste rosse si basano su una procedura di valutazione delle minacce scientificamente riconosciuta. Il presente rapporto costituisce una sintesi di tutte le Liste rosse svizzere delle specie vegetali, animali e fungine. Numerose analisi mirate forniscono nuove conoscenze sullo stato e sulla distribuzione geografica delle specie minacciate, come pure sulle minacce. Le attività relative alle Liste rosse sono coordinate dall'Ufficio federale dell'ambiente (UFAM).

Parole chiave:
Liste rosse, diversità delle specie, biodiversità, stato, grado di minaccia, origini della minaccia, habitat

> Foreword

In order to preserve species diversity, we need to know about the situation of as many plants, animals and fungi as possible. Information on the endangerment level of individual species is provided by Red Lists which, in Switzerland, are compiled by experts on behalf of the Federal Office for the Environment, and updated at regular intervals. These lists place the emphasis on species grouped according to distinct and scientifically verifiable categories of endangerment.

Red Lists are considered to be a barometer of nature conservation, and rightly so. They raise public awareness and challenge land users to act responsibly in dealing with the natural resource of biodiversity. This status indicator was immediately adopted in practice, and has proven to be highly effective. Newspapers often report in detail on newly published or revised Red Lists.

Insofar as available data allow it, this synthesis report provides new and important insights into Red Lists. Information from all of Switzerland's current Red Lists has been collated for this purpose. Among other things, the authors shed light on the proportion of species in individual categories of endangerment, investigate the spatial distribution of threatened species and analyse what caused species to be assigned to a certain category of endangerment.

Overall, it becomes obvious that either the range or the population size of many species have been reduced. As a result, there is an urgent need to act. This has also been recognised by the international community of states. At the 10th Conference of the Parties to the Convention on Biological Diversity, held in October 2010 in Nagoya, Japan, participating nations agreed on a strategic plan defining the priority areas for action in the next ten years. One of the targets is stated as follows: "The extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained". Switzerland is one of the countries that have committed themselves to reaching this target by 2020. It is imperative that we meet this challenge not only because biological diversity is the foundation of our existence, but also because we have a moral duty to protect it. We still have time to turn the tide. While the classification of a species as "threatened" does indeed mean that this species might go extinct, it also means that there is still hope.

Willy Geiger
Vice Director
Federal Office for the Environment (FOEN)

> Summary

Red Lists are recognised expert inventories which indicate the extinction risk of native species and subspecies. Red Lists have succeeded in conveying scientifically sound – but easy-to-understand – information about the current state of species diversity to a broad target audience. Red Lists continue to provide the primary means of generating awareness of the critical condition of flora and fauna. However, the Red Lists not only provide information to the public, they also signal the need for action, provide arguments in support of practical nature conservation measures and their assessment, strengthen the protection of species and biotopes, are incorporated into various indicators of sustainable development, support systematics, and prompt the implementation of research projects and action plans on threatened species.

Red Lists in Switzerland

> Red Lists have been in use in Switzerland for more than 30 years. The first Lists were developed within circles of alarmed experts. In 1999, the Federal Office for the Environment (FOEN) merged the separate projects into one Red List Programme.
> Since 2000, each Red List in Switzerland has been prepared according to the criteria of the International Union for Conservation of Nature (IUCN), a process that can take several years. The purpose of these internationally recognised guidelines is to improve the objectivity of classifications and thereby the comparability of Red Lists at national and international levels. This necessitates field work that can be highly resource intensive.
> The criteria for the classification of species into categories of endangerment are based on a combination of factors that substantially determine the likelihood of extinction. Primary factors are the extent of the area a species actually colonises, the size and the degree of isolation of populations, and changes in population size. The smaller and more fragmented the area of occupancy, and the faster the population decline, the higher the level of endangerment.
> To date, a quarter (10,350) of the 45,890 known species have been evaluated for Red Lists.
> Red Lists are currently available for 27 organism groups (Tab. 1): these include 3 plant groups (vascular plants, bryophytes and stoneworts), 21 animal groups (all vertebrates and 15 invertebrate groups) and 3 fungus and lichen groups (macrofungi, epiphytic and terricolous lichens).
> In 1991, Red Lists were formally anchored in the Swiss Federal Ordinance on the Protection of Nature and Cultural Heritage (NCHO; SR 451.1). In particular, they are referred to for the identification of biotopes that are worthy of protection, the assessment of habitat interference and in the evaluation of competing interests for proposed projects.

Tab. 1 > National Red Lists of threatened species in Switzerland

To date, the FOEN has released Red Lists for 27 organism groups (last status as of 2010). They were issued as 14 separate publications in the FOEN "Environment in Practice" series. The only exception is the three native large crustacean species: their degree of endangerment is listed in the Ordinance to the Federal Act on Fish and Fisheries (FFO; SR 923.01). First Red List editions for further organism groups (e.g. wood-dwelling stag beetles, longhorn beetles and jewel beetles) are currently in progress. Italics: currently valid Red Lists.

Groups	Red Lists	1991–2000	2001–2012	Revision in preparation
Vertebrates	Mammals (excluding bats)	*1994*		x
	Bats	*1994*		x
	Breeding birds	1994	2001, *2010*	
	Reptiles	1994	*2005*	x
	Amphibians	1994	*2005*	x
	Fish and cyclostomes	1994	*2007*	FFO 2011
Insects	Craneflies	*1994*		
	Butterflies	*1994*		x
	Caddisflies		*2012*	
	Ants	*1994*		x
	Bees	*1994*		x
	Lacewings	*1994*		
	Ground and tiger beetles	*1994*		x
	Water beetles	*1994*		
	Stoneflies		*2012*	
	Grasshoppers	1994	*2007*	
	Dragonflies	1994	*2002*	x
	Mayflies	1994	*2012*	
Crustaceans	Decapods	1994	*2011*	
Molluscs	Bivalves	1994	*2012*	
	Gastropods	1994	*2012*	
Plants	Vascular plants (ferns and flowering plants)	1991	*2001*	x
	Bryophytes	1992	*2004*	x
	Stoneworts		*2012*	
Lichens	Epiphytic lichens		*2002*	x
	Terricolous lichens		*2002*	x
Fungi	Macrofungi		*2007*	

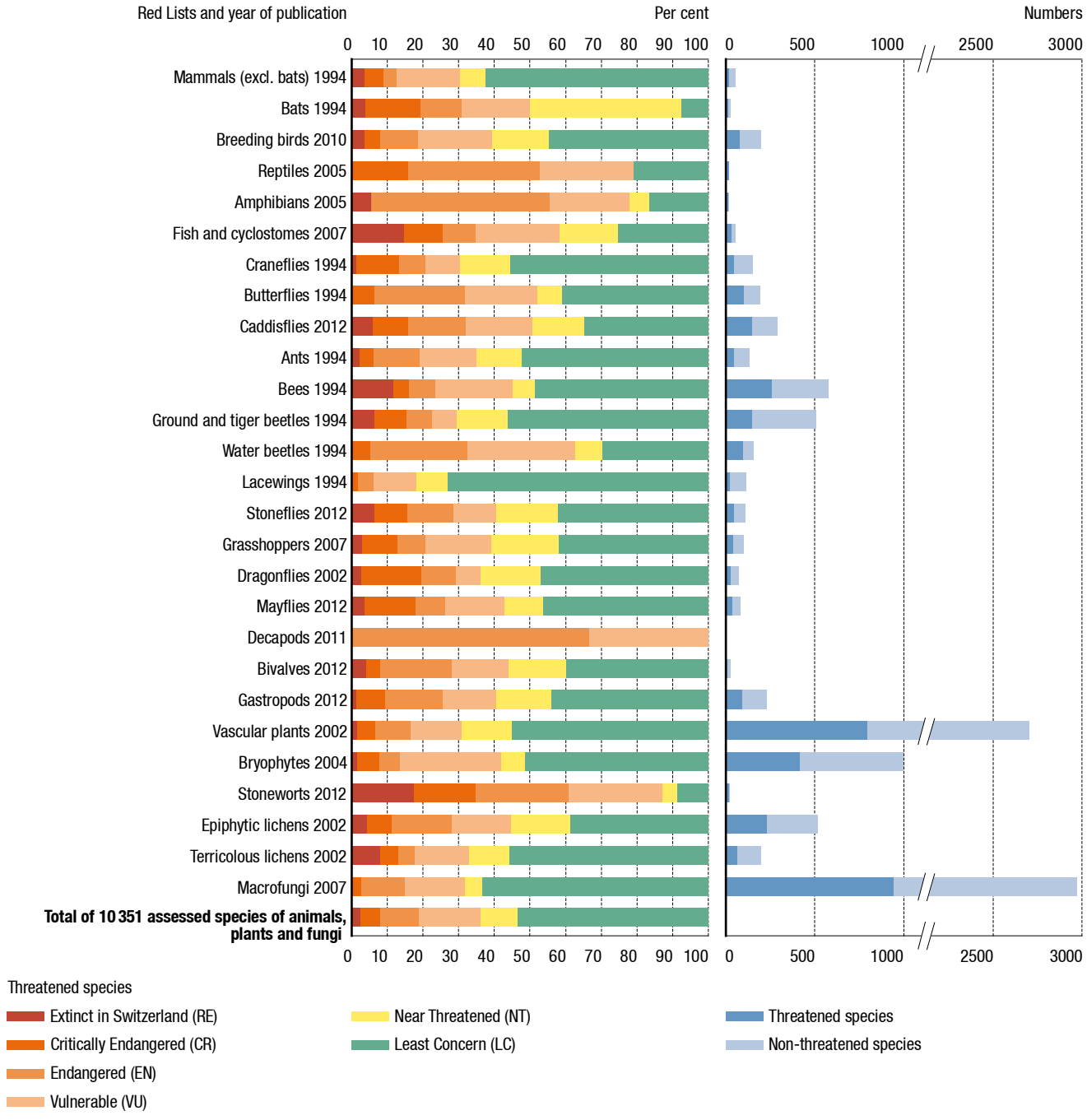
Source: FOEN

Endangerment situation

- Of the species evaluated to date (10,350), 36 per cent (3,741) are categorised as threatened.
- 3 per cent (255) of all evaluated species are considered Extinct in Switzerland (RE, i.e. regionally extinct), 5 per cent (554) Critically Endangered (CR), 11 per cent (1,144) Endangered (EN) and 17 per cent (1788) Vulnerable (VU).
- 10 per cent (1053) of species are considered Near Threatened (NT) and require close monitoring as they risk reaching endangerment status in the future. Combined consideration of the threatened (RE, CR, EN, VU) and near threatened (NT) species reveals that almost half (4,794 or 46 per cent) of all native species assessed in Switzerland are under threat.
- The proportion of threatened species varies according to organism groups (Fig. 1).
- Organism groups inhabiting wet and humid habitats feature particularly high proportions of threatened species.

Fig. 1 > Proportion of threatened species in various organism groups and absolute numbers of threatened species

Only includes species for which sufficient data are available. All species in the Extinct in Switzerland, Critically Endangered, Endangered and Vulnerable categories are classified as "threatened". For detailed figures, see Tab. 9.



Data source: Red Lists, FOEN

Species which are extinct or threatened with extinction in Switzerland

- Worldwide, 330 land and freshwater taxa have been confirmed extinct; this represents 1 per cent of all species assessed by the IUCN (around 33,000). At 2 per cent, the proportion of extinct species in Switzerland is twice as high. These figures clearly demonstrate that the disappearance of species begins at regional level in that individual populations die out and the global range of the individual species becomes increasingly fragmented. If this process continues, the species eventually becomes extinct at global level.
- 255 species on Switzerland's Red Lists are classified as Extinct in Switzerland. The proportion of nationally extinct species would be considerably higher if it were not for the fact that, after a period time, some previously extinct species have either returned of their own accord or – like the Bearded Vulture and the lynx – been actively reintroduced under species recovery programmes.
- 554 species in Switzerland are considered Critically Endangered, e.g. near extinction. Such species tend to have an extremely restricted or fragmented range in this country, arise in significantly reduced population sizes or are only represented by a few individuals.
- Species in the Extinct in Switzerland and Critically Endangered categories may represent a high proportion of species assessed for Red Lists (e.g. stoneworts: 35%, Fig. 1).

Endemic and globally threatened species in Switzerland

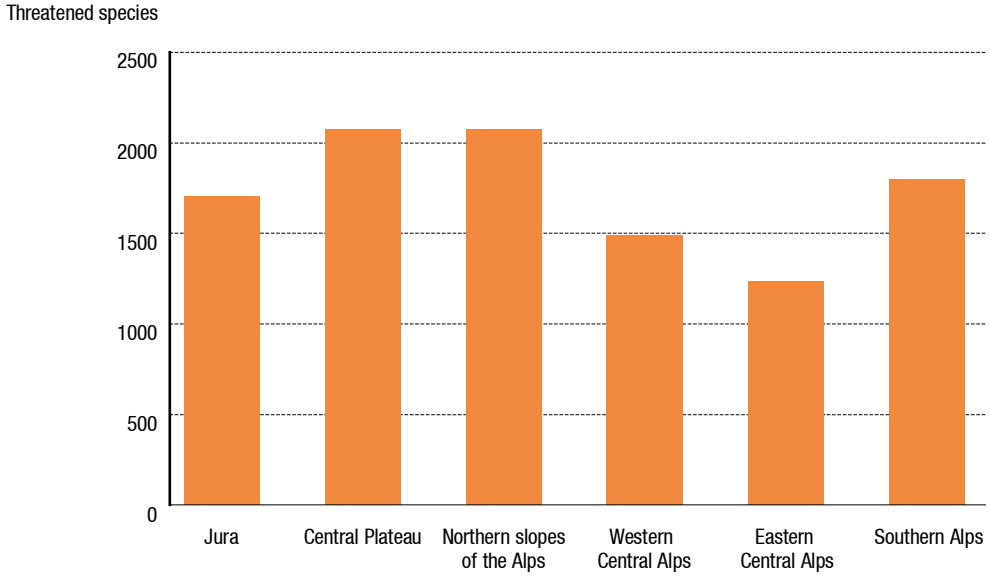
- Switzerland takes particular international responsibility for species whose extinction in Switzerland would mean global extinction or a significantly higher risk of global extinction. This includes both endemic species and native species that are globally threatened.
- To date, 116 taxa composed of 97 species and 19 subspecies have been confirmed as having over 50 per cent of their global range restricted to Switzerland. Of these species and subspecies, 49 are found only in Switzerland and may, therefore, be considered truly endemic.
- Of the species and subspecies found primarily or exclusively in Switzerland, 57 per cent are considered threatened or near threatened. 25 per cent have not yet been recorded in a Red List or have not yet been assessed due to a lack of data.
- Switzerland hosts 79 globally threatened and 21 globally Near Threatened species recorded in the international IUCN Red Lists.

Spatial distribution of threatened species

> The Swiss Central Plateau and the northern slopes of the Alps are home to the highest number of threatened species (Fig. 2).
> Some 70 per cent of known sites of severely threatened species (Critically Endangered and Endangered categories) in the Swiss lowlands (10,000 km²) lie outside protected biotopes of national importance. It is obvious that additional and better connected biodiversity priority areas are needed, and that biodiversity must increasingly be promoted on a large-area basis founded on the principles of sustainable development within sectoral policies, and incorporate extensive areas.
> The proportion of threatened species per habitat varies greatly. Particularly high numbers of severely threatened species are found in watercourses and water bodies, ruderal areas and wetlands (Fig. 3).
> Plants on either wet or dry sites feature an above-average proportion of endangered species.

Fig. 2 Number of threatened species in Switzerland by biogeographical region

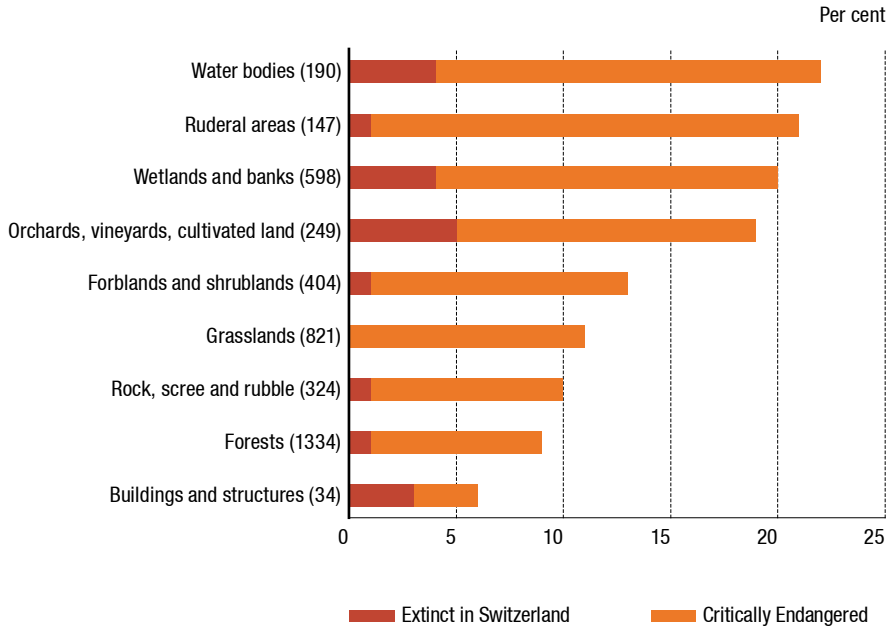
The analysis encompasses 3,161 threatened species.



Data source: Lists of National Priority Species, FOEN

Fig. 3 Proportion of Critically Endangered or Extinct in Switzerland species by habitat type

Percentage of the 2,900 species and 54 subspecies of plants, animals and fungi that spend their life cycles in particular habitats (multiple habitats possible).
In brackets: absolute number of Critically Endangered or Extinct in Switzerland species per habitat type. Sample interpretation: around 22 per cent of all water-dwelling species are either already extinct or Critically Endangered (190 species in total).



Data source: Red Lists, FOEN: macrofungi, lichens, bryophytes, vascular plants, insects (dragonflies, mayflies, stoneflies, caddisflies, grasshoppers, butterflies), molluscs, amphibians, reptiles, breeding birds, mammals

Causes of endangerment

> Every plant, animal and fungus species is more or less adapted to its local environmental conditions. If these conditions change to a species' disadvantage as a result of human activity, this may result in a decline in population densities and/or cause ranges to shrink and fragment into numerous small, isolated pockets. Consequently, the species may need to be added to the relevant Red List or moved to a higher category of endangerment.

> At present, 19 per cent of species assessed for the Red Lists have only very small populations and/or inhabit very small and in some cases highly fragmented areas of occupancy. Such species can be referred to as "rare species". Almost all rare species (95%) are considered to be threatened. These species are rare either because their population sizes or their ranges have dramatically declined due to the impact of human activity in the past, or because they have always been rare in Switzerland.

> Half (52%) of all threatened species are rare species (Fig. 4). These species are exceptionally sensitive to interference in their habitats. If pressure on their habitat or on the remaining individuals increases, the risk of the species completely disappearing from Switzerland within a short period of time increases as well.

> The endangerment criteria applied to the other half of redlisted threatened species (48%) are quite different. Their populations have clearly declined or their ranges

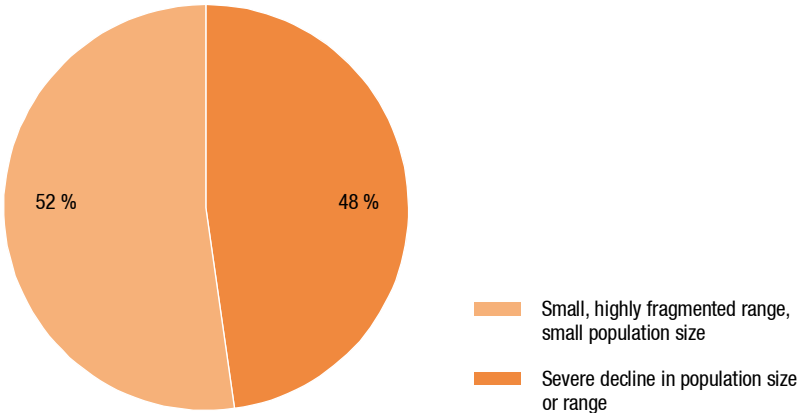
have shrunk dramatically during the investigated period of at least ten years or three generations.

> The most common causes for the decline of a species are, in decreasing order of importance: impairment or destruction of the habitat, changes to and destruction of the ecosystem's natural dynamics, and damage or disturbance to the species populations.

> Detailed analysis has shown that, in recent decades, the intensification of agricultural production and the destruction of habitat structures have been by far the most significant causes of endangerment. The impact of each cause of endangerment varies by organism group.

Fig. 4 Threatened species by endangerment criteria

A total of 2,943 threatened species were analysed; of these, 52 per cent fulfill the criteria for "rare species", i.e. IUCN criteria for small population sizes and/or very small, highly fragmented areas of occupancy at increasing risk of a diminishing range: D, D1, D2 and B2a (see Annex A2).



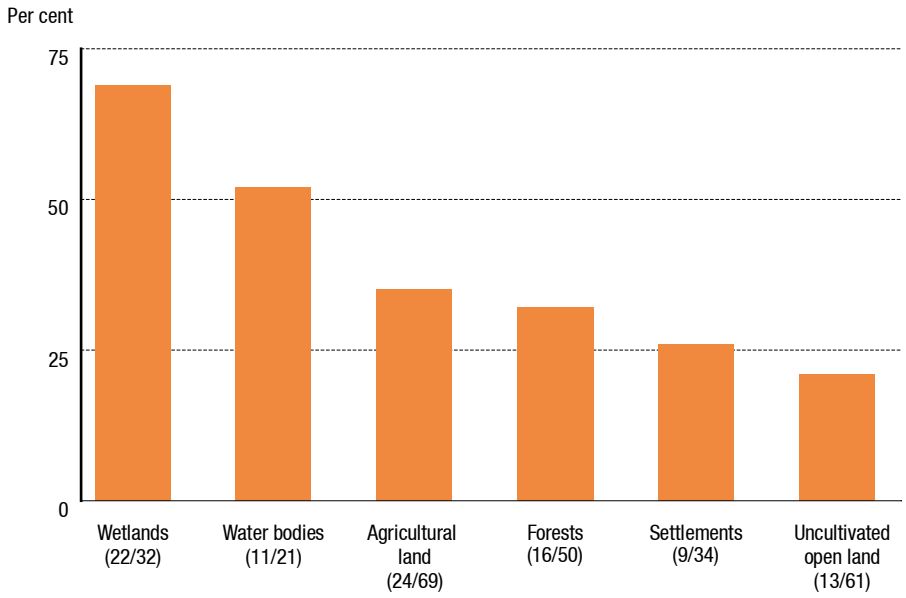
Data source: Red Lists based on IUCN criteria, FOEN

Threatened habitats

> Habitat diversity is under pressure in all ecosystems.
> The proportion of threatened habitats in each ecosystem varies greatly. The highest proportion of threatened habitats is found in wetlands and in watercourses/water bodies; the lowest is found in settlement areas and uncultivated open land (Fig. 5).

Fig. 5 Habitats under pressure

The proportion of threatened habitat types is highest in wetlands and in watercourses/ waterbodies (number in relation to the total number of habitat type occurrence in Switzerland according to Delarze & Gonseth 2008). Sample interpretation: of 32 types of wetland, 22 are threatened.



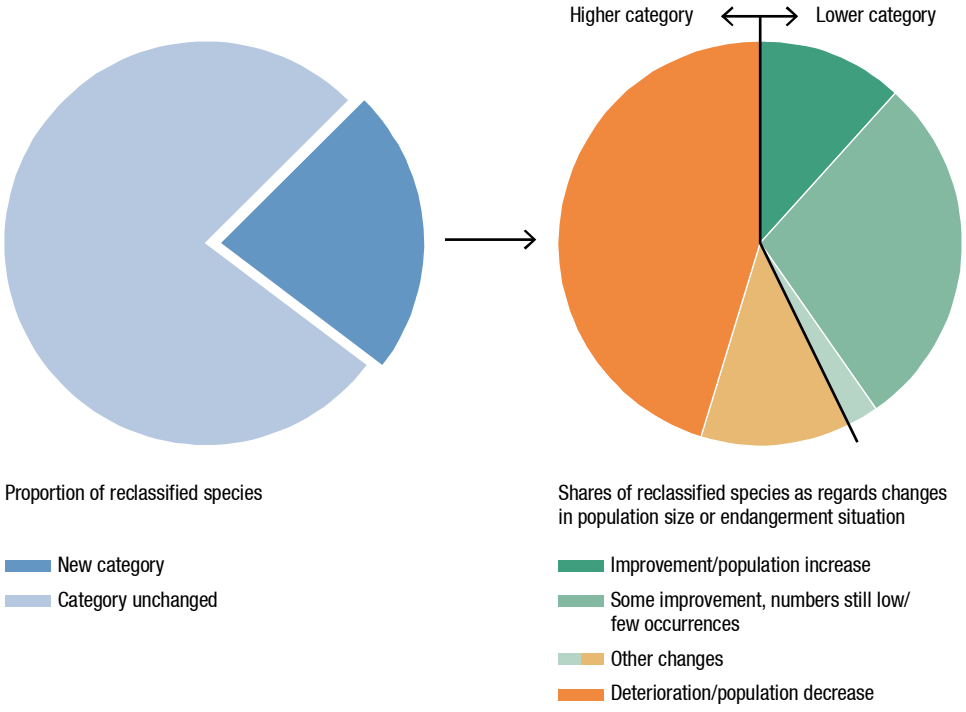
Data source: experts

Changes in degree of endangerment

> Each Red List compiled in accordance with the IUCN criteria documents changes in population size and range for the last ten years, thereby reflecting not only the current situation but also the (negative and positive) trends in biodiversity in recent years.
> Two directly comparable Red Lists are available for breeding birds (2001, 2010). The proportion of redlisted species has remained almost the same, which means that populations continue to decline. In addition, the number of species that needed to be assigned to a higher endangerment category is higher than the number of species that could be downgraded (Fig. 6).

Fig. 6 Changes in the endangerment categories of breeding birds

Comparison of the 2010 revised Red List of breeding birds with the 2001 edition (proportions of reclassified species).



Source: 2010 Red List of Breeding Birds

Conclusions

- The Swiss Federal Constitution calls for the long term preservation of natural resources (Art. 2 para. 4 Cst.; SR 101). Animal and plant life must be protected, and threatened species must be prevented from extinction (Art. 78 para. 4 Cst.). The Federal Act on the Protection of Nature and Cultural Heritage aims to conserve the biological diversity of indigenous species and their natural habitats (Art. 1 para. d NCHA). Within the framework of the Swiss Landscape Concept (Landschaftskonzept Schweiz, LKS) of 1998, the Federal Council set the objective of reducing the number of redlisted species by 1 per cent per year. In 2002, the members of the international Convention on Biological Diversity– including Switzerland – agreed on the objective of significantly reducing biodiversity loss at global, regional and national levels by 2010.
- The high proportion of threatened species on Red Lists is a plain indication that all of these commitments and goals have not yet been fulfilled or reached. Species are still dying out at local, regional and national levels.
- The efforts made to date have not been sufficient to maintain species diversity in Switzerland in the long term. Even stabilising the current state of species diversity would require a significantly higher level of commitment than is presently the case. There is a clear need for action at all social and political levels.
- Quantitative and qualitative expansion of biodiversity priority areas together with biodiversity-compatible land use are a prerequisite for preserving and improving biodiversity.
- For this purpose, sectoral environmental goals are currently being developed at federal level. These include, in particular, the definition of a national biodiversity strategy.
- The main instrument for achieving species protection in Switzerland is habitat protection. Federal and cantonal species recovery programmes will be initiated for a limited selection of species. The focus here is on threatened species, for which Switzerland takes international responsibility.
- Each revised edition of a Red List will show whether these intensified efforts to preserve and promote biodiversity have been fruitful.

1 > Red Lists in Switzerland

Red Lists have been used in Switzerland for over 30 years. This chapter provides an overview of the development, methodology and significance of this most important indicator of the state of species diversity.

1.1 Origins of the Red Lists

Nature and landscape under pressure

"There was a strange stillness. The birds, for example – where had they gone?" wondered American author Rachel Carson in her carefully researched work "Silent Spring" in 1962. Carson was the first to draw attention to a phenomenon that most people had not been conscious of: the gradual loss of biological diversity. For the first time, people were made aware of what it means to upset the balance of nature by massive infringements in complete disregard of biological correlations. Public reaction was overwhelming. Rachel Carson received countless letters from people all over the country reporting that plants and animals that used to be common and familiar were no longer regularly seen and heard. This made it obvious how fatally slow people are in perceiving the impact of their actions.

First IUCN Red List

Human pressure on biodiversity has strongly increased since the beginning of the last century (Ewald & Klaus 2009, Lachat et al. 2010). Land use has continuously been intensified; natural and near-natural habitats have been altered, impaired or destroyed (Fig. 7). As a result, more and more species have disappeared at local and regional levels. In 1963, alarmed by this development, experts of the International Union for the Conservation of Nature (IUCN) began working on a list of extinct or endangered plants and animals. The first Red Data Book was published in 1966. It documented the global threat to species throughout their biogeographical range. The colour red was deliberately chosen for the list of threatened species to symbolise the urgent need for attention.

In the following years, directories of threatened plants, animals and fungi – so-called Red Lists – were compiled in many countries (Zamin et al. 2010; Fig. 8). In essence, they show which species in a certain area are fighting for survival. As such, they constitute an "unspecific appeal to act" (Flury-Kleubler & Gutscher 1996). Basically, Red Lists pursue a number of goals:

- the assessment of the status and development trends of species or organism groups;
- the identification of species and ecosystems that are under pressure;
- the provision of a basis for prioritising and initiating measures for the conservation and promotion of biodiversity;
- the raising of awareness of the need for a sustainable approach to species and their habitats.

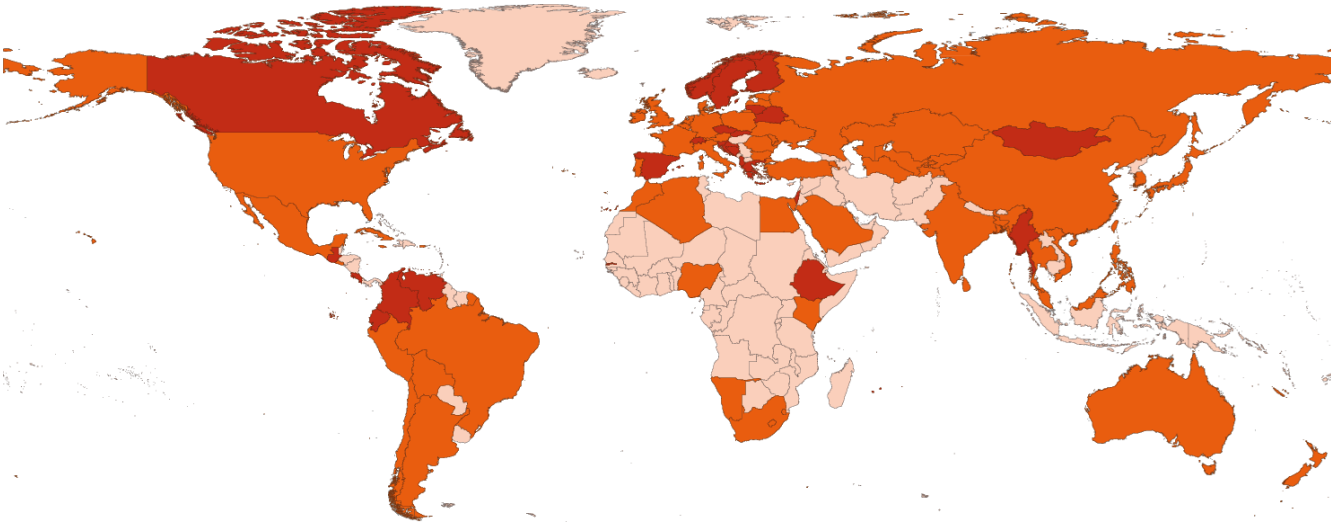
Fig. 7 > Habitat loss

North-east view of the Obermoos bog, north of Münchenbuchsee (canton of Bern), 1916 and 1994. Switzerland lost 82 per cent of its bogland between 1900 and 2010 (Lachat et al. 2010).

Photos: Alt-Buchsee collection (left); ETH Library Zürich, photo archive (right)

Fig. 8 > Countries with Red Lists of nationally threatened species

In 2001, the International Union for the Conservation of Nature (IUCN) published criteria for the regional assessment of species at risk of extinction. Countries coloured dark red use the IUCN criteria. Countries coloured bright red use other criteria to classify species, or are currently in a transition phase (Miller et al. 2007).



Source: www.nationalredlist.org

1.2 Development in Switzerland

Switzerland's first Red List was published more than 30 years ago (Bruderer & Thönen 1977). It was focused on birds, an organism group with an excellent evidence base thanks to the efforts of a large number of volunteers. Five years later, a revised list was released and the first Swiss Red Lists of threatened and rare amphibians and reptiles (Hotz & Broggi 1982) and vascular plants (Landolt et al. 1982) were published. The Red List of vascular plants was based on data gathered during the intensive mapping in the 1970s for Welten & Sutter's (1982, 1984) range atlas for this organism group.

In 1983, Ritter & Waldis published a special Red List of segetal and ruderal plants. This was followed by endangerment assessments for craneflies (Dufour 1986), butterflies (Gonseth 1987), dragonflies (Maibach & Meier 1987), fish and cyclostomes (Kirchhofer et al. 1990). Data for the latter were collected through systematic sampling originally conducted for the atlas of fish and cyclostomes in Switzerland (Pedroli et al. 1991).

Officially recognised instrument for the conservation of biodiversity

All Red Lists published before 1991 were established by experts who wanted to express the gradual loss of populations and species in numbers in order to raise awareness of the problem amongst the public and politicians. Their work was communicated through scientific publications or brochures for public distribution. Only after the Swiss Agency for the Environment, Forests and Landscape (SAEFL, today FOEN) was established in the late 1980s and the biotope protection article in the Ordinance on the Protection of Nature and Cultural Heritage came into force in February 1991 did Red Lists become an officially recognised instrument of nature conservation (section 1.3).

In the early 1990s, the SAEFL issued the first legally binding Red List of ferns and flowering plants (Landolt 1991), followed by the wildlife Red Lists (Duelli 1994 – an anthology of 11 Red Lists of around 2,400 invertebrate species and 376 native vertebrate species). Like their predecessors, all these lists were primarily based on collated field observations and literature research by their authors. Systematic field campaigns were not conducted yet.

However, substantial data were already available for some animal groups like birds, thanks to the long-standing efforts of the Swiss Ornithological Institute at Sempach and the establishment of the first national data centre in 1985: the Swiss Biological Records Centre (Centre Suisse de Cartographie de la Faune, CSCF) in Neuchâtel. The CSCF had initiated its activities in connection with two national inventories for butterflies and dragonflies. Almost ten years later (1994), the Centre of the Swiss Flora Data Network (Info Flora – CRSF or Centre du Réseau Suisse de Floristique) was set up. After initially concentrating on vascular plants, it now also covers algae.

As all Red Lists prior to 2000 were primarily based on the expert knowledge of their authors, meticulous research and the exchange of information between species specialists throughout Switzerland, there were large discrepancies regarding the assessment criteria for the various organism groups. It must be assumed that weighting the status of a species – whether it was classified as "critically endangered" or "rare" – was handled differently for different organism groups. Given the heterogeneous nature of

the data available at the time, it made sense, however, for the experts to have a certain leeway in their application and interpretation of the criteria used to assess endangerment levels.

IUCN criteria and categories become the standard for national Red Lists

Other countries also used various methods for assessing endangerment. This made it difficult, if not impossible, to carry out a cross-comparison between countries, or between organism groups within the same country. Hence, the IUCN developed new guidelines for assessment criteria and endangerment categories – just after the Red List of Swiss Fauna had been published in 1994. Switzerland was then faced with the decision as to whether to remain on the path it had already adopted and accept the incomparability of its data at international level, or to adopt the IUCN guidelines with their precisely defined, consistent and reproducible evaluation criteria, thereby risking its own revised lists to be incomparable with previous national lists. In 2000, the FOEN opted for international comparability, making the IUCN criteria and categories (section 1.5) the standard for evaluation and communication of national Red Lists.

1.3 Legal bases

Swiss Federal Constitution

The Swiss Federal Constitution requires that the federal government protect threatened species (Art. 78 para. 4 Cst.; SR 101):

> *"The federal government legislates for the protection of animal and plant life and for the conservation of their habitats in all their natural diversity. It protects threatened species from extinction".*

Red Lists play a key role in this process: they indicate the extinction risk of a species in the form of endangerment categories that indicate by implication the urgency of measures required.

Ordinance on the Protection of Nature and Cultural Heritage

Since 1991, Red Lists have been a legally binding instrument of nature and cultural heritage protection, as stated in Article 14, paragraph 3 of the Federal Ordinance on the Protection of Nature and Cultural Heritage (NCHO; SR 451.1):

> *"Biotopes are designated as meriting protection on the basis of (…) threatened and rare plant and animal species as specified in Red Lists issued or recognised by the FOEN".*

Red Lists therefore constitute enforcement tools and working aids with a supra-cantonal scope of application.

Legally protected Red List species

Some redlisted species have been granted legally protected status that extends beyond that of the biotope protection article (Art. 14 NCHO) because they are especially attractive (pressure due to collection or exploitation) or they are required to be protected under an international convention (Bern Convention). Altogether, 92 per cent of vertebrate species with Red List status are subject to protection regulations as opposed to a mere 7 per cent of invertebrates (Tab. 2).

Article 20 (para. 1, 2 and 4) of the Federal Ordinance on the Protection of Nature and Cultural Heritage states that:

> *"Unauthorised picking, digging up, pulling out, removal, offer, sale, purchase or destruction, particularly via technical means, of wild plants belonging to the species set out in Appendix 2 is prohibited."*
> *"In addition to those specified in the Federal Act of 20 June 1986 on the hunting and protection of wild mammals and birds, wild animals belonging to the species set out in Appendix 3 are protected."*
> *"The cantons, in consultation with the FOEN, are responsible for regulating the appropriate protection of the plant and animal species set out in Appendix 4."*

Appendix 2 lists protected plant species, Appendix 3 protected animal species (including all reptiles, amphibians and bats) and Appendix 4 species under cantonal protection. Animal species protected under the NCHO are complemented by vertebrate species protected under the Federal Act on Hunting (HuntA; SR 922.0). For fish and cyclostomes, protection is regulated in the Ordinance to the Federal Act on Fish and

Fisheries (Art. 5 FFO; SR 923.01) based on the degree of endangerment of individual species):

> *"The cantons shall take the measures necessary to protect the habitats of threatened species and varieties. They may enact further measures, in particular fishing bans."*

It is prohibited to catch fish that are assigned to the endangerment status of 0 (Extinct), 1 (Critically Endangered) or 2 (Endangered) in Appendix 1 of the Ordinance to the Federal Act on Fish and Fisheries of 24 November 1993, and for which there is no seasonal fishing ban or minimum size requirement as per Article 1 or 2 of the Ordinance.

Some birds and mammals, which qualify as huntable outside of the close season according to the Hunting Act, may not be hunted if the canton classifies them as protected or not huntable for a certain period of time. The Grey Partridge *(Perdix perdix)* and the Eurasian Woodcock *(Scolopax rusticola)*, both of which feature on the Red List of threatened bird species, are examples of species to which this regulation applies. The cantons may also extend close seasons or restrict the list of huntable or catchable species for a period of time (moratorium); this has been done in a number of cantons for the European Hare *(Lepus europaeus)* and the Grayling *(Thymallus thymallus)*. The cantons are obliged to take such measures when necessary for the protection of locally threatened species. With the FOEN's prior approval, they may also temporarily shorten close seasons in order to reduce large populations or to maintain biodiversity.

Tab. 2 > Red List species protected under federal law

Number of threatened species that are completely or temporarily protected by federal law (NCHO, HuntO and FFO), and of the proportion of all redlisted threatened species they represent. The cantons must protect species listed in Appendix 4 of the NCHO that are considered to be especially attractive and/or are protected by the Bern Convention. The cantons may legislate to protect additional species.

Organism group	Protected redlisted species				
	Completely protected	Protected at certain times (close seasons)	To be protected at cantonal level (App.4 NCHO)	Total	Percentage of all threatened species on relevant Red List
Fish, amphibians, reptiles, birds, mammals	143	8	4	155	92 %
Insects, crustaceans, molluscs	80	3	0	83	7 %
Bryophytes, vascular plants	102	-	25	127	11 %
Macrofungi, epiphytic and terricolous lichens	44	-	0	44	4 %
Total	369	11	29	409	11 %

Source: FOEN; Ordinance on the Protection of Nature and Cultural Heritage (NCHO; SR 451.1), Ordinance on Hunting and Protection of Wild Mammals and Birds (HuntO; SR 922.01) and the Ordinance to the Federal Act on Fish and Fisheries (FFO; SR 923.01)

1.4 Significance of Red Lists

Red Lists not only document the situation of a whole taxonomic group and provide an indication of the quality of its habitat, they are also multi-functional instruments (Tab. 3).

Tab. 3 > Red Lists as multi-functional instruments, and their users

Function	Stakeholders	Red List services
Information	Public, politicians, media, federal and cantonal authorities, organisations and environmental agencies of international conventions such as the Bern and Rio conventions, IUCN, research	• Publications with lists, statistics and evaluations of the status and development of species, in three national languages G-F-I (E on the internet) • Data for Biodiversity Monitoring Switzerland (BDM) and for the IUCN Red Lists • Basis for Switzerland's Species Recovery Concept and for the protection of habitats
Awareness raising	Public, politicians, media	• Publications explaining the critical condition of threatened species, the causes of endangerment and recommended actions
Implementation	Experts, organisations with the right of appeal, federal and cantonal authorities, data centres and coordination offices for species recovery, communes and nature parks	• Species lists with endangerment status for the weighing up of interests in accordance with the NCHA • Recommendations for use in practice • Easy to access • Available in three national languages • Periodically revised
Research	Experts on species, universities and research institutes, expert associations of the Swiss Academy of Sciences, nature research associations	• Development or optimisation of new field methods and efficient field strategies • Support for the planning of field work, evaluations
Education	Experts on species (professional or avocational), universities and research institutes, environmental consultants, individuals	• Support of species specialists • Continuing education and training in special organism groups • Participation in research and development projects during academic training (masters, doctorates) • Promotion of knowledge about species and methodologies within society (cultural assets)

Source: FOEN

1.4.1 Providing Information and raising awareness

In Red Lists, complex methodologies and data are presented in the form of scientifically rigorous and verifiable, yet easy-to-understand evaluation criteria. Hence, they are particularly well-suited to providing information and raising awareness about the status of species diversity among the general public and politicians. Red Lists have increased the political priority of nature conservation considerably.

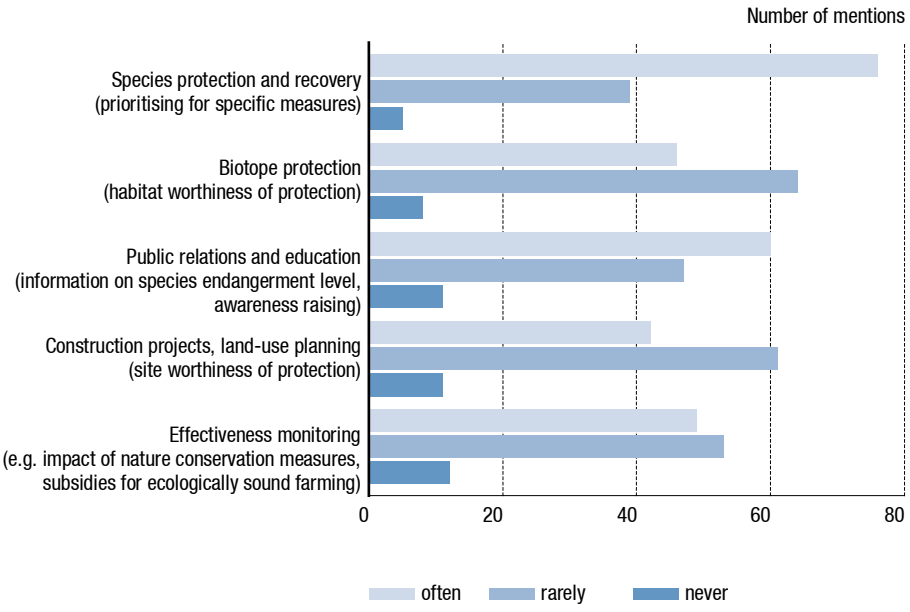
Red Lists are the means by which the federal authorities fulfil their responsibilities to inform and advise the authorities and the public of the significance and state of nature and the landscape (Art. 25a NCHA; SR 451). Red List data also feed into the status reports of Biodiversity Monitoring Switzerland (BDM Coordination Office 2009) and are an integral component of national and international environmental reporting.

1.4.2 Enforcement

Red Lists are deployed in various aspects of nature protection practice (Fig. 9). They encourage the development of protection concepts and provide an impetus to authorities and non-governmental organisations to develop species recovery programmes. Furthermore, Red Lists are used to identify habitats worthy of protection, to assess cases involving habitat alteration and to evaluate project proposals (see section 1.3). Red Lists are an important tool in Environmental Impact Assessments, infrastructure and development projects, structural improvement projects, habitat connectivity projects, landscape development concepts, the updating of regional forest development plans, operational planning in quarries, and wall and building renovation. Table 4 lists the "telltale" organism groups for the various habitat types. Not all organism groups receive equal interest. Attractive and popular groups, such as birds, are most frequently referenced (Fig. 10).

Fig. 9 The use of Red Lists in practice

Survey of the cantonal offices for nature, hunting, fishing and water and of members of the SVU/ASEP (Swiss Association of Environmental Professionals) by the FOEN (2009). The responses revealed that the occurrence of threatened species does not necessarily determine a biotope's worthiness of protection as stipulated by the biotope protection article (Art. 14) of the Ordinance on the Protection of Nature and Cultural Heritage. Instead, Red Lists help direct recovery measures and contribute to awareness-raising.



Data source: FOEN Survey 2009

Tab. 4 > Organism groups suitable for the assessment of habitat alterations

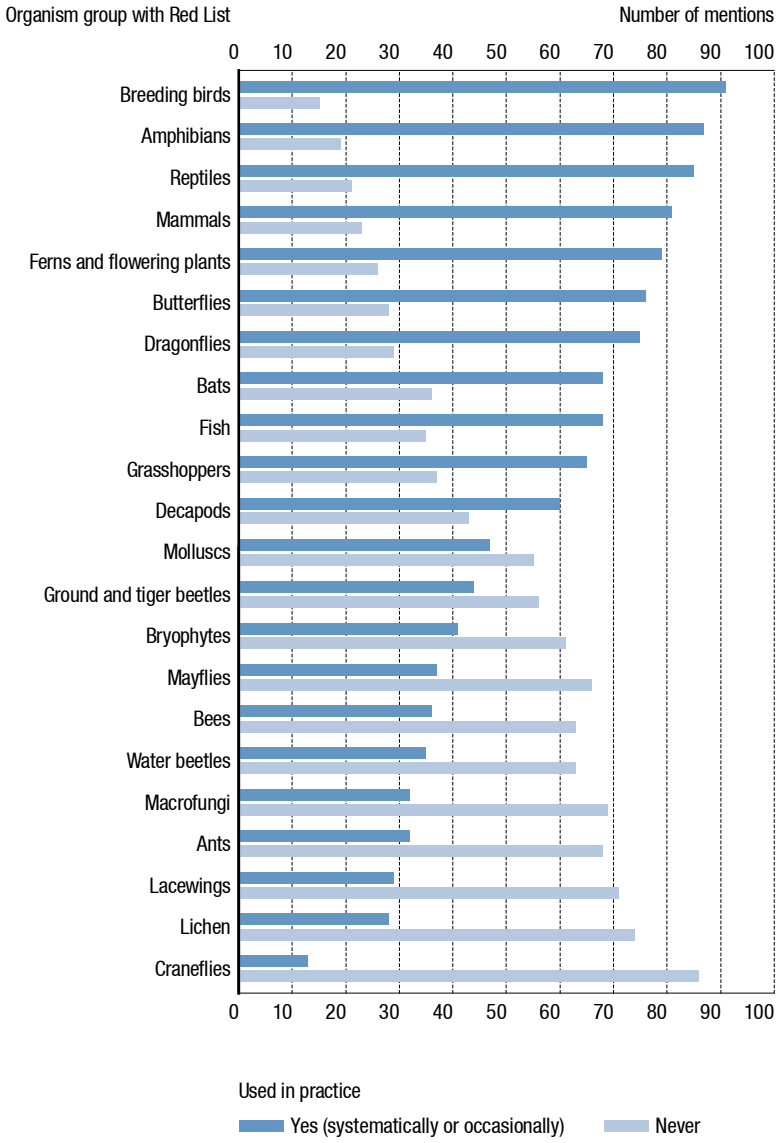
*Tell-tale organism groups are indicated by a large or a small dot depending on their relevance. Habitat types as defined by Delarze & Gonseth 2008. * = Red List being prepared.*

	Standing waterbody	Watercourse	Wetland	Alluvion, scree	Rock	Grassland	Shrubland	Forest	Ruderal, settlement
Mammals (excl. bats)		●	●	●	●	●	●	●	●
Bats		●	●	●		●	●	●	●
Breeding birds	●	●	●		●	●	●	●	●
Reptiles	•	•	●	●	●	•	●	●	•
Amphibians	●	●	●				•	•	•
Fish and cyclostomes	●	●							
Craneflies			●	•	●	●	●	•	●
Butterflies			●	•	•	●	●	•	•
Moths*			●	●	●	●	●	●	●
Caddisflies	●	●							
Ants			●	●		●	●	●	●
Bees			●	●	●	●	●	•	●
Wasps*			●	●	●	●	●	●	●
Ground and tiger beetles			●	●		●	●	●	●
Rove beetles*			●	●	●	●	●	●	●
Stag, longhorn and jewel beetles*							●	●	•
Water beetles	●	●	•						
Lacewings	●	●	•	•		●	●	●	•
Stoneflies		●							
Grasshoppers			●			●	●	●	•
Dragonflies	●	●	●			•		•	
Mayflies	•	●							
Spiders*	•		●	●	●	●	●	●	●
Decapods	●	•							
Bivalves and gastropods	●	●	●	●	●	●	●	●	●
Vascular plants	●	●	●	●	●	●	●	●	●
Bryophytes	•	•	●	●		●		●	●
Stoneworts	●	•	●						
Epiphytic lichens			•			●	•	●	●
Terricolous lichens			●	●	●	●	●	●	●
Macrofungi			●	●		●	●	●	●

Data source: Red Lists, FOEN; CSCF

Fig. 10 The use of various Red Lists in Environmental Impact Assessments

Survey of the cantonal offices for nature, hunting, fishing and water and of members of the SVU/ASEP (Swiss Association of Environmental Professionals) by the FOEN (2009). The responses revealed that not even half the organism groups are used systematically in practice, while the Red Lists of "attractive" organism groups (e.g. birds, amphibians, reptiles) are referred to particularly often. The cantonal offices responsible for forests use the Red Lists of lichens and fungi in connection with species recovery measures.



Data source: FOEN Survey 2009

1.4.3 Education and research

Red List projects sometimes initiate training programmes aimed at improving the knowledge of species. They also challenge species experts to develop their methodological skills. Hence, the Red Lists contribute to maintaining and improving expert knowledge.

Field work for establishing or updating a Red List triggers an enormous surge in reported sightings to be recorded in the various databases. In the case of grasshoppers, for example, three times more data items originate from the Red List campaign than from other sources (e.g. other projects, routine reporting). The digital recording and archiving of data in existing databases and the lodgement of verified and dated voucher specimens in museum collections opens new perspectives for further evaluation and enquiry.

New species of fauna in Switzerland or particular Swiss regions are sometimes discovered during the intensive field campaigns carried out for the Red Lists (e.g. four new caddisflies species in 2001/04; the first Dainty Damselfly *Coenagrion scitulum* was discovered in the canton of Aargau in 2009). Similarly positive events include the rediscovery of species believed to be nationally or regionally extinct, for example the sighting of the Dark Whiteface *(Leucorrhinia albifrons)* in the canton of Bern where the last confirmed sighting was in 1959.

Red List projects and the associated research projects and recording programmes inspire many scientists to focus more intensively on the issues of species and habitat loss. They trigger research and promote the establishment of networks between experts. The Red Lists have prompted numerous research projects on threatened species and their habitat needs, thereby significantly increasing the knowledge available on the ecology of these species.

1.5 Assessing endangerment

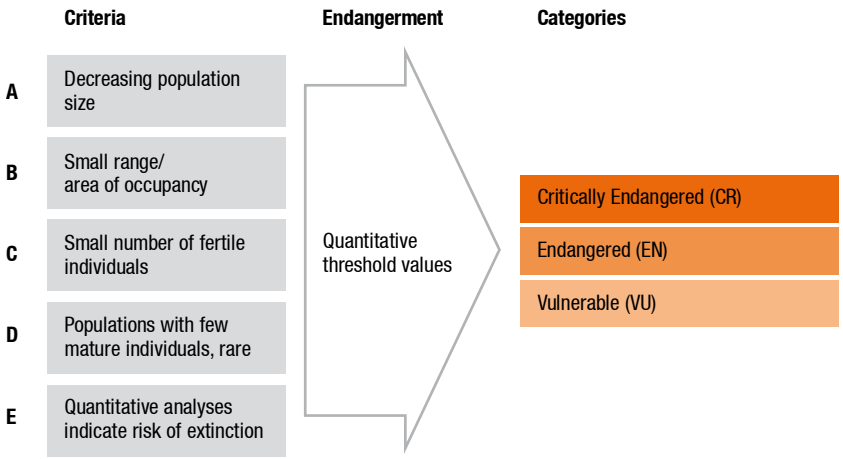
1.5.1 IUCN criteria and categories

Each endangerment assessment must be documented in order to reveal the criteria leading to the proposed classification. The IUCN criteria (see Fig. 11 and Annex A2) for allocating species to an endangerment category (see Tab. 5, Fig. 12 and Annex A1) are based on data collected in the field. For the most part, special field campaigns are carried out in order to complement the evidence base. If quantitative data on population size are lacking – this tends to be the rule rather than the exception for many species and organism groups (e.g. lichen, fungi, insects) – distribution data are used; expert opinions may also be sought as an additional measure. Both the FOEN and Red List contractors constantly endeavour to improve the quality of the evidence base.

Field campaigns to complement the evidence base

Fig. 11 Assessment criteria and endangerment categories

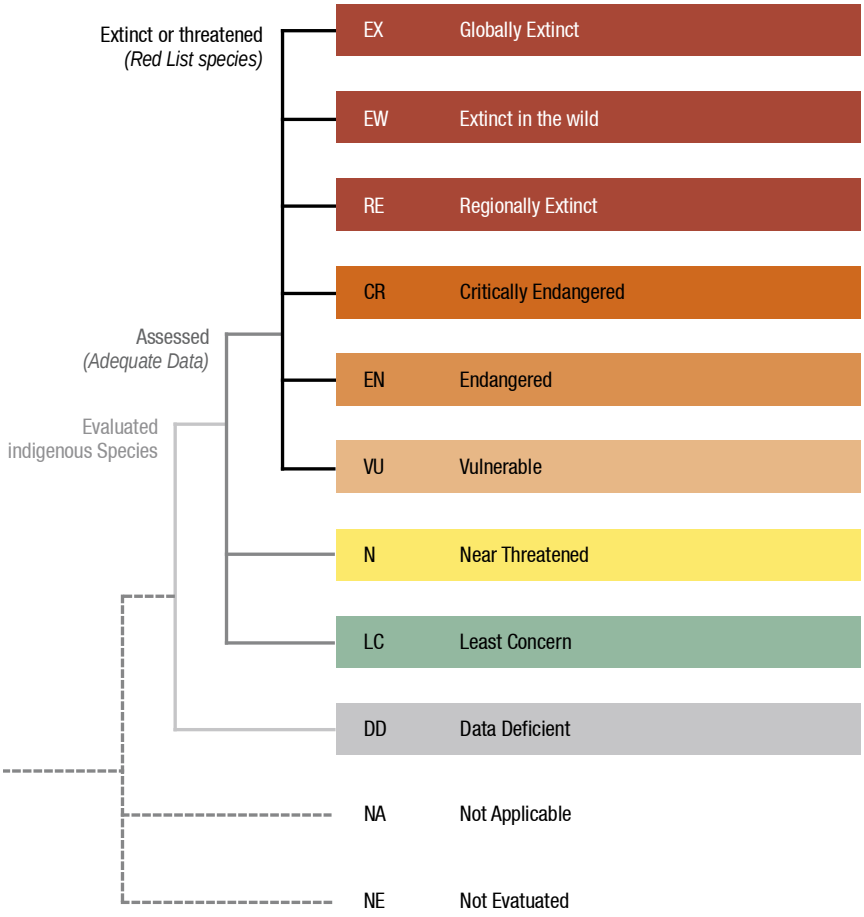
Quantitative threshold values: see Annex A2.



Source: IUCN Species Survival Commission

Fig. 12 Threatened species by IUCN categories

Threatened species have an endangerment status ranging from EX to VU. Strictly speaking, only species actually still found in Switzerland can be designated as threatened; however, statistically, threatened species encompass all endangerment categories, i.e. including Extinct in Switzerland (RE). The Near Threatened (NT) category is considered an advance warning as many species in this category only manage to avoid fulfilling the criteria for threatened species thanks to recovery measures. The Red Lists become longer if pressure on these species increases, or if existing efforts dwindle. The inclusion of Data Deficient (DD) gives the total number of known native species. Alien species, occasional visitors and migratory species are not evaluated (NA), nor are species with taxonomic uncertainties (NE).



Source: IUCN 2003

The adoption of IUCN criteria is in no way meant to cast doubt on the quality and viability of the Red Lists published in Switzerland prior to 2001. Yet the new criteria (IUCN 2001, 2003) offer a number of advantages, such as the possibility of comparing the status of different organism groups and different countries, as well as earlier and revised lists of an organism group. The use of the IUCN criteria requires the fulfilment of the following prerequisites:

Prerequisites for using IUCN criteria

- setting up a representative and species-specific observation system;
- establishment of a quantitative evidence base (especially in relation to the change in population size within approximately ten years or three generations, and/or change in area of occupancy);
- assessment of the level of endangerment based on quantitative information;
- periodic revision of Red Lists.

Indeed, the new assessment system also presents problems. For example, a slow population decline will not be heavily weighted as long as the population does not fall below a certain size. From the perspective of "extinction risk", this is justified because a large population does not run a high risk of disappearing from an area until it starts to decline very rapidly. In other words, certain dynamics in the makeup and population size of species are accepted. However, the adoption of this approach means that common species whose populations are decreasing and even disappearing from some areas – as in the case of the Skylark *(Alauda arvensis)* – are not classified as threatened (Keller et al. 2010). Yet such species may point to the deterioration in the quality of a habitat. Scientists continue to stress that measures for the protection or recovery of species generally have a higher likelihood of success when initiated early (Keller et al. 2010) rather than waiting until the species appears on the Red List.

Assessing a species' endangerment level based on changes taking place during a relatively short period of about ten years is also criticised. Any decline that occurred eleven or more years ago is either not taken into account at all or only very indirectly through the size of a species' range. The European Tree Frog *(Hyla arborea),* for example, had already lost more than 90 per cent of its former range by the end of the 1980s. As it has not experienced any further massive population losses since then, and, although it is even smaller, its area of occupancy is still "too big", the European Tree Frog may no longer be considered a critically endangered species when the next (revised) Red List is released (in 2015).

IUCN criteria are more precise and binding

On the whole, nevertheless, it may be said that the criteria and categories recommended by the IUCN are more precise and binding than those used in the Swiss Red Lists prior to 2000 – an achievement we owe to the commitment and outstanding work of the Red List authors.

Tab. 5 > IUCN endangerment categories and their equivalents in the old and new Red Lists of Switzerland

For detailed explanations of the endangerment categories, see Annex A1. The lists of threatened fish/cyclostomes and decapods specified in the Ordinance to the Federal Act on Fish and Fisheries (FFO; SR 923.1) and all animal groups in as yet unrevised pre-2001 Red Lists use the 1994 categories.

1994 endangerment categories	Post-2000 IUCN endangerment categories	Equivalent in Switzerland
0 Extinct, missing, exterminated	• EX (Extinct) • EW (Extinct in the Wild) • RE (Regionally Extinct)	Extinct or missing • globally • in the wild • in a region or a country where the species had previously been found
1 Threatened with extinction	CR (Critically Endangered)	Threatened with extinction
2 Highly endangered	EN (Endangered)	Highly endangered
3 Endangered	VU (Vulnerable)	Vulnerable
4 Potentially endangered 4a: rare species, fringe areas 4b: taxonomical uncertainties or occurrence unclear 4c: genetically mixed with introduced or bred individuals 4d: occurrence in Switzerland largely dependent on human activities	NT (Near Threatened) • (Considered as criteria) • NE (Not Evaluated) • NE (Not Evaluated) • CD (Conservation Dependent)	Potentially endangered • Classified according to criteria • Not evaluated • Not evaluated • Dependent on specific conservation measures (e.g. nesting aids)
n Not endangered	LC (Least Concern)	Not endangered
	DD (Data Deficient)	Insufficient data
"-": see 4b Not indigenous	NE (Not Evaluated) NA (Not Applicable)	Not evaluated Not applicable

Source: IUCN; FOEN

1.5.2 Assessed species

Regional and national Red Lists compiled according to IUCN criteria will only assess indigenous species living in the wild within their ranges as well as reintroduced originally native species (Fig. 12). Species for which the data are inadequate or that do not reproduce within the investigation area (migratory species such as birds of passage) are not considered. Alien species (neobiota) are not assessed either, among other things to prevent enforcement conflicts. Such a conflict arose when the Common Ragweed *(Ambrosia artemisiifolia)* was put on the Red List of threatened ferns and flowering plants in 2002, only to appear on the first Black List of (unwanted) invasive alien plant species just two years later.

1.5.3 Adjustments made for National Red Lists

As IUCN criteria were originally developed to determine a species' global endangerment status (IUCN 2001), threshold values for individual criteria (e.g. area of occupancy, population size, population decline) generally cannot be applied to smaller geographical units. After all, a species' range is usually not limited to a single country and, hence, larger than the investigation area for a national Red List. For this reason, the IUCN developed a procedure to accommodate smaller geographical units (Gärdenfors et al. 2001). This procedure gave rise, in turn, to a set of recommendations and

instructions for applying categories and criteria at the regional or national level (IUCN 2003) as well as a method for assessing endangerment (IUCN 2010).

The first step in this process is to classify the species according to global IUCN criteria (treating the population within the survey area – for example, Switzerland – as if it were the global population). The second step is to weight the result in the context of the national situation, i.e. look for connection possibilities with partial populations in neighbouring countries (IUCN 2003). Finally, partial populations of the assessed species living outside the investigation area must be evaluated as regards their influence on the risk of extinction of the regional population. In doing this, the assessors start from the hypothesis that populations outside the investigation area can have a "rescue effect", which would cause most species to be less threatened than it appears. However, this is only the case where habitats are of sufficient quality and offer a degree of connectivity that would allow recolonisation. A dried-out bog, for example, cannot be recolonised by sphagnicolous lamella mushrooms, even if spores from nearby populations are introduced (Senn-Irlet et al. 2007).

In Switzerland, endangerment status is evaluated using a reproducible method that is specific to each organism group (Keller et al. 2005). In addition, every Red List makes special mention of species that have undergone a change in endangerment status. This step requires thorough verification as the Extinct in Switzerland endangerment status may only be applied if the last fertile individual in the investigation area is very likely to have died. Time and again, more extensive research yields surprise findings, such as the rediscovery of the European Pond Turtle (*Emys orbicularis orbicularis;* Fig. 23), which was believed to be extinct prior to 1994, or of *Distichophyllum carinatum* (Fig. 31), a moss species tracked down by Biodiversity Monitoring Switzerland in 2005.

1.5.4 Three classification examples

Critically Endangered: the Viperine Snake

The Viperine Snake *(Natrix maura)* has an extremely small range in Switzerland. Its area of occupancy is optimistically estimated at 17 km² as potential terrestrial habitats are very narrow and usually situated on the banks of lakes, rivers and streams. A genetic study was able to demonstrate that the populations in the cantons of Geneva, Vaud and Valais are isolated. Targeted follow-up field research proved that favourable terrestrial habitats for this species are almost completely lacking between Lausanne and Geneva, while the monitoring of twelve sampling squares with previous confirmed sightings in the canton of Geneva showed that the species has disappeared from all twelve sites. Of the seven watercourses and water bodies in this canton that were still colonised in 1975, only three with individuals – separated into three very localised populations – remain today. On the shores of Lake Geneva, between Lausanne and Villeneuve, the population still locally presents greater densities but the risk of extinction remains high. In Valais, the species is extremely rare and highly endangered. The

population in this canton is estimated at a few dozen mature individuals, limited to areas along canals. The decline of the Viperine Snake's original range, the fragmentation of its habitats and the isolation of its populations are sufficient arguments to justify the assignment of the species to the Critically Endangered category (Monney & Meyer 2005).

Fig. 13 > The Viperine Snake and its habitat

Natrix maura; *endangerment status: Critically Endangered.*

Photos: Andreas Meyer

Endangered: the Natterjack Toad

The Natterjack Toad *(Bufo calamita)* was assessed as Vulnerable in the 1994 Red List; since the publication of the new Red List in 2005, it has been considered Endangered. The species was reassigned to a higher endangerment status because of a strongly negative trend in its population size. The Natterjack Toad is a species that inhabits transient pools and small waterbodies. It used to be found mainly in floodplains. After the extensive canalisation of the rivers on the Central Plateau and the disappearance of active floodplains, the species moved to gravel pits and other mining areas. Of the amphibian species investigated for the 2005 Red List, the Natterjack Toad underwent the most dramatic decline (more than 60 per cent). Due to its high level of mobility, neighbouring areas were also searched when surveys failed to yield sightings. However, the results failed to correct the highly concerning decline situation. Apparently, the secondary habitats in gravel pits are also disappearing due to changed exploitation methods and more intense land use (Schmidt & Zumbach 2005).

Fig. 14 > The Natterjack Toad and its habitat

Bufo calamita; *endangerment status: Endangered.*

Photos: Andreas Meyer (left); Jan Ryser (right)

Vulnerable: the Grayling

The Vulnerable category is represented by the Grayling *(Thymallus thymallus)*, an indicator species for ecologically intact rivers. The Grayling is one of the most popular species among anglers. Large populations capable of reproducing naturally are rare as the species needs loose gravel beds and, hence, rivers with correctly functioning bedload transport. However, bedload transport in many waterways is greatly disturbed, so the species is artificially boosted through stocking measures. As the record-breaking hot summer of 2003 showed, Grayling populations are also affected by the warming of the watercourses on the Central Plateau (Kirchhofer et al. 2007).

Fig. 15 > The Grayling and its habitat

Thymallus thymallus; *endangerment status: Vulnerable.*

Photos: Michel Roggo / www.roggo.ch (left); Francis Cordillot (right)

1.6 Compiling a Red List

1.6.1 Surveyed organism groups

An organism group for a Red List is primarily selected relating to the major taxonomic units of class, order or family. Any such organism group must meet the following criteria:

- current knowledge is adequate for planning a nationwide field survey (including range data, tools for identification, appropriate observation or catch/collection methods);
- in order to yield representative results, the survey strategy must also be able to accommodate species that are difficult to identify and find;
- in addition to available funds, the availability of species specialists required for field work and evaluation is a key factor.

Red Lists are not compiled for largely parasitic organism groups like flukes and tapeworms, most of the roundworms and waterbears (Tardigrada) or for disease hosts (e.g. ticks, mosquitoes, worms). Although these organism groups can play an important role in the ecological fabric, it would be difficult to communicate Red Lists for them. Red Lists are not currently planned either for organism groups that are very time-consuming to research such as turbellarians and nematodes.

1.6.2 A seven-stage cycle

Using IUCN criteria to compile a Red List requires a relatively clear picture of national species ranges. This, in turn, requires a strategy for confirming the presence or absence of the species in their potential habitats.

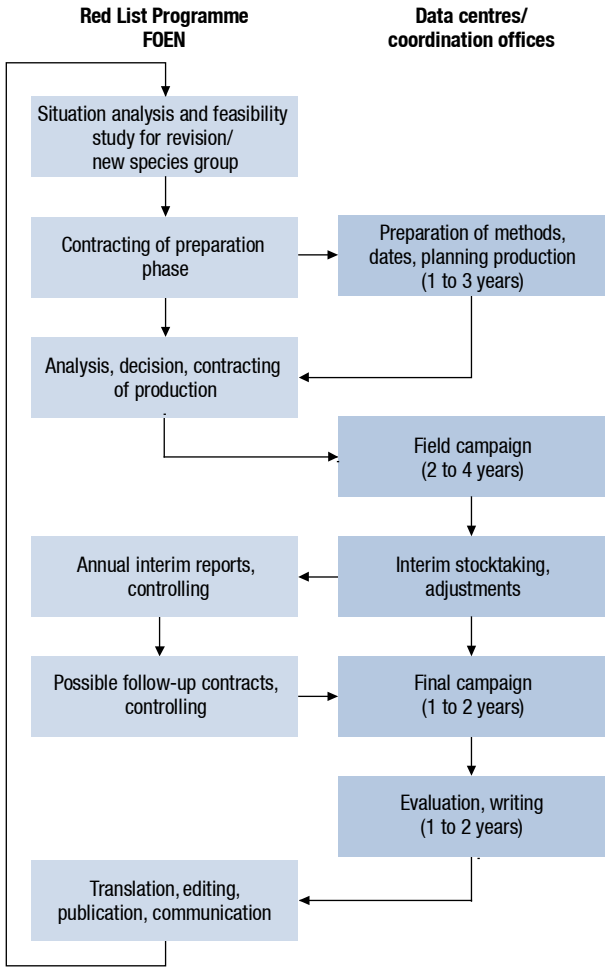
To begin, all available and viable information on the target species is collected; the data are mostly sourced from museums, collections or specialist literature. If this initial research is fruitful, the organism group is ready for a Red List campaign. The best indication of this is the publication of species catalogues or plant identification guides, range atlases, and identification tools with the current nomenclature.

Based on the experience gained with the first revisions of the Red Lists of dragonflies (2002), lichens (2002) and bryophytes (2004), the best solution proved to be the elaboration of the Swiss lists in accordance with the IUCN standards in seven stages (see box on page 39). The standard operating procedures for the compilation of national Red Lists were essentially developed by scientists from the Swiss Biological Records Center (CSCF).

The most time-consuming aspect of Red List production is the multi-year field campaign that follows the initial exploration stage (Fig. 16). The final evaluation and publication stage normally takes one to two years. Programme planning, report editing, printing and communication are the responsibility of the FOEN, in close cooperation with the authors. It takes at least five years for a Red List to be ready for publication; in the case of a first edition, the process is likely to take ten years or more.

Fig. 16 The role of the FOEN and data centres in the compilation and production of a Red List

Left column: Tasks of the FOEN. The Red List Programme runs in species-specific projects and cyclical processes: before national data centres and coordination offices (right column) can carry out field campaigns and evaluations, the FOEN must carefully examine the resources and feasibility.



Source: FOEN

Seven stages to a Red List

- **Preparation:** *Organism groups without Red List so far: experts first review all available information and appraise possible survey methods. Previously reported sightings are verified.*
  Organism groups with previous Red List: for organism groups whose Red List is to be revised, databases are updated with grey data and more recent observational data from private or public sources. The new Red Lists of vascular plants, bryophytes, snails and butterflies, for example, rely on ongoing field surveys conducted by Biodiversity Monitoring Switzerland as an important data source.
  A provisional list of probable threatened species is then compiled. The number of target species and known habitats is crucial for estimating the time required for both field and laboratory investigations (species identification). In addition to processing and evaluating the evidence base for each species, a field survey log is produced and tested for the organism group, and any methods and techniques used are assessed. Stage 1
- **Field campaign:** *Both the known and new sites populated by the target species are surveyed in the context of a field campaign. This usually requires two to three years. The aim is to gain as informative a sampling grid as possible. In the case of field work involving relatively easy-to-identify organism groups (e.g. breeding birds, butterflies, grasshoppers, flowering plants), the campaigns attempt to build up a mainly volunteer network of people who will remain responsible for selected sites in the long term. For difficult-to-identify species, evidence must be taken for subsequent confirmation (photos or voucher specimens) and deposited in reference collections (private collections or publicly accessible natural museums).* Stage 2
- **Interim stocktaking and eventual adjustments:** *Interim assessment enables the analysis of all of the data collated thus far. The aim here is to identify any gaps in the sampling grid or imbalances between biogeographical regions, and to make suggestions for improvements. Any necessary additions or adjustments will be incorporated into the planning of the subsequent final field campaign. If necessary, this stage is carried out in cooperation with research institutes that help to classify difficult-to-identify species, using molecular genetic techniques if required (e.g. for reptiles, fish, lichen).* Stage 3
- **Final field campaign:** *All species for which a reduced range has been identified are targeted for a further campaign. The sampling grid is adjusted for species for which problems emerged in stages 2 or 3. New sites are also sampled, if necessary. A representative number of potentially suitable habitats (or number of square kilometres) is sought for target species with few historical sightings.* Stage 4
- **Evaluation of endangerment status and writing up:** *Data processing based on the IUCN criteria is followed by expert critical assessment. Among other things, the experts check whether the species-specific population dynamics have been taken into account in the classification process and whether changes have occurred since the previous publication (if applicable). Finally, the Red List is translated and edited.* Stage 5

> **Publication and publicity:** *Depending on the taxonomic unit involved, a Red List may comprise several parts (e.g. Red List of molluscs with an aquatic part and a terrestrial part). Several Red Lists are often published together, for example when they have been compiled using the same surveying methods (e.g. the Red Lists of the three water insect orders of mayflies, stoneflies and caddisflies). The Red Lists are readily accessible to the public: the FOEN publishes all Red Lists in the three national languages, both on its website and in printed form, and with recommendations for dealing with organism groups and their habitats. The finalised Red List is published by the FOEN, the contracted national data centre and coordination office and any other participating institutions. They issue a joint media release to publicise the latest legally binding Red List. The endangerment status of the redlisted species is eventually taken into account in the various federal and cantonal environmental indicators.* Stage 6

> **Needs assessment and revision:** *The Federal Council has decreed (FOEN & ARE 1998, LKS) that Red Lists should be revised every ten years so that information can be provided on species trends. The due date for revision is noted in the needs assessment, thereby concluding the Red List Programme production cycle.* Stage 7

Fig. 17 National data centres and coordination offices in Switzerland

For further details please refer to the table on the next page.

	Organism groups	Institutions	Acronym	Website
	Mammals	Swiss Biological Records Center (Neuchâtel)	CSCF	www.cscf.ch
		National Beaver Office (Neuchâtel)	CSCF	www.cscf.ch
	Bats	Swiss Bat Center East (Zurich)	KOF	www.fledermausschutz.ch
		Swiss Bat Center West (Geneva)	CCO	www.ville-ge.ch/mhng/cco
	Birds	Swiss Ornithological Institute (Sempach)		www.vogelwarte.ch
		Coordination Office for Bird Species Relief; SVS/BirdLife Switzerland, Swiss Ornithological Institute, FOEN		www.artenfoerderung-voegel.ch
	Amphibians and reptiles	Coordination Centre for Amphibian and Reptile Protection in Switzerland (Neuchâtel)	karch	www.karch.ch
	Fishes	Swiss Biological Records Center (Neuchâtel)	CSCF	www.cscf.ch
	Invertebrates	Swiss Biological Records Center (Neuchâtel, Zurich-Reckenholz, Lugano)	CSCF	www.cscf.ch
	Flowering plants and ferns, algae	Swiss Flora Data Network (Geneva, Bern)	ZDSF	www.crsf.ch
		Swiss Commission for Wild Plant Conservation (Geneva)	CPS-SKEW	www.cps-skew.ch
	Bryophytes	National Inventory of Swiss Bryophytes (Zurich)	NISM	www.nism.uzh.ch
	Lichens	Swiss Lichen Centre (Birmensdorf), Swiss Federal Institute for Forest, Snow and Landscape Research WSL	SwissLichens	www.swisslichens.ch
	Fungi	National Inventory of Swiss Fungi (Birmensdorf), Swiss Federal Institute for Forest, Snow and Landscape Research WSL	Swissfungi	www.swissfungi.ch

1.7 The federal Red List Programme

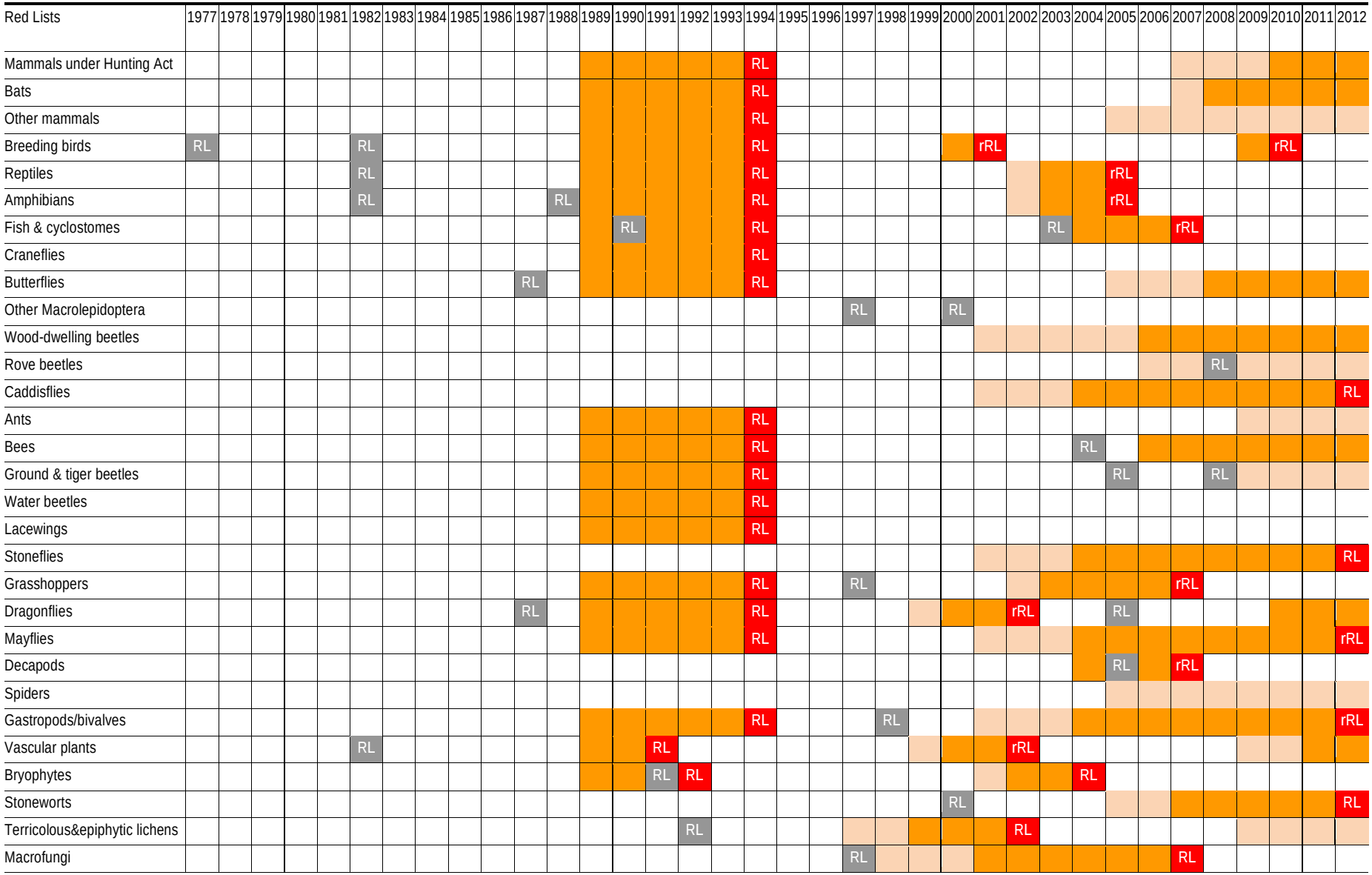
Red List projects are implemented by national data centres and coordination offices

Under the Ordinance on the Protection of Nature and Cultural Heritage (NCHO; SR 451.1), the FOEN is responsible for the authorisation and publication of Red Lists. The federal Red List Programme consists of a bundle of projects for the compilation and production of individual Red Lists of organism groups (Tab. 6).

The projects are implemented by national data centres and coordination offices, which receive the flow of information from practice and research (Fig. 17). The nationwide overview and close networking between these centres and institutions and organisations that work in the area of nature and landscape conservation, both at home and abroad, is very important. The centres for flora and fauna maintain contact with qualified species specialists and operate as a network. Their data are increasingly accessed by way of virtual portals that facilitate complex and correlated enquiries about species and their habitats and ranges, ecological requirements and endangerment levels.

Tab. 6 > The federal Red List Programme

The Programme consists of a set of organism-specific projects that are implemented over a period of several years and are published every ten or more years. Pale orange: Red List Project preparatory stage (see Fig. 16); orange: production period; red: publication; RL = first edition; rRL = revised edition; grey: scientific Red List without legal force.



Source: FOEN

1.8 Other lists raising a flag

1.8.1 Cantonal and regional Red Lists

One of the first regional Red Lists in Switzerland was compiled in the early 1980s for the Aletsch area (Béguin & Theurillat 1983). In 1986, Keller & Hartmann developed a Red List for the canton of Aargau. Up until 2010, the cantons of Basel-Stadt, Basel-Landschaft, Vaud and Geneva had published one or more Red Lists on selected organism groups. These are used in connection with cantonal species protection regulations and priority setting. There is also a special Red List for the flora and fauna of the cantons of Aargau, Schaffhausen and Zurich, which includes information about particular conservation success stories (see Blue Lists, section 1.8.2).

Few regional Red Lists in Switzerland

In contrast to Austria and Germany, Switzerland has only few regional Red Lists (Landmann 2005). There was little imperative to compile and publish such lists in Switzerland as the first national Red Lists of animals and plants also assessed the risk of extinction by biogeographical region (Gonseth et al. 2001) or separately for the northern and southern parts of the country, and Switzerland is a relatively small country anyway. Today, only the national Red List of threatened ferns and flowering plants and of lichens provide information on regional statuses. This is due to the largely inadequate density of the spatial information available on individual species, which means that the finer-level categorisation is not very meaningful. There is a danger that changes to small populations are weighted too heavily. Conversely, nationally threatened species may be less endangered at regional level, which makes communicating results difficult. Furthermore, IUCN criteria are based on larger spatial units.

Nevertheless, a needs assessment carried out by the FOEN in 2009 among employees of enforcement agencies showed that almost three-quarters of them use the regional status of vascular plants and lichens in their reporting. In doing so, they underline the specific situation of the region (especially when it is graver than the national situation). There is clearly a general need for biogeographical classification.

1.8.2 Blue Lists

"Nature is in the red" is a common headline that features in the media when a new Red List is published. For this reason, Red Lists are often perceived as registers of deaths. However, there are also success stories to report in species conservation, for example, the reintroduction of the Alpine Ibex *(Capra ibex)*, Eurasian Lynx *(Lynx lynx)* and Eurasian Beaver *(Castor fiber)*, or the renewed spreading of the Peregrine Falcon *(Falco peregrinus)*. In the early 1990s, this misconception triggered the idea of creating a concise survey of the success stories in species conservation. The appropriate methodology for compiling directories of species whose populations had either increased or ceased to decline over the past ten to 15 years owing to certain nature conservation measures was developed by Gigon et al. (1998). To highlight their close association with the Red Lists, these directories were called "Blue Lists".

Blue Lists show that efforts made to conserve and recover biodiversity have been, and continue to be, worthwhile. By focusing on the successful measures used to date, they counteract the negative messages associated with the Red Lists.

Pilot project discontinued

At this time, Blue Lists only exist for the region encompassing the cantons of Aargau, Schaffhausen and Zurich (Gigon et al. 1998). The data (which have not been updated since 1998) were provided by the cantonal nature conservation offices, experts, targeted surveys and the literature. However the pilot project was not continued. Data collection was found to be highly time-consuming. It also proved to be a disadvantage that classification into categories based mainly on expert reports and on the findings of individual projects. The Blue List idea has been partly integrated into the Red Lists revised lists now show the trend for each species.

1.8.3 List of National Priority Species

In view of the large number of threatened species and limited financial resources, priorities must be identified in the area of species protection. It is important that priority species be selected carefully, and that the selection be based on suitable criteria. In recent years, representatives of the national databases working in cooperation with experts on species from the various organism groups developed a priority list of species on behalf of the FOEN (FOEN 2011). As a supplement to the Red Lists, this instrument may help to lead the way in conservation enforcement. National Priority Species were identified through the consideration of two complementary factors:

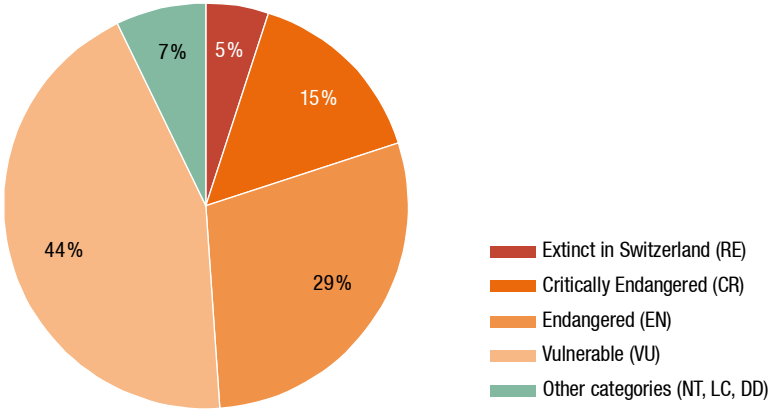
Endangerment and responsibility determine priorities

- Endangerment according to current Red Lists or – for species that have not yet undergone assessment for a Red List – based on expert evaluations. Ninety-three per cent are of all priority species are redlisted (Fig. 18);
- International responsibility for species whose range is largely restricted to Switzerland. Switzerland shoulders the greatest responsibility for species whose extinction in Switzerland would mean global extinction; in other words, for species endemic to Switzerland.

Priority is weighted on an incremental scale depending on the level of endangerment or responsibility. For enforcement purposes, feasibility is taken into account as well. The key question is whether we have adequate knowledge about a species in order to be able to define recovery measures. In other words, it is not necessary to launch immediate measures for all priority species. Given the position of the List of National Priority Species between the Red Lists and Blue Lists, and in keeping with the colour-based designation of these lists, it could be referred to as the “Amber List”, i.e. like the traffic light.

Fig. 18 Endangerment status of National Priority Species

93 per cent of National Priority Species are currently defined as threatened in the Red Lists.



Source: List of National Priority Species, FOEN

1.8.4 Grey and Black Lists

Potentially harmful alien species

Both Grey and Black Lists refer to potentially harmful alien species introduced to Europe – intentionally or not – from other continents (Tab. 7). These lists are periodically updated on the basis of damage reports and range maps by the Swiss Commission for Wild Plant Conservation (SKEW-CPS) and the Centre for Agricultural Bioscience International (CABI) on behalf of the FOEN. As is the case everywhere on the planet, invasive neophytes and neozoans present a threat to indigenous biodiversity in Switzerland. Activities that address the issue have increased, and range from providing information and raising awareness to containing and controlling such species. With the revision of the Ordinance on the Handling of Organisms in the Environment (Release Ordinance (RO); SR 814.911) in October 2008 Switzerland created the legal basis for protecting people and the environment against the harm done by invasive alien species.

Tab. 7 > Lists relating to species protection

The national Red Lists are legally binding. The publication of the List of National Priority Species substantiates unspecific legal terms contained in acts and ordinances, and aims to encourage uniform enforcement in practice (FOEN 2011). Enforcement authorities that use this tool may safely assume that they are applying federal law correctly.

Lists	Subject matters	Application	Further information
Red	Threatened plants, animals and fungi	See section 1.4	www.bafu.admin.ch > Topics > Red Lists
National Priority Species	Priority species that are nationally or regionally threatened and for which Switzerland or its regions take particular responsibility.	Basis for programme agreements in the area of conservation enforcement (Species recovery programmes)	www.bafu.admin.ch > Topics > Biodiversity
Blue	Recovered plant, animal and fungus species, with indication of any known recovery measures.	Enforcement and effectiveness monitoring of recovery measures used to date.	www.bluelists.ethz.ch
Grey	List of potentially harmful invasive alien species in Switzerland.	Lists plant species whose spreading needs to be monitored and, if necessary, contained (early warning list).	www.cps-skew.ch > Invasive alien plants > Watch List
Black	List of invasive alien species in Switzerland causing harm in the areas of biodiversity, public health and/or the economy.	Lists plant species that should not be used, traded, acquired, planted, or propagated.	www.cps-skew.ch > Invasive alien plants > Black List

Source: FOEN

2 > State of Biodiversity in Switzerland

This chapter presents all of the Red List data in aggregated form. Special analyses provide new insights into the state of biodiversity, the spatial distribution of threatened species and the nature of the threats they face.

2.1 Known and classified species

The number of known species in Switzerland (not including unicellular or few-celled algae, slime moulds and protozoa) totals 45,890 (8,272 fungi and lichens; 5,275 algae, bryophytes and vascular plants; 32,343 animals; Tab. 8). Experts estimate that Switzerland is home to another roughly 20,000 species (including 9,000 fungi and 8,000 insects).

45,890 known species in Switzerland

Red Lists include only indigenous, wild species within their ranges and areas of occupancy, including reintroduced native species. They disregard alien species (neobiota or introduced non-native species) as well as species not reproducing within the investigation area or affected by taxonomic uncertainties. Species whose data have been found to be deficient (Fig. 19) are not assessed either.

To date, 10,350 indigenous species in Switzerland with a sufficient evidence base have had their endangerment status established, corresponding to 23 per cent of all known species in Switzerland (Tab. 8). However, the flipside is that three quarters of all known species have not yet been assessed for a Red List.

Endangerment status of 10,350 species established

Tab. 8 > Number of estimated, known, assessed and threatened species in Switzerland

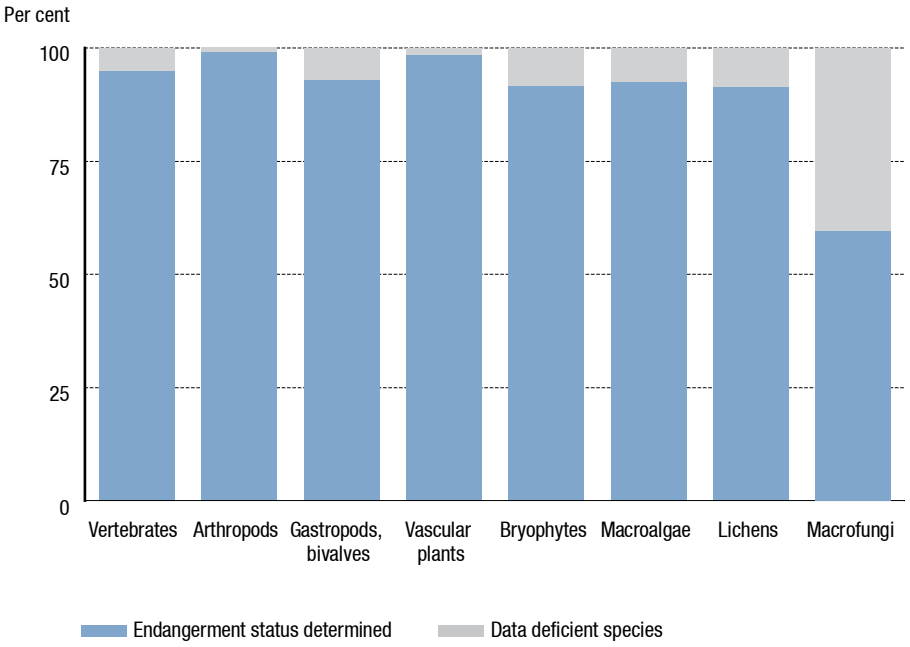
Not including unicellular or few-celled algae, slime moulds and protozoa. All known indigenous species with a sufficient evidence base have been assessed. Species assigned to an endangerment category (RE, CR, EN, VU) are designated as "Threatened".

Indigenous species		Threatened	Near threatened	Not threatened	Assessed	Known ±	Estimated ±
Animals	Number	1283	381	1445	3109	32343	41000
	per cent	41.2 %	12.3 %	46.5 %	10 %	100 %	
Plants (vascular plants, bryophytes, stoneworts)	Number	1226	422	1924	3572	5275	6000
	per cent	34.3 %	11.8 %	53.9 %	68 %	100 %	
Lichens, fungi	Number	1232	250	2187	3669	8272	17000
	per cent	33.6 %	6.8 %	59.6 %	44 %	100 %	
Total	Number	3741	1053	5556	10350	45890	64000
	per cent	36.1 %	10.2 %	53.7 %	23 %	100 %	

Data source: Red Lists, FOEN; experts

Fig. 19 Proportion of data deficient species (DD)

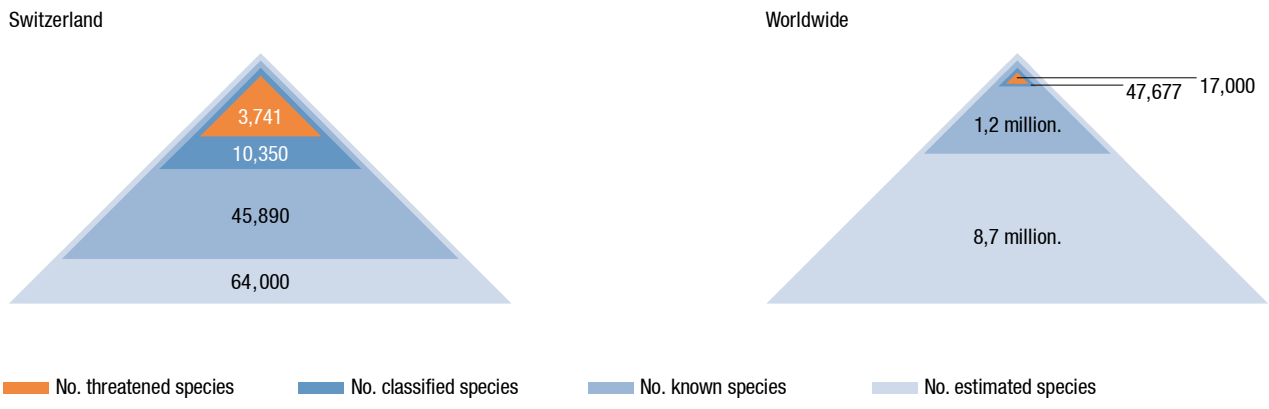
Population: assessed species of redlisted organism groups (12,628 species; see Tab. 9). A species is considered Data Deficient (2,278 species) if the data available on its range and/or population size are not sufficient to allow for direct or indirect assessment of its extinction risk.



Data source: Red Lists, FOEN

It is interesting to compare the numbers for Switzerland with those from the international IUCN Red Lists: the proportion of known and assessed species is significantly lower globally than in this country (Fig. 20). The two pyramids in Figure 20 clearly demonstrate the need for further research.

Fig. 20 > The state of species diversity in Switzerland and worldwide



Data source: Red Lists, FOEN; Millennium Ecosystem Assessment 2005; Mora et al. 2011; IUCN

2.2 Threatened species

More than one third of assessed species are threatened

At the end of 2010, Red Lists were available for the following organism groups: 3 plant groups (vascular plants, bryophytes, stoneworts), 21 animal groups (15 invertebrate and 6 vertebrate groups) and 3 fungus and lichen groups (macrofungi, epiphytic and terricolous lichens). Central to the Red Lists is the enumeration of threatened species. Within the scope of Red List projects, 12,628 species have been assessed to date. The data available for 2,278 species were deficient, hence their endangerment status could not be determined. Of 10,350 species assessed, 3,741 (36%) were categorised as threatened (Fig. 20).

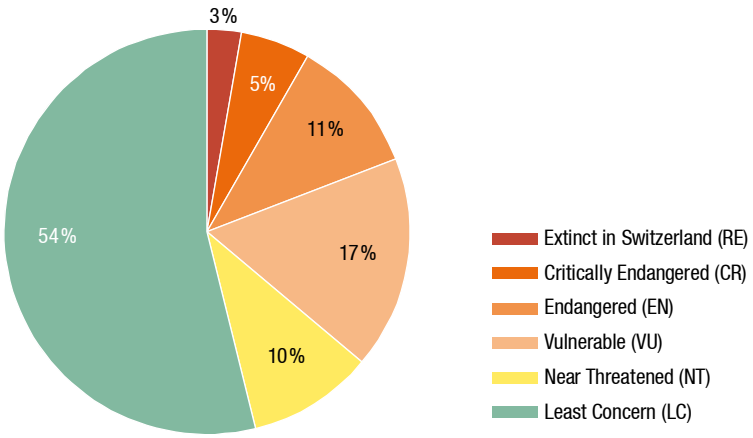
One tenth of assessed species are Near Threatened

Another ten per cent of assessed species were categorised as Near Threatened. Many of these species are still widespread, but their population sizes are declining; other species in this category only manage to maintain their populations thanks to conservation measures. Thus, almost half (46%) of all investigated indigenous species in Switzerland give reason for concern.

The proportion of threatened species varies depending on organism groups (Tab. 9). It is particularly high for native decapods, stoneworts, reptiles and amphibians.

Fig. 21 Proportion of threatened plant, animal and fungus species in Switzerland

Status 2010. Of 10,350 assessed species, around 36 per cent are considered to be threatened (RE, CR, EN, VU categories).



Data source: Red Lists, FOEN

Tab. 9 > Number and proportion of redlisted threatened species in Switzerland for all organism groups evaluated to date

"Threatened species" encompass IUCN categories RE to VU (for correspondence with pre-2001 categories, see Tab. 5).

Organism groups	Extinct in Switzerland		Critically Endangered		Endangered		Vulnerable		Near Threatened		Least Concern		Threatened species		No. of assessed species	No. of categorised species	Data Deficient species	Species Not Evaluated	
																			of which, alien species
	RE		CR		EN		VU		NT		LC		RE+CR+EN+VU				DD	NE	NA
Vertebrates	19	5.1 %	25	6.7 %	47	12.6 %	78	20.9 %	57	15.3 %	147	39.4 %	169	45.3 %	373	394	21	40	28
Mammals (excl. bats)	2	3.6 %	3	5.3 %	2	3.6 %	10	17.9 %	4	7.1 %	35	62.5 %	17	30.4 %	56	57	1	6	6
Bats	1	3.8 %	4	15.4 %	3	11.6 %	5	19.2 %	11	42.3 %	2	7.7 %	13	50.0 %	26	26	0	0	0
Breeding birds	7	3.5 %	9	4.5 %	21	10.6 %	41	20.6 %	32	16.1 %	89	44.7 %	78	39.2 %	199	199	0	18	6
Reptiles	0	0 %	3	15.8 %	7	36.8 %	5	26.3 %	0	0 %	4	21.1 %	15	78.9 %	19	19	0	0	0
Amphibians	1	5.5 %	0	0 %	9	50.0 %	4	22.2 %	1	5.6 %	3	16.7 %	14	77.8 %	18	20	2	1	1
Fish and cyclostomes	8	14.5 %	6	10.9 %	5	9.1 %	13	23.6 %	9	16.4 %	14	25.5 %	32	58.2 %	55	73	18	15	15
Insects	136	5.5 %	188	7.6 %	286	11.5 %	400	16.1 %	284	11.4 %	1190	47.9 %	1010	40.7 %	2484	2506	22	113	94
Craneflies	2	1.3 %	18	11.9 %	11	7.3 %	15	9.9 %	21	13.9 %	84	55.7 %	46	30.5 %	151	151	?	0	0
Butterflies	0	0 %	12	6.3 %	49	25.5 %	39	20.3 %	13	6.8 %	79	41.1 %	100	52.1 %	192	192	0	14	14
Caddisflies	17	5.8 %	29	10.0 %	47	16.1 %	54	18.6 %	43	14.8 %	101	34.7 %	147	50.5 %	291	302	11	7	0
Ants	3	2.2 %	5	3.8 %	17	12.9 %	21	15.9 %	17	12.9 %	69	52.3 %	46	34.8 %	132	132	?	2	2
Bees	67	11.7 %	25	4.3 %	42	7.3 %	125	21.7 %	37	6.5 %	279	48.5 %	259	45.0 %	575	575	?	0	0
Ground and tiger beetles	32	6.3 %	45	8.9 %	37	7.3 %	34	6.7 %	72	14.3 %	285	56.4 %	148	29.3 %	505	505	0	76	76
Water beetles	0	0 %	8	5.2 %	42	27.1 %	47	30.3 %	12	7.7 %	46	29.7 %	97	62.6 %	155	155	0	0	0
Lacewings	0	0 %	2	1.7 %	5	4.3 %	14	12.1 %	10	8.6 %	85	73.3 %	21	18.1 %	116	116	?	0	0
Stoneflies	7	6.4 %	10	9.2 %	14	12.9 %	13	11.9 %	19	17.4 %	46	42.2 %	44	40.4 %	109	111	2	0	0
Grasshoppers	3	3.0 %	10	9.8 %	8	7.8 %	19	18.6 %	19	18.6 %	43	42.2 %	40	39.2 %	102	105	3	7	2
Dragonflies	2	2.8 %	12	16.7 %	7	9.7 %	5	6.9 %	12	16.7 %	34	47.2 %	26	36.1 %	72	76	4	6	0
Mayflies	3	3.6 %	12	14.3 %	7	8.3 %	14	16.7 %	9	10.7 %	39	46.4 %	36	42.9 %	84	86	2	1	0
Crustaceans																			
Decapods	0	0 %	0	0 %	2	66.7 %	1	33.3 %	0	0 %	0	0 %	3	100 %	3	3	0	4	4
Molluscs	3	1.2 %	19	7.6 %	41	16.5 %	38	15.3 %	40	16.0 %	108	43.4 %	101	40.6 %	249	270	21	34	27
Bivalves	1	4.0 %	1	4.0 %	5	20.0 %	4	16.0 %	4	16.0 %	10	40.0 %	11	44.0 %	25	29	4	5	5
Gastropods	2	0.9 %	18	8.0 %	36	16.1 %	34	15.2 %	36	16.1 %	98	43.7%	90	40.2 %	224	241	17	29	22

Organism groups	Extinct in Switzerland		Critically Endangered		Endangered		Vulnerable		Near Threatened		Least Concern		Threatened species		No. of assessed species	No. of categorised species	Data Deficient species	Species Not Evaluated	
																			of which, alien species
	RE		CR		EN		VU		NT		LC		RE+CR+EN+VU				DD	NE	NA
Vascular plants	39	1.5 %	131	5.1 %	248	9.7 %	372	14.6 %	354	13.9 %	1410	55.2 %	790	30.9 %	2554	2592	38	545	389
Flowering plants	34	1.4 %	124	5.0 %	241	9.8 %	361	14.6 %	344	13.9 %	1 365	55.3 %	760	30.8 %	2 469	2 504	35	545	389
Ferns	5	5.9 %	7	8.3 %	7	8.2 %	11	12.9 %	10	11.8 %	45	52.9 %	30	35.3 %	85	88	3	0	0
Bryophytes	15	1.5 %	61	6.1 %	58	5.8 %	282	28.4 %	67	6.7 %	512	51.5 %	416	41.8 %	995	1093	98	2	1
Liverworts	3	1.2 %	9	3.6 %	16	6.3 %	92	36.5 %	15	6.0 %	117	46.4 %	120	47.6 %	252	259	7	0	0
Mosses	12	1.6 %	52	7.0 %	41	5.5 %	190	25.7 %	52	7.0 %	394	53.2 %	295	39.8 %	741	832	91	1	1
Hornworts	0	0 %	0	0 %	1	50.0 %	0	0 %	0	0 %	1	50.0 %	1	50.0 %	2	2	0	1	0
Macroalgae																			
Stoneworts	4	17.4 %	4	17.4 %	6	26.1 %	6	26.1 %	1	4.3 %	2	8.7 %	20	87.0 %	23	25	2	0	0
Lichens	38	5.3 %	45	6.3 %	96	13.5 %	116	16.3 %	107	15.0 %	311	43.6 %	295	41.4 %	713	786	73	0	0
Epiphytic	22	4.3 %	35	6.8 %	87	16.9 %	86	16.7 %	84	16.4 %	200	38.9 %	230	44.7 %	514	521	7	0	0
Terricolous	16	8.0 %	10	5.0 %	9	4.5 %	30	15.1 %	23	11.6 %	111	55.8 %	65	32.7 %	199	265	66	0	0
Macrofungi	1	0.0 %	81	2.7 %	360	12.2 %	495	16.8 %	143	4.8 %	1876	63.5 %	937	31.7 %	2956	4959	2003	20	20
Total	255	2.5 %	554	5.3 %	1 144	11.0 %	1 788	17.3 %	1 053	10.2 %	5 556	53.7 %	3 741	36.1 %	10 350	12 628	2 278	762	563
Animals overall	158	5.1 %	232	7.5 %	376	12.1 %	517	16.6 %	381	12.3 %	1 445	46.5 %	1 283	41.3 %	3 109	3 173	64	191	153
Vertebrates	19	5.1 %	25	6.7 %	47	12.6 %	78	20.9 %	57	15.3 %	147	39.4 %	169	45.3 %	373	394	21	40	28
Invertebrates	139	5.1 %	207	7.6 %	329	12.0 %	439	16.0 %	324	11.8 %	1 298	47.5 %	11 145	40.7 %	2 736	2 779	43	151	125
Plants overall	58	1.6 %	196	5.5 %	312	8.7 %	660	18.5 %	422	11.8 %	1 924	53.9 %	1 226	34.3 %	3 572	3 710	138	547	390
Lichens and fungi overall	39	1.1 %	126	3.4 %	456	12.4 %	611	16.7 %	250	6.8 %	2 187	59.6 %	1 232	33.6 %	3 669	5745	2076	20	20

Data source: Red Lists, FOEN (see Annex A3)

Taxon or species?

The species (animal, plant or fungus) is the basic taxonomic unit. A biologically defined species capable of sexual reproduction comprises all individuals that can interbreed or potentially interbreed (biospecies) with each other, for example all Common Blackbirds (Turdus merula) *in Switzerland. However, as this can only be verified for a very limited number of species, most of the species are defined purely on a morphological basis (morphospecies).*

In rare cases, Red Lists not only assess individual species, but also subspecies or genera. The Whitefish (genus Coregonus*) in Swiss lakes, for example, are believed to consist of at least 25 independent species. Hence, strictly speaking, Red Lists are not about species but taxa. This neutral term includes, inter alia, genus, species and subspecies. Nonetheless, as the vast majority (approx. 95%) of taxa assessed for the Red Lists are species, for the sake of simplicity, this publication generally refers to "species".*

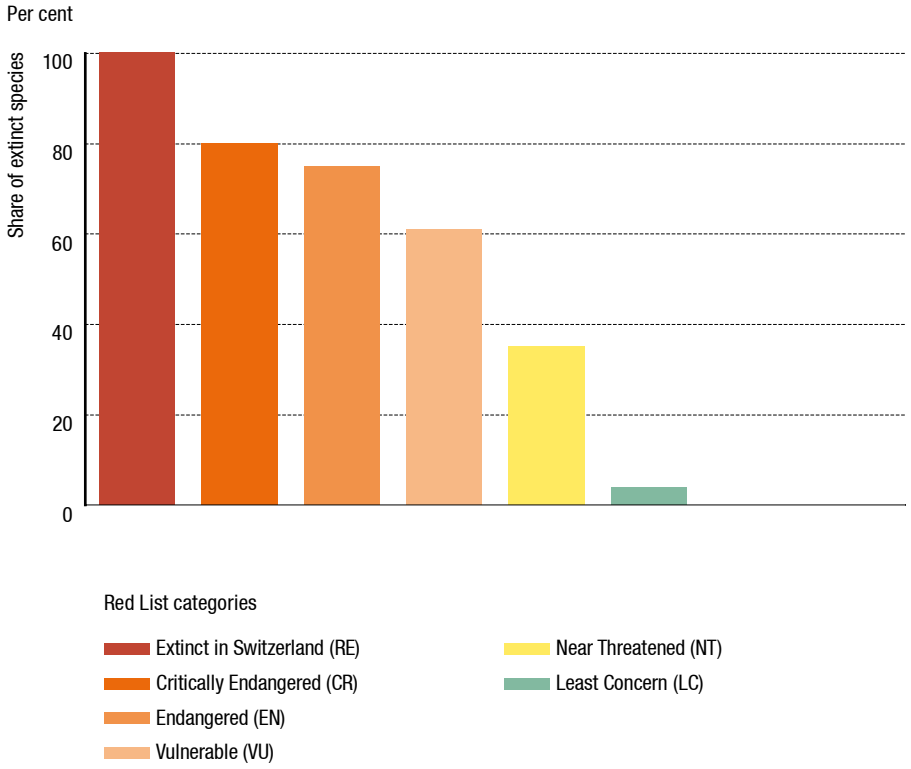
Species loss begins at local level

The flora of the commune of Küsnacht on Lake Zurich has been extensively surveyed. For this reason, we know which of the species found in the area prior to 1915 were no longer present in 2003 (Holderegger & Wirth 2007): a total of 127 species are involved here. Using these missing species, Holderegger (2009) verified the reliability of the endangerment levels assigned by the Red List of threatened ferns and flowering plants in Switzerland. The researcher expected species considered Critically Endangered or Endangered at national level to be more prominently represented among the species that went extinct in Küsnacht than species that faced little or no risk of extinction.

His analysis showed that the pattern of extinction of plant species in the commune of Küsnacht corresponds exactly to the expectations based on the Red List. In general, the proportion of species extinct in Küsnacht decreases along with the endangerment level assigned in the Red List (Fig. 22). In Küsnacht, 80 per cent of species found prior to 1915 and currently considered Critically Endangered at national level have died out. The same applies for 75 per cent of the Endangered species, 61 per cent of the Vulnerable species and 35 per cent of the Near Threatened species. In contrast, only 4 per cent of species not considered as threatened went extinct in Küsnacht. In other words, the current Red List matches the pattern of extinction observed in Küsnacht.

Fig. 22 Extinction begins at local level – a case study

100 per cent: all species found in Küsnacht (canton of Zurich) in the past or today (728 species), differentiated by endangerment category as assigned in the national Red List of threatened vascular plants. The coloured columns show the number of species in each endangerment category that have gone extinct since 1915. Of the total of 127 species that died out in Küsnacht, one has also disappeared at national level.



Source/Data: Holderegger 2009; Red List of Vascular Plants 2002, FOEN

2.2.1 Species Extinct or Critically Endangered in Switzerland

The disappearance of species is usually a gradual process that begins at local level. The density of individuals in remaining populations declines due to the deterioration in habitat quality and entire populations disappear as a result of the destruction of habitats. The range that was once a unified whole becomes increasingly fragmented. If the threat factors persist, the species will disappear from entire regions and countries, in the worst case, it will go extinct throughout the world.

One in 20 species is on the brink of extinction

Most species in Switzerland have had to endure population losses in recent decades. Some of them have been left with very small ranges or are represented by only a few individuals. Species meeting these criteria are categorised as Critically Endangered in the Red Lists. In Switzerland, 554 species have been assigned to this category, that is 5 per cent of all assessed species. As demonstrated by the example of the European Pond Turtle *(Emys orbicularis)* (see box), the transition between Extinct in Switzerland and Critically Endangered is often a fluid one.

The "return" of the European Pond Turtle

In the 1994 Red List, the European Pond Turtle (Emys orbicularis orbicularis) *was classified as Extinct in Switzerland, as the authors assumed that all turtles observed in the wild were abandoned animals that did not form a population capable of reproducing. However, in their range atlas of reptiles in Switzerland, Hofer et al. (2001) came to the conclusion that it is not possible to state definitively whether the Pond Turtle is extinct in Switzerland or not.*

Recent studies have revealed that this reptile species does in fact reproduce in the canton of Geneva, among others. The population there consists of around 300 individuals. Very small and isolated populations also occur in other cantons. However, the animals observed in Switzerland belong to various subspecies: genetic analyses have identified not only the subspecies Emys orbicularis orbicularis *but also largely illegally abandoned animals of various European origins. This information prompted the authors of the Red List of threatened reptiles (2005) to re-assess the status of the European Pond Turtle in Switzerland, and to downgrade its categorisation from Extinct in Switzerland to Critically Endangered.*

There are a number of reasons for the demise of the European Pond Turtle in Switzerland. Historically, the Pond Turtle was a food source caught with nets and traps and this led to its disappearance from certain regions. It was further pressured by the loss of wetlands and river engineering measures, the fragmentation of habitats, and the loss of egg-laying sites due to human settlement, traffic and agriculture. Intermixing with stray, non-native subspecies poses a particular problem today. The complete disappearance of native individuals through hybridisation has prompted several cantons to take measures such as public information campaigns and attempts at controlled re-establishment.

Fig. 23 > The European Pond Turtle and its habitat

Emys orbicularis; *endangerment status: Critically Endangered.*

Photos: Jean-Claude Monney

One in forty species is extinct

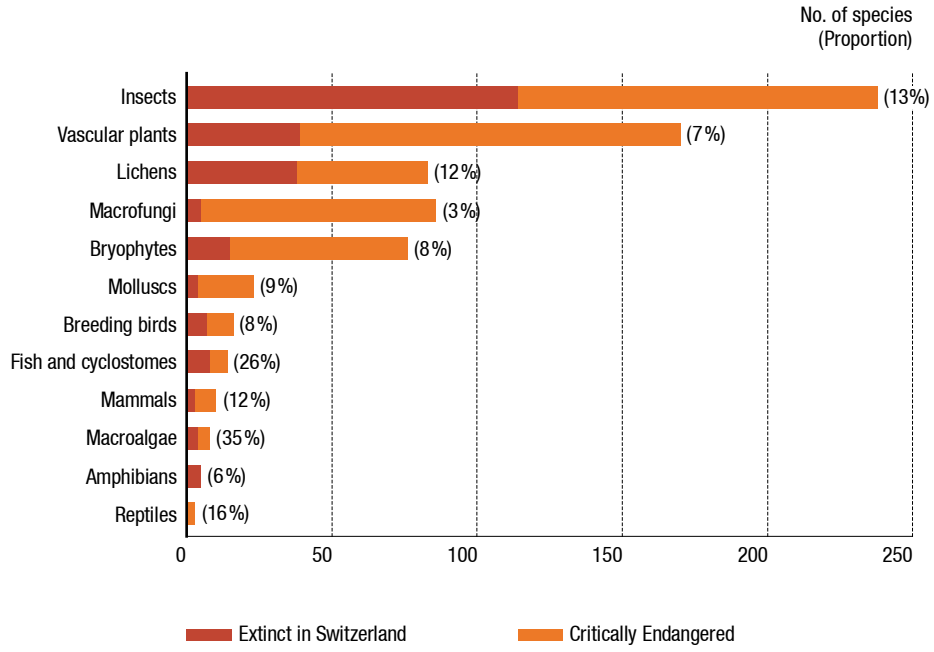
Switzerland's Red Lists record 255 species that have disappeared from this country. A species is considered extinct in Switzerland when there are no reproductive individuals left in the country. The year of the last sighting is known for many vertebrates. For example, the last Green Toad *(Bufo viridis)* was last sighted in 1910, the last Allis Shad *(Alosa alosa)* in 1960, and the last Lesser Grey Shrike *(Lanius minor)* in 1980.

The highest proportion of Extinct in Switzerland or Critically Endangered species is found in the aquatic organism groups (fish, macroalgae); in terms of absolute numbers, the pole position is held by insects, vascular plants (including some aquatic plants), lichens and bryophytes (Fig. 24). When all organism groups are considered in combination, it emerges that most of the lost species were specialised ones that depended on watercourses and water bodies, wetlands and dry sites. These habitats have suffered considerable qualitative and quantitative decline over the past 150 years (Lachat et al. 2010).

Only in exceptional cases does the disappearance of a species from a country result in its global extinction. Nevertheless, the regional extinction of a species signifies that its range has declined to an alarming extent. For example, all of the bird species that have disappeared from Switzerland are threatened throughout Europe.

Fig. 24 Species classified as Extinct or Critically Endangered in Switzerland

Absolute numbers and percentages of species per organism group. All species from the Extinct in Switzerland or Critically Endangered categories. In total, these species represent 8 per cent of all assessed species.



Data source: Red Lists, FOEN

Some species that are now extinct used to be widespread. The Osprey *(Pandion haliaetus)* is a case in point. It was forced out of vast sections of its range in southern and central Europe in the 19th and early 20th centuries. Today, northern Europe is almost the only region, in which it still breeds. The last pair to raise chicks in Switzerland was observed in 1911. In the case of other species that have died out in Switzerland, they only existed here on the margin of their ranges; for example, the European Rose-winged Grasshopper *(Bryodemella tuberculata)* which used to be found in the Inn Valley of the Lower Engadine region between Scuol and Tschlin and was last sighted in 1959 in Ramosch. The reasons for its disappearance include the changes in the water regime brought about by the construction of several power plants on the river Inn and the quarrying of gravel banks. The last populations of this species, which is facing extinction in central Europe, are found north of the Alps in Germany and Austria.

Biotope and species conservation measures are effective

Some species extinct in Switzerland return of their own accord after a period of time – for example the Grey Wolf *(Canis lupus)* and the Brown Bear *(Ursus arctos)* – or they are actively reintroduced. Examples of successful reintroduction measures include the return of the Eurasian Beaver *(Castor fiber)* and the Bearded Vulture *(Gypaetus barbatus)*. Nevertheless, in each decade since 1900, the number of extinct vertebrate species has been equal to or exceeded that of the returned native animal species (Fig. 25). The reappearance of indigenous species arises mainly in wetland areas (Fig. 26). Biotope conservation measures have proven effective here.

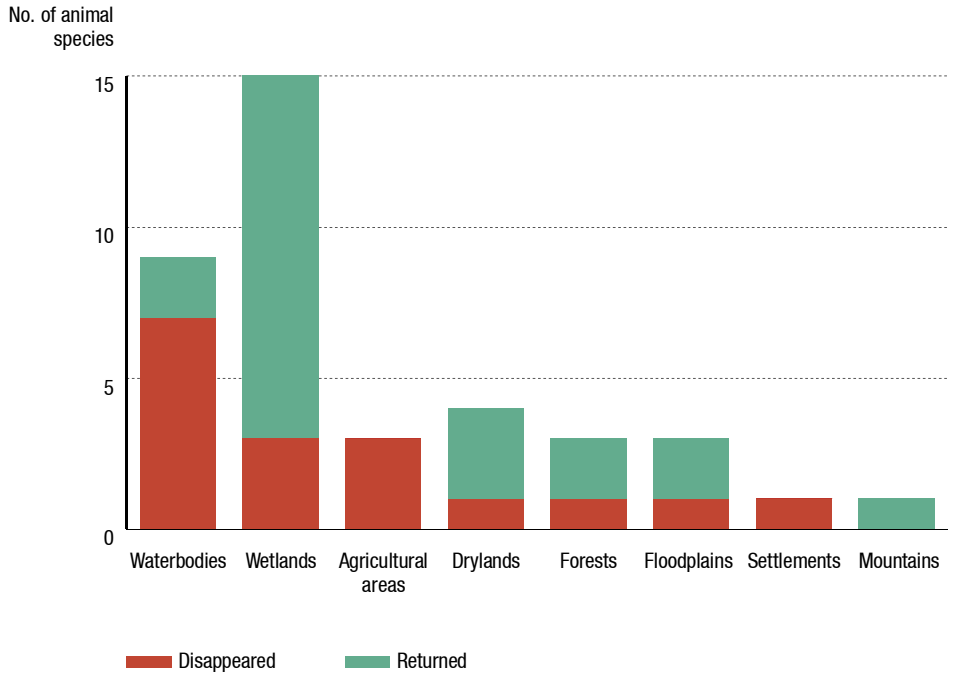
Fig. 25 Returned or reintroduced vertebrate species that had disappeared from Switzerland in the last 110 years

Vertebrate species (mammals, birds, reptiles, amphibians, fish) only as their disappearance and return can be determined with greater certainty than those of inconspicuous and difficult-to-identify invertebrates. Most species that have returned had died out prior to 1900 (e.g. the wolf). The overall balance is negative.

Data source: Native animal species of fish, amphibian, reptile, breeding bird and mammal groups, from Martinez et al. 2009, BDM and Red Lists, FOEN

Fig. 26 Returned or reintroduced animal species presumed to have disappeared from Switzerland between 1900 and 2010 by habitat

Water bodies and watercourses have experienced the greatest loss of species. Species have also disappeared from other habitats. However, biotope conservation measures have contributed to their return. The positive net balance is mainly due to the return or rediscovery of missing invertebrate species.



Data source: Native animal species of butterfly, locust, dragonfly, fish, amphibian, reptile, breeding bird and mammal groups from Martinez et al. 2009, BDM and Red Lists, FOEN

2.2.2 Threatened endemic species

Endemic species have a highly restricted range. Although they are not threatened as such, the area they colonise is so small it must be assumed that disturbances could rapidly have a critical impact on their survival. An endemic species assessed as not or near threatened today may slip quickly into a higher endangerment category. The IUCN's normal threshold values are not applicable in such cases and probably too optimistic.

To date, research has identified 97 species and 19 subspecies that have over 50 per cent of their global area of occupancy located in Switzerland. The ranges of 49 species are believed to lie exclusively in Switzerland. These species may be considered endemic (Fig. 27). There are 27 species endemic to Switzerland (34 including subspecies) that are not listed as National Priority Species (see section 1.8.3).

The species and subspecies whose ranges are mostly or entirely restricted to Switzerland are predominantly animals (Fig. 28). Of these taxa, a total of 57 per cent are considered to be threatened or near threatened (Fig. 29). The endangerment levels of 26 per cent of these species have not been assessed yet.

New endemic species are regularly being discovered in the context of research projects. Sometimes, the number of endemic species also increases due to taxonomic reclassification. Scientists recently identified a series of fish species endemic to Switzerland (genus *Coregonus*), four of which are both regionally and globally extinct.

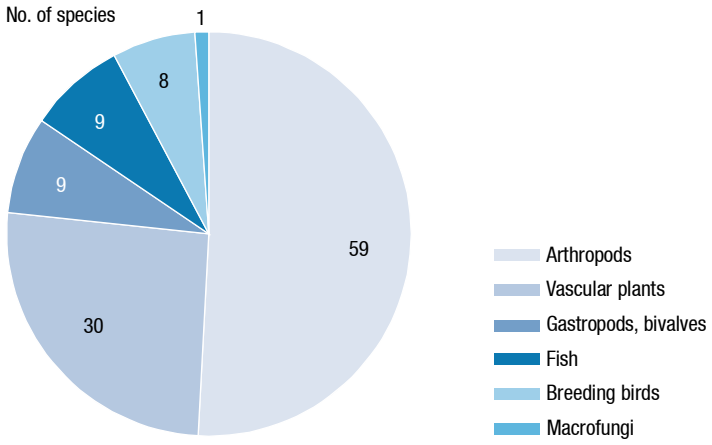
Fig. 27 > Endemic plants of Switzerland

*The ranges of these four species are completely limited to the territory of Switzerland: Engadine Whitlow Grass (*Draba ladina; *Endangered, above left),* Arenaria bernensis *(Vulnerable, below left), Swiss Lungwort (*Pulmonaria helvetica; *Vulnerable, above right) and* Artemisia nivalis *(Endangered, below right).*

Photos: Michael Jutzi (above left, below); Konrad Lauber (above right)

Fig. 28 Species mostly or entirely restricted to Switzerland in range

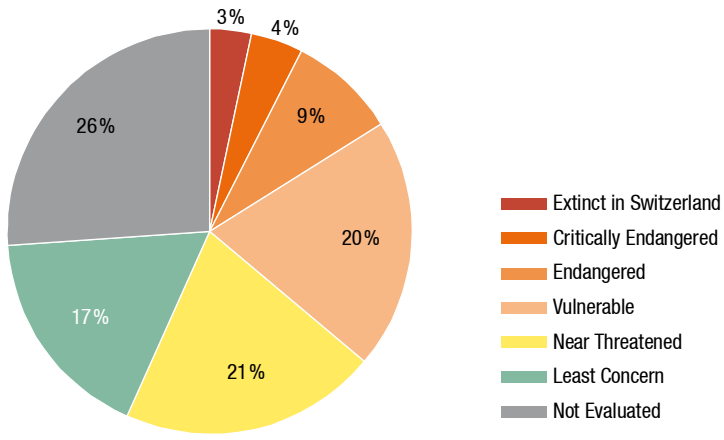
Proportion of species and subspecies whose range is mostly or entirely restricted to Switzerland, by organism group. 97 species and 19 subspecies have been confirmed as having over 50 per cent of their global areas of occupancy in Switzerland. Arthropods: insects, spiders, crustaceans, myriapoda.



Data source: experts; list of National Priority Species, FOEN

Fig. 29 Endangerment assessment of species found predominantly in Switzerland

Both endemic species and species with more than 50 per cent of their range located in Switzerland.



Data source: experts; list of National Priority Species and Red Lists, FOEN

Unique copepod in the groundwater of the Neuchatel Jura

There are only two species in the world belonging to the Gelyellidae family (Crustacea: Copepoda). The range of Gelyella monardi *is limited to a karst area of the Neuchatel Jura (Areuse Gorge and Combe-Garot Spring). Based on current knowledge, this may be the animal species in Switzerland most worthy of conservation from an international perspective (Fig. 30). Any disruption to this region's water regime could present a grave threat to the species.*

Fig. 30 > The endemic copepod *Gelyella monardi*

This species only lives in the underground waterways of certain karst caves of the Areuse Gorge in the Neuchatel Jura.

Illustration: Cédric Marendaz. Copyright Muséum d'histoire naturelle de Genève (left); Photo: Alain Kropf (right)

2.2.3 Globally threatened species

Switzerland is home to 79 species that are redlisted by the IUCN and therefore considered as globally threatened; a further 21 species found in Switzerland have been categorised as Near Threatened on a worldwide level. The species in question are mainly insects, vascular plants and fish (Tab. 10). These figures are updated every five years based on a state indicator established by Biodiversity Monitoring Switzerland (Z4: "Number of Species in Switzerland Facing Global Extinction").

Global extinction always begins at the local or regional level

For 59 per cent of species categorised as threatened by both the IUCN and Switzerland, the global endangerment level is the same as or lower than that recorded in Switzerland (Tab. 10). This is not surprising as global extinction always begins at regional level. The fact that 41 per cent of taxa have nonetheless been assigned to a higher endangerment status worldwide than in Switzerland could be due either to the fact that the evidence base is better in this country or that population sizes have declined less markedly in Switzerland.

Some Swiss populations of globally threatened species are particularly valuable. This is the case, for example, for the *Distichophyllum carinatum* moss (Fig. 31). Its Swiss site is one of only six known locations throughout the world (Biodiversity Monitoring Switzerland Coordination Office 2009). Swiss populations of the Apron *(Zingel asper)* and the Lake Constance Forget-me-not *(Myosotis rehsteineri)* also merit special conservation efforts. The Apron is only represented by a few populations in the Rhone, and by probably fewer than 200 individuals in the river Doubs.

Tab. 10 > Globally threatened species in Switzerland

	Number of globally threatened and near threatened species in Switzerland	Number of species whose global endangerment status is lower or the same as in the Swiss Red Lists
Mammals	2	1
Birds	1	1
Amphibians	5	4
Fish	17	4
Insects	39	26
Decapods	2	0
Bivalves and gastropods	6	6
Vascular plants	27	16
Bryophytes	1	1
Total	100	59

Data source: IUCN 2010 Red Lists, FOEN, www.iucnredlist.org

Fig. 31 > *Distichophyllum carinatum* and its habitat

This moss species is extremely rare and threatened both in Switzerland and globally. To date, only six populations have been found, one of which is located in Switzerland.

Photos: Norbert Schnyder

Switzerland's global responsibility

Switzerland bears international responsibility for the conservation of certain species. These include both species that are globally threatened, endemic or limited to certain habitats and species with a high proportion of the global population occurring in this country (Tab. 11). Species of international significance in Switzerland are primarily found in the Alps.

Tab. 11 > Levels of responsibility

Level of responsibility	Description	Significance and examples (only first two levels)
Very high	• Species endemic or quasi-endemic to Switzerland	Extinction in Switzerland would mean worldwide extinction. E.g. *Trochulus biconicus* (a snail found in Nidwalden); the Swiss Lungwort *Pulmonaria helvetica;* and the moth *Chelis simplonica.*
High	• Species partially endemic to Switzerland • Genetically distinctive fringe populations • Species with completely isolated populations in Switzerland • Species endemic to the Alps with restricted ranges	Extinction in Switzerland would have a serious impact on the overall population; global endangerment would dramatically increase. E.g. the Mount Generoso gastropod *Chondrina generosensis;* the ground beetle *Nebria crenatostiata;* the stonefly *Leuctra ravizzai.*
Medium	• More than 20 % of the species' range lies within Switzerland • Species with partially isolated populations in Switzerland • Species endemic to the Alps with relatively large range	
Low	• Less than 20 % of the species' range lies within Switzerland • Fringe populations	

Source: List of National Priority Species, FOEN

2.3 Spatial distribution of threatened species

2.3.1 Biogeographical regions

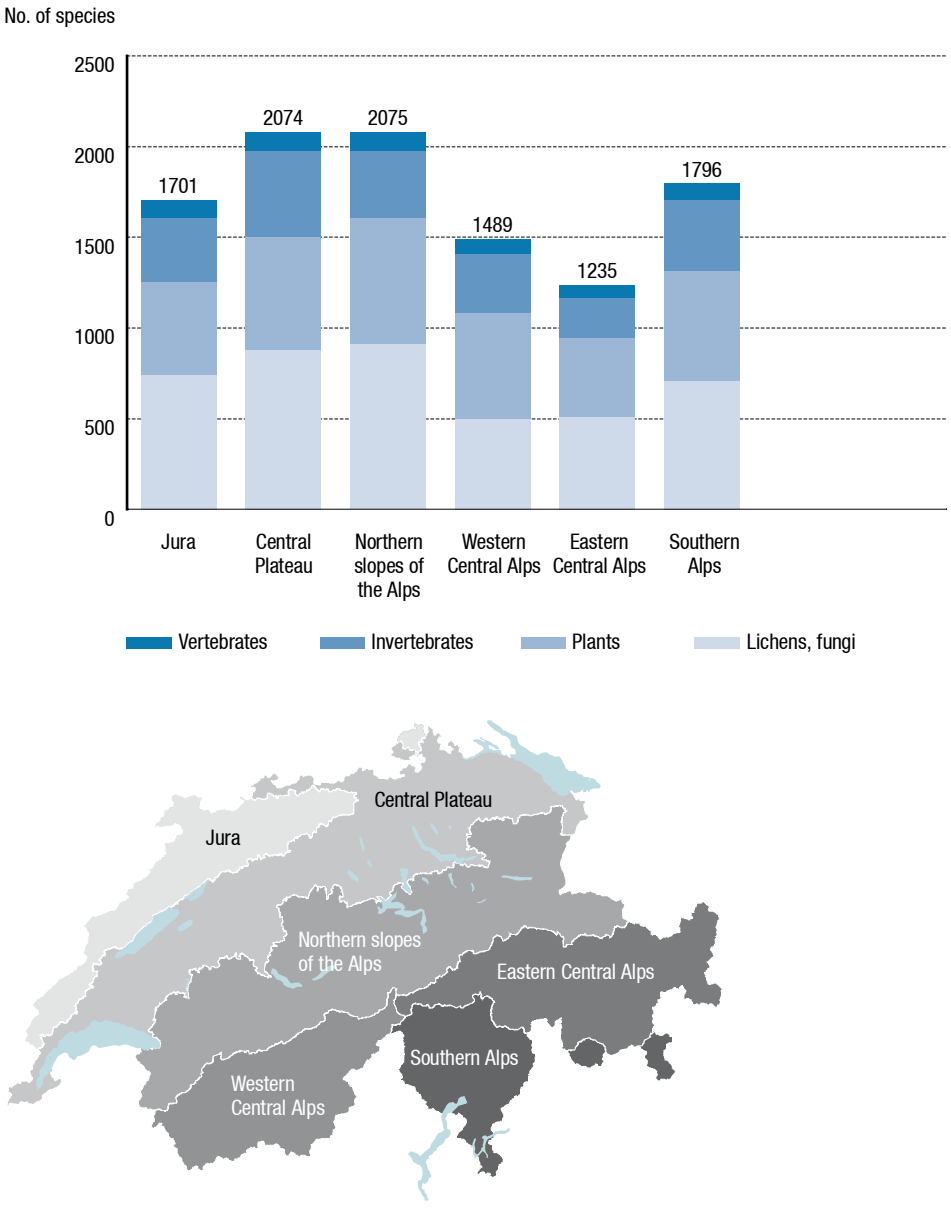
Particularly high numbers of threatened species are found on the Central Plateau and in the Northern Alps

Redlisted threatened species are not equally spread throughout Switzerland. Particularly high numbers of threatened species are found on the Central Plateau and in the Northern Alps (Fig. 32). There are two explanations for this:

- The Central Plateau and the Northern Alps are the two biggest regions with considerable potential in terms of natural landscape units. The diversity of habitat types is naturally high in both regions. As cultural landscapes developed, additional habitats were added, such as pastures, crop lands and hedges, and rendered the mosaic even more diverse. Overall, traditionally managed landscapes provided habitats for numerous animal and plant species.
- The elimination of the remains of the natural landscape and the intensive use of these spaces by humans (intensive agriculture and forestry, high density of settlements and transport infrastructure) resulted in most species being subjected to a reduction in their ranges and population sizes that varied in terms of severity. Many species in these regions now occur only as remnant populations and are, therefore, gravely endangered. In contrast, due to the sparser land use in mountain areas, the number of threatened species there is lower.

Fig. 32 Number of threatened species in Switzerland's biogeographical regions

Distribution of 3,161 threatened species. Multiple references possible.



Data source: List of National Priority Species, FOEN

2.3.2 Biotopes of national importance

The inventories of biotopes of national importance (raised and transition bogs, fens, floodplains, amphibian spawning areas, and dry meadows and pastures) constitute an important pillar of federal biodiversity policy. In the mid-1990s, Switzerland's lowlands (around 10,000 km²) were assessed for the number of recorded occurrences (in national databases) of redlisted species of the Critically Endangered and Endangered categories in biotopes of national importance (only raised and transition bogs, fens, floodplains) and internationally important water and migratory bird reserves (Broggi & Schlegel 1998). The results showed that 20 per cent of all occurrences of these species, which are particularly severely threatened at national level, are found in biotopes registered in federal inventories.

Additional areas have been included in the Inventory of Floodplains of National Importance in the meantime, and new inventories have been created: the Inventory of Amphibian Spawning Areas (2001) and the Inventory of Dry Meadows and Pastures (2010). In total, biotopes of national and international importance currently account for around 0.8 per cent of Switzerland's lowlands. Given that many Red Lists have also been compiled or revised, the figures for the proportion of occurrences of species that are particularly severely threatened at national level in biotopes of national importance are outdated.

Almost one third of all known habitats of severely threatened species lie within biotopes of national importance

A re-assessment carried out for the purposes of this publication revealed that the proportion of sites containing highly threatened species located in protected biotopes of national importance is now 28 per cent – and, moreover, within an area of less than one per cent of the lowlands. This means that biotopes of national importance cover a substantial part of the habitats of highly threatened species. Most of the other occurrences of highly threatened species are likely to be located within other types of sanctuaries (e.g. forest reserves, regional, local and private conservation areas, ecological compensation areas of high ecological quality).

However, the Red Lists show that all of the efforts made to date have not been sufficient to conserve species diversity in Switzerland. The risk of extinction is not decreasing, but tending to increase instead. Additional and better interconnected biodiversity priority areas are needed. At the same time, it must also be made possible to conserve threatened species outside protected areas. For this to occur, biodiversity must be promoted to a greater extent on an extensive basis in accordance with the principles of sustainable development within sectoral policies (e.g. agriculture, forestry, spatial planning, tourism, energy).

2.3.3 Site-specific situations

60 % of native aquatic plant species are threatened

The proportion of threatened species varies greatly between habitats. Figure 33 illustrates this using the example of plant species. With more than 60 per cent of species threatened or extinct throughout Switzerland, the ecological group under greatest pressure is aquatic plants. This reflects the extensive river engineering and control measures and the large-scale loss of small water bodies since the mid-19th century.

Almost half of all pioneer and marsh plant species are threatened. Pioneer plants rely on the periodic recreation of their habitats. However, the dynamic processes required for this to happen have largely been halted by human activity. As a result, the habitat for the species from this ecological group is lacking.

The destruction and draining of bogs, reed meadows and riparian vegetation proved disastrous for the marsh plants. Between 1900 and 2010, bog areas alone were reduced by 82 per cent (Lachat et al. 2010). Yet many species rely on bogs as their sole habitat. Figure 34 shows extreme bog specialists on the Red List of threatened ferns and flowering plants.

Dry meadows and pastures, which shrunk in area by 95 per cent over the same period, have fared even worse (Lachat et al. 2010). 35 percent of the plant species typical of poor grassland are threatened. Overall, it is possible to observe that species found on either wet or dry sites feature far more often on Red Lists than species that prefer soil of average humidity (Fig. 35).

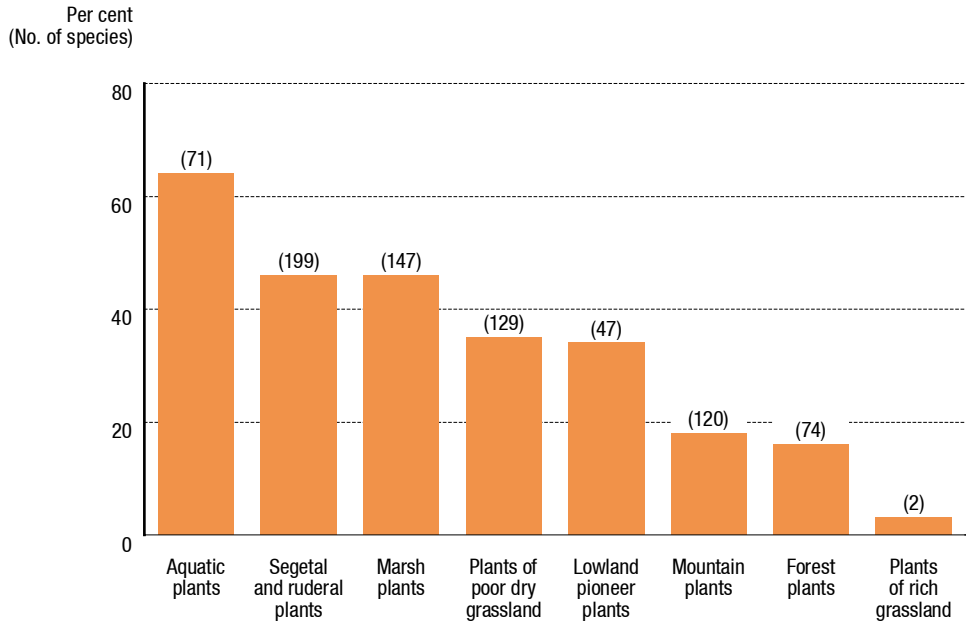
Over 80 % of forest and mountain plants are not threatened

Typical forest and mountain plant species are under significantly less pressure (Fig. 33). Over 80 per cent of these species are widespread and not threatened. Despite ski run levelling and inappropriate agricultural land use, which have altered habitats at local level in the Alps, relatively few species are threatened at national level. “Only” 16 per cent of forest species are included in the Red List of threatened vascular plants, which indicates that the forest is still a relatively near-natural system for flowering plants. It is primarily light-requiring plant species that are endangered.

For other organism groups, however, the picture is quite different: in the case of bryophytes, 26 per cent of threatened species are forest species (Schnyder et al. 2004) and the corresponding figure for epiphytic lichens is as much as 44 per cent (Scheidegger et al. 2002). Moss and lichen species diversity is affected above all by the lack of old trees, the loss of natural dynamic processes and the removal of old wood and deadwood from forests.

Fig. 33 Proportion of threatened plant species by ecological group

Sample interpretation: more than 60 per cent of aquatic plants are on the Red List of threatened vascular plants in Switzerland (2002). In brackets: absolute number of species.



Data source: Red List of Vascular Plants, FOEN; indicator values: Landolt et al. 2010

Fig. 34 Bog specialists on the Red List of threatened vascular plants

Extreme bog specialists in the various bog communities assigned to an endangerment level of Vulnerable or higher. More than 50 per cent of species identified in a single bog plant community during bog conservation effectiveness monitoring.

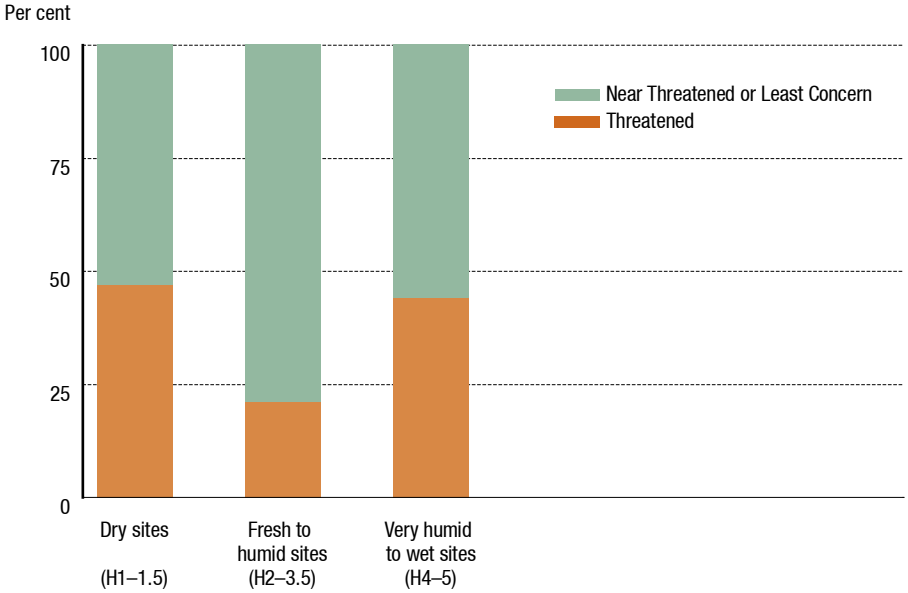
Bog specialists	Communities
Marsh Foxtail *(Alopecurus geniculatus)*	Wet grassland
Dwarf Birch *(Betula nana)*	Bog forests
Lesser Panicled Sedge *(Carex diandra)*	Transition bogs
Bristle Sedge *(Carex microglochin)*	Alkaline low sedge swamps
Greater Pond Sedge *(Carex riparia)*	Reed and tall sedge swamps
Inundated Club Moss *(Lycopodiella inundata)*	Hummock-forming and heather moors
Bog Pondweed *(Potamogeton polygonifolius)*	Bog hollows
Brown Beak Sedge *(Rhynchospora fusca)*	Bog hollows
Great Yellowcress *(Rorippa amphibia)*	Reed and tall sedge swamps
Hybrid Yellowcress *(Rorippa x anceps)*	Reed and tall sedge swamps
Flatleaf Bladderwort *(Utricularia intermedia)*	Reed and tall sedge swamps

Type of bog
Raised bog
Fen

Source: Klaus 2007

Fig. 35 Soil moisture requirements

Almost half the vascular plants reliant on wet or dry sites are threatened in Switzerland (H=humidity index).



Data source: Red List of Vascular Plants 2002, FOEN; indicator values: Landolt et al. 2010

2.4 Causes of endangerment

2.4.1 Analysis by endangerment criteria

Species are categorised as threatened when at least one of the following two IUCN criteria is met: (1) severe drops in population and/or losses of area of occupancy, (2) small range and/or small population size. The following analysis examines the question as to which criteria determined species endangerment statuses in Switzerland's Red Lists.

Definition: rare species

Approximately 19 per cent of species assessed for Red Lists have only very small populations and/or very small, in some cases highly fragmented areas of occupancy. These species may be designated as "rare species". They can be rare for the following reasons:

- The area of suitable habitat has shrunk severely over time (e.g. through direct destruction by draining or building development), or the quality of the habitat has deteriorated massively (e.g. through the removal of habitat structures or through changes in land use). For example, there are hardly any watercourses and water bodies left that are allowed to dry out periodically. Yet these form the most important type of habitat for amphibians and certain stoneworts.
- Their range has always been small. Occurrences are located in isolated areas, mountains, watercourses or water bodies. This is the case, for example, for species that can only occur in special types of habitats which are only found in a few places (these species are known as specialists).
- Switzerland lies at the margins of the species' range. For example, a number of species from the Mediterranean only find favourable conditions in Switzerland in the warm parts of the canton of Valais and the southern side of the Alps.

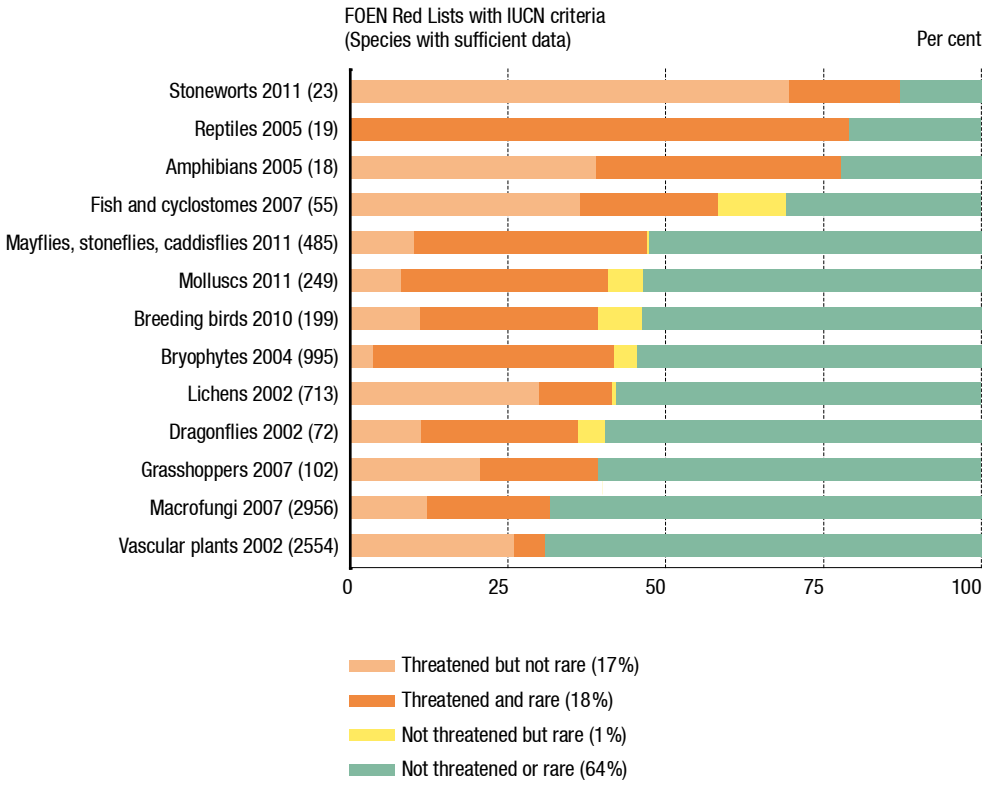
All such rare species react exceptionally sensitively to changes in their habitats. If the pressure on the area of occupancy or on remaining individuals increases, the risk that the species will completely disappear from all of Switzerland within a short period of time also increases.

Almost half of all threatened species are redlisted because their population sizes or ranges have shrunk severely over a short period of time

Almost all rare species (95 %) are considered to be threatened (Fig. 36). In other words, half of all threatened species (52 %) are rare species (IUCN criteria B2a, D, D1, D2; see Annex A2). The other 48 per cent of redlisted threatened species are endangered primarily because their populations have significantly decreased within the investigation period, or because their range has shrunk severely (IUCN criteria A and B, excluding B2a; see Annex A2).

Fig. 36 Proportion of rare species by organism group

Rare = small population and/or small, fragmented range (criteria D, B2a, see Annex A2). Threatened = only CR, EN, VU. Only organism groups with IUCN criteria, i.e. Red Lists from 2001 on. The proportion of so-called rare species in all evaluated species that are rare is 19 per cent (1,631 of 8,418 species with IUCN criteria) and varies widely from one organism group to the next. Reptiles feature the highest number of rare species that are also threatened.



Data source: Red Lists, FOEN

The end of the Woodchat Shrike

*The Woodchat Shrike (*Lanius senator, *Fig. 37) was once widespread on the Central Plateau. This songbird mainly lived in the extensively cultivated open orchard meadows that used to be common there. When these disappeared and the remaining orchards were put to more intensive use, loss of habitat contributed to the decline of the species. However, the Woodchat Shrike has also vanished from areas that are still of high ecological quality. Hence, there must be other reasons for the loss of this long-distance migrant, such as habitat changes in its wintering grounds and climatic changes. We know, for example, that poor weather conditions more quickly result in breeding failure in this species than in its close relation, the Red-backed shrike* (Lanius collurio).

It has not been possible to halt the dwindling of the population in central Europe. The Woodchat Shrike has ceased to breed regularly in Switzerland since 2006. Whether it will be possible to keep the species breeding in Switzerland appears doubtful at present.

Keller et al. 2010

Fig. 37 > The Woodchat Shrike and its habitat

Lanius senator; *the species no longer breeds regularly in Switzerland and is Critically Endangered.*

Photo: Andreas Gygax (left); Markus Jenny (right)

2.4.2 Threat factors

Humans have a profound and multifaceted influence on biological diversity. There is probably not a single square metre left in Switzerland that is not affected in some way – at least indirectly, for example by airborne nitrogen input. Numerous driving forces have played a part in this development, including consumerism, agriculture, forestry, urban expansion, traffic, energy production, tourism, recreational activities, hunting and fishing.

Diminishing habitat quality as the main cause of endangerment

The list of threats that have a direct impact is even longer (see box on page 72). Since the main causes of endangerment have been recorded for many redlisted species, it is possible to rank the different influences. An initial analysis based on a – still provisional – catalogue of impacting factors shows that the main reasons for the redlisting of species (Fig. 38) are diminishing habitat quality (e.g. impaired water regime) and habitat destruction (e.g. development of dry grassland). Breeding birds, mammals and amphibians are also affected by recreational activities.

A more differentiated analysis based on a hierarchically subdivided catalogue of impacting factors reveals that "changes on agricultural land" and the "removal of habitat structures" are by far the most common causes of endangerment (Fig. 39). In the future, potentially harmful alien species are likely to increase the pressure on species diversity even further. Invasive alien organisms cause an appreciable decrease in indigenous species diversity in and around water bodies in particular.

Knowledge about the correlations between climate change and animal species endangerment levels is still inadequate. Mediterranean species will extend their ranges while high Alpine species will lose terrain.

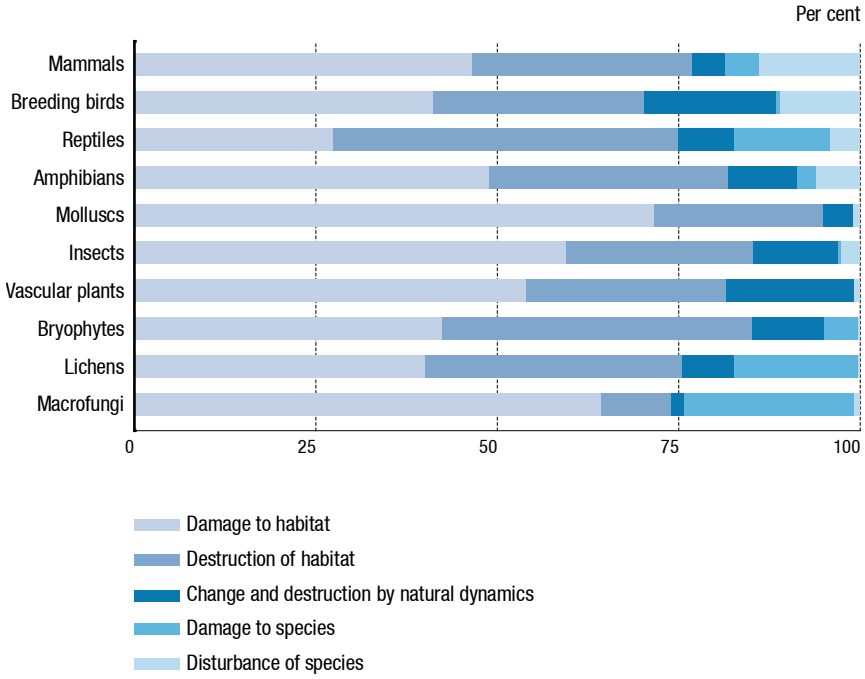
The current Red List of grasshoppers (Monnerat et al. 2007) refers to the fact that great care must be taken when assigning a species to an IUCN endangerment category based on the effects of climate change. However, shifting areas of occupancy have already been demonstrated for a number of organism groups (Vittoz et al. 2010). Many species display a tendency to spread to higher altitudes, making habitat space scarcer for species already restricted to high Alpine areas. Hence, corresponding losses of habitat and population sizes would have to be expected.

Fragmented landscapes and lack of interconnecting structures

Further threat factors and indirect effects heighten the impact of climate change on biodiversity. Pronounced landscape fragmentation and the lack of interconnecting structures reduce many species' chances of finding alternative habitats (Vittoz et al. 2010). Warming climates will allow mountain areas to be more intensively farmed, and the earlier advent of spring will lead to shifts in the development of certain species, and possibly impair a community's network of interactions and disrupt food chains.

Fig. 38 Main causes of endangerment of organisms

Prevalence of threats (see box below) among approximately 1,800 redlisted species (633 fungi and lichens, 571 vascular plants and bryophytes, 594 animals including vertebrates (excluding fish), insects, land gastropods and bivalves). Includes 47 subspecies. A species may be exposed to more than one negative influence (multiple references possible).



Data source: Red Lists and Catalogue of Impacting Factors (draft), FOEN

Threats at a glance

Damage to habitat

- ***Alteration of surface water bodies:*** *river engineering measures (e.g. damage to riverbed structures, straightening, canalisation, culverting, construction of sills, hydropeaking, insufficient residual flows, the absence of a natural bedload regime, loss of natural erosion processes); damage/disruption to standing water bodies (e.g. raising/lowering of water levels, reinforcement of shorelines, prevention of seasonal drying out, stabilisation of water level fluctuations, siltation, recreational activities); water pollution*
- ***Changes to groundwater, drainage:*** *disruption of the water regime (lowering of the water table, drainage of wetlands), disruption of nutrient regimes (e.g. nutrient intake), drainage on agricultural land*
- ***Changes to forests:*** *inappropriate reforestation and forest management (e.g. abandonment of chestnut groves, coppices and coppices with standards; afforestation with introduced tree species; monocultures; removal of undergrowth)*

- ***Changes on agricultural production land:*** *mechanical disruption (e.g. inappropriate hay-making techniques, cutting too often or at the incorrect time, inappropriate machinery use, use of heavy machinery, use of mower conditioners, use of rotary mowers, inappropriate pasture management, irrigation); chemical disruption (e.g. fertilisation of grassland, use of pesticides, antibiotic inputs); changes in agricultural land use (e.g. changes in land-use intensity, conversion of meadows to pasture, abandonment of crop terracing, no longer leaving land fallow)*
- ***Distruption to unproductive lands:*** *disruption due to presence of ski pistes; being run over or trampled on roads; chemical interventions*

Destruction of habitats

- ***Complete destruction of the vegetation cover:*** *sealing of the soil surface through covering or compaction; deposits of various materials; excavation/removal of soil (e.g. for construction, power plants, ski pistes, quarries); soil erosion; destruction by fire; removal due to rehabilitation or cleaning of buildings*
- ***Removal of habitat structures:*** *removal of woody plants (e.g. hedges, standard fruit trees, copses); removal of buffer zones (e.g. structured forest edges, grass verges, shorelines, fallow land, crop margins); elimination of waterways and wetlands; removal of rock, scree and soil structures (e.g. cobblestones, dry stone walls, rocks)*
- ***Removal of old and dead plant material:*** *removal of deadwood, removal of forb/grass litter and bark debris*

Change and destruction caused by natural dynamics

- ***Change by natural dynamics:*** *changes to vegetation due to succession (e.g. scrub and forest encroachment following land-use abandonment; decrease in forest management leading to denser and darker forests); soil change due to succession*
- ***Extreme natural phenomena:*** *hydrological natural hazards (e.g. flooding, mud flows, bank erosion, avalanches); meteorological natural hazards (e.g. cold spells, drought)*

Damage to species

- ***Physicochemical pollution:*** *air pollution (especially airborne nitrogen intake, ozone); harmful emissions (e.g. light, noise)*
- ***Habitat fragmentation, barriers:*** *fragmentation caused by transport routes (e.g. highways, high-traffic roads, railway lines)*

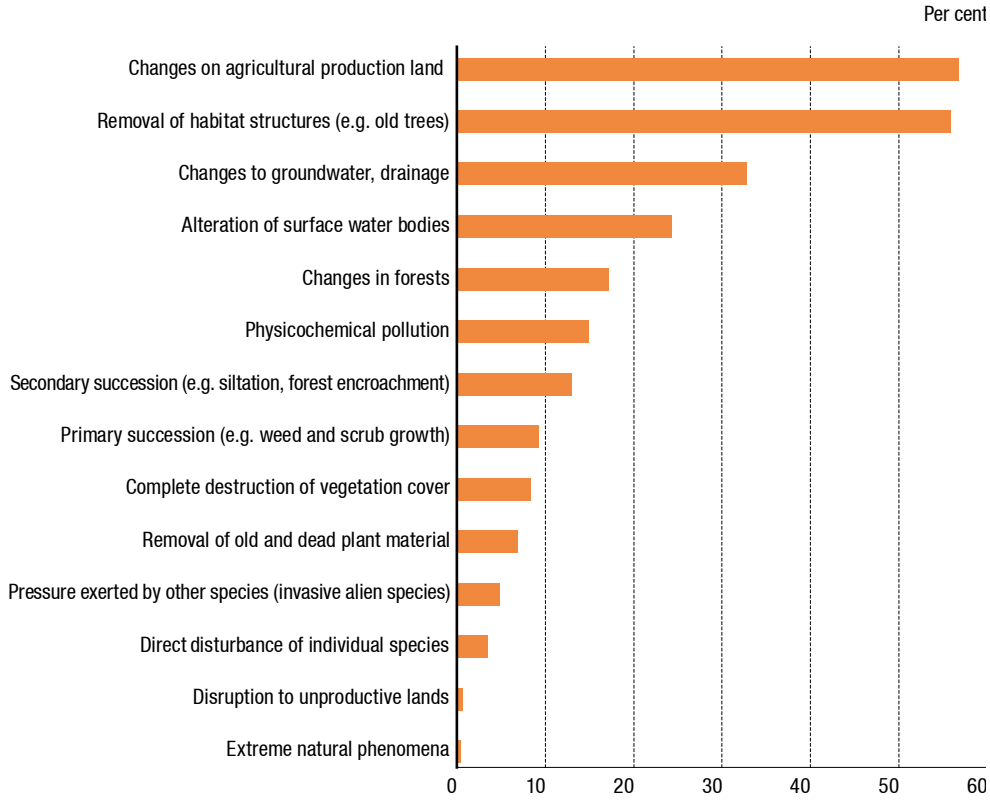
Disturbance of species

- ***Direct disturbance of individual species:*** *excessive taking from the wild (e.g. hunting, fishing, collecting, weeding); disturbance (e.g. due to recreational activities, forestry and agriculture)*
- ***Pressure exerted by other species:*** *parasites and pests; predatory pressure by domesticated animals (cats, dogs), releasing predators/fish stocking; decrease of food sources (e.g. missing nectar plants, missing prey); displacement by alien invasive species (e.g. due to competition, hybridisation, pathogens).*

Based on the draft FOEN catalogue of impacting factors, status 2010

Fig. 39 Differentiated analysis of causes of endangerment

The analysis covered 633 fungi and lichens, 571 vascular plants and bryophytes, and 594 animals (vertebrates excluding fish, insects, land gastropods and bivalves) on the Red Lists. It includes 47 subspecies. A species may be exposed to more than one negative influence.



Data source: Red Lists and draft catalogue of impacting factors, FOEN

Ecological deficits in forests

Forests are still relatively near-natural habitats, hence the animal and plant species dependent on them are generally less threatened than species living in other ecosystems. Some bird species whose populations had declined in the past are even showing an upward trend again as they are apparently benefiting from the increased amount of dead wood available in forests. This applies, for example, to the Black Woodpecker (Dryocopus martius) *and the Three-toed Woodpecker* (Picoides tridactylus).

Nevertheless, forests also feature ecological deficits that are responsible for the decline of certain species. The quantity and quality of the deadwood available in many forests on the Central Plateau and in the Jura continue to be ecologically unsustainable. This leaves thousands of xylobiotic species (fungi; insects, in particular beetles; cave-nesting birds; small mammals) without any means of subsistence. Large areas of forest have become denser, darker and nutrient richer, causing many light- and warmth-loving species to disappear. Such species include many flowering plants that favour partially shady, nutrient-poor locations, butterflies such as the Woodland Brown (Lopinga achine) *and Ilex Hairstreak* (Satyrium ilicis), *ants, and snakes such as the European Asp* (Vipera aspis aspis), *of which many occurrences in the central and eastern Jura have vanished. Special programmes have been launched to compensate for the loss of open forests (e.g. the "Lichter Wald" (open forest) programme in the canton of Zurich and the reintroduction of coppice-with-standards forest management in the canton of Basel-Landschaft).*

Many of the Central Plateau's hardwood forest sites are colonised by spruce trees which have displaced the autochthonal broad-leaved tree species. For numerous animals susceptible to disturbances, such as the Capercaillie (Tetrao urogallus), *the Black Grouse* (Tetrao tetrix), *the Rock Ptarmigan* (Lagopus muta) *and the Chamois* (Rupicapra rupicapra), *the intrusion of recreation-seekers on even the most remote forest areas is an increasing problem, despite the fact that attempts are being made to counter this problem by extending wildlife resting zones and conducting awareness campaigns. A further deficit – particularly on the Central Plateau – is the fragmentation of the forest into many small, ecologically isolated islands. These could be improved through species-rich forest boundaries interconnected with hedges and bank side copses, but so far, funds for the comprehensive implementation of this concept have not been forthcoming. However, targeted enhancement and the interconnection of forest boundary areas would be one of the most effective species recovery measures as it would benefit a large number of threatened species such as butterflies, ants, birds and reptiles.*

As a matter of principle, it must be emphasised that the scientific foundation needed for targeted recovery efforts is lacking for many forest organisms (e.g. taxonomic gaps; insufficient knowledge about ranges, population and nutrition biology, and ecology). The approximate number of species is not even known for some taxa.

Communication from Markus Bolliger, FOEN

2.4.3 Why species become rarer – three case studies

A land snail along the N4 in the Zurich Weinland

"In the autumn of 2006, I was examining reptile habitats along the N4 in the Zurich Weinland area between the river Thur near Kleinandelfingen and Laufen-Uhwiesen in light of the reptile substitute remediation that had been stipulated under the terms of the Environmental Impact Assessment for the construction of a mini highway (expansion from 2 to 4 lanes). While doing this, I discovered what is by today's standards an extraordinarily large population (2,000-10,000 individuals) of the land snail *Candidula unifasciata* (Fig. 40) living on a plot near the Laufen-Uhwiesen junction. This

plot was intended for the construction of a truck inspection post and a water treatment plant (SABA) for runoff from the N4.

According to the current Red List of molluscs, this snail is considered Vulnerable throughout Switzerland. There are only a few small known populations of the species in the canton of Zurich – and, indeed, in large parts of the country. In addition, the species is redlisted in several European countries and German *Laender;* it is often even categorised as Endangered or Critically Endangered. The species must be considered as a priority mollusc at cantonal level. For this reason, it was a matter of considerable importance to the Nature Conservation Office of the canton of Zurich to preserve the existing populations and support the species.

Following my fortunate discovery, I immediately informed the environmental construction supervisor, who quickly notified the client for the N4 project (the canton of Zurich to the end of 2007, the FEDRO from 2008) and the site supervisor of the situation. From then on, both the site supervisor and the Public Works Office repeatedly assured us that for the time being, nothing would happen on the plot, and that we would be notified in good time when the plans for construction of the truck inspection post and the SABA were more concrete.

However, the plot was partially prepared for a storage area in connection with the construction of the N4 in 2007 without us being notified. This involved the removal of the topmost layer of soil on a part of the land and pushing it aside. Unfortunately, this resulted in the annihilation of 90 to 95 per cent of the snail population. The population could have recovered in a matter of a few years and, again, the site supervisor assured us that nothing else would be done on the plot without our prior involvement. Yet, in the meantime and, again, without us being informed, the levelled site that would have been suitable for the population's recovery has been converted into a temporary asphalt deposit."

Report by Peter Müller, reptile and mollusc specialist, canton of Zurich

Fig. 40 > The land snail *Candidula unifasciata* and its habitat

Candidula unifasciata; *endangerment status: Vulnerable.*

Photos: Peter Müller

A victim of the NRLA: the liverwort *Frullania parvistipula*

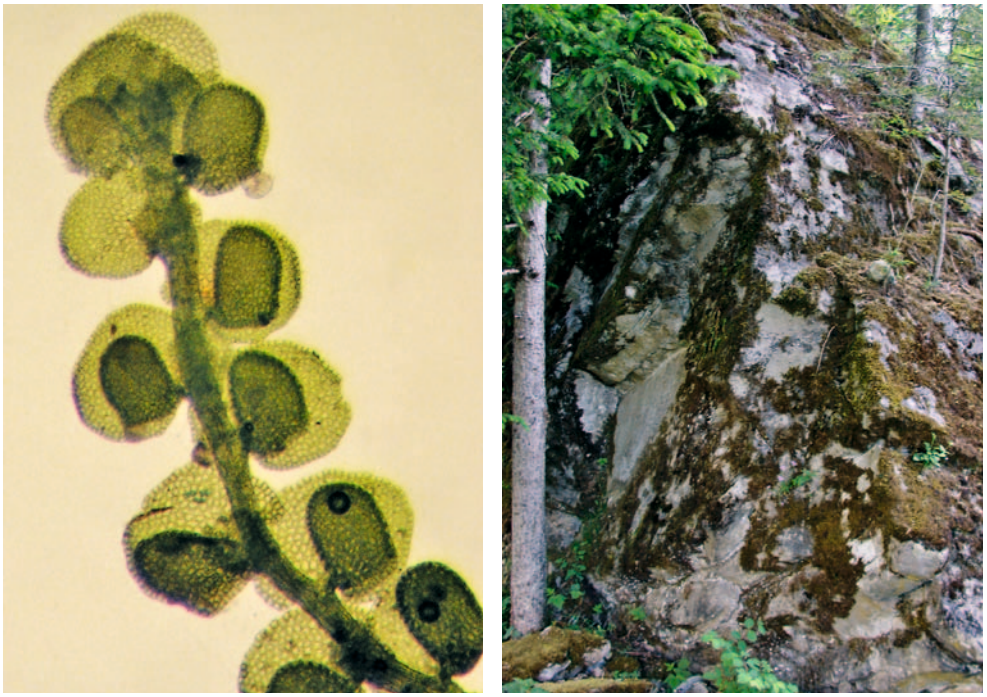
"During the construction of the NRLA (New Railway Link through the Alps), most of a population of the liverwort *Frullania parvistipula* (Fig. 41) was destroyed. Information on the occurrence of this species was gathering dust in a file – a file not consulted during the Environmental Impact Assessment. A follow-up survey commissioned by the canton of Bern identified individual clusters of this species in the immediate surroundings. The occurrence was logged and a reintroduction trial launched.

In order to prevent similar cases in the future, the national Record Centre of Swiss Bryophytes (NISM) has provided the cantons with comprehensive data in digital format on the locations of threatened species for entry into cantonal GIS. This will make the information as easily accessible as the corresponding data on flowering plants. For cantons that do not yet have a GIS, the NISM has made the data available on the internet (*www.ecogis.admin.ch*, as of 2012 *map.bafu.admin.ch*) along with a series of information sheets on the occurrence of threatened bryophytes *(www.nism.uzh.ch)*."

Communication from Heike Hoffmann & Norbert Schnyder, NISM

Fig. 41 > The liverwort *Frullania parvistipula* and its habitat

Frullania parvistipula; *endangerment status: Critically Endangered.*



Photos: Heike Hoffmann and Norbert Schnyder

Extract from a letter from Sylvie Barbalat, a saproxylic beetle specialist, to the authorities of the city of Solothurn: "As part of our ongoing research for the Red List of wood insects, we searched various Swiss sites previously known to harbour the Hermit Beetle (*Osmoderma eremita*, Fig. 42) for specimens of this species, but in vain. The only location outside of Geneva, in which we know with certainty that the species still occurs today is the city of Solothurn. We found indications of the presence of the Hermit Beetle in three lime trees along Steinbruggallee, near the area known as Kreuzen in the commune of Rüttenen, and on the trunk of a lime tree on Fegetzallee. As the city of Solothurn has only a few trees that shelter this rare beetle, they must be protected at all costs. Please allow us to remind you that the Hermit Beetle is protected by Swiss law (Appendix 3 NCHO) and by the Bern Convention, to which Switzerland is a signatory. Unfortunately, despite the information we have provided to you and the legal protection this beetle enjoys, at least two lime trees known to house the Hermit Beetle for with certainty have been felled since 2003: one of these was a tree on Steinbruggallee that was cut down several years ago and another recently on Fegetzallee. Specialists discovered Hermit Beetle larvae in the latter's stump. For this reason, it is exceedingly important to ensure the survival of the larvae through immediate action."

Response of the city of Solothurn: The city has promised that in the future, all available options will be exhausted so that – if possible – the total removal of suitable trees will not arise.

Fig. 42 > The Hermit Beetle and its habitat

Osmoderma eremita; *endangerment status: Critically Endangered (expert assessment)*
Right: a lime tree near Solothurn colonised by Hermit Beetles.

Photos: Felix Amiet

2.5 Threatened types of habitat

The conservation of threatened species is achieved largely by conserving their habitats. According to the Ordinance on the Protection of Nature and Cultural Heritage, any habitat that is home to threatened species is worthy of protection (Art. 14 para. 3 NCHO; SR 451.1). This approach becomes problematic, however, when a threatened habitat contains only a few redlisted species or rare species which belong to groups that are difficult to identify or for which there are no Red Lists.

Inventory of threatened habitats

With this in mind, in the mid-1990s, the Federal Office for the Environment (then SAEFL) commissioned a group of experts to develop an inventory of threatened habitats. The evaluation was made on the basis of the potential and actual distribution of species typical of a particular habitat. Following the definition of threshold values for each endangerment category, 136 habitat types were assessed. Although the inventory does not have official Red List status, it proved to be a valuable instrument for the designation of habitats worthy of protection (Appendix 1 NCHO).

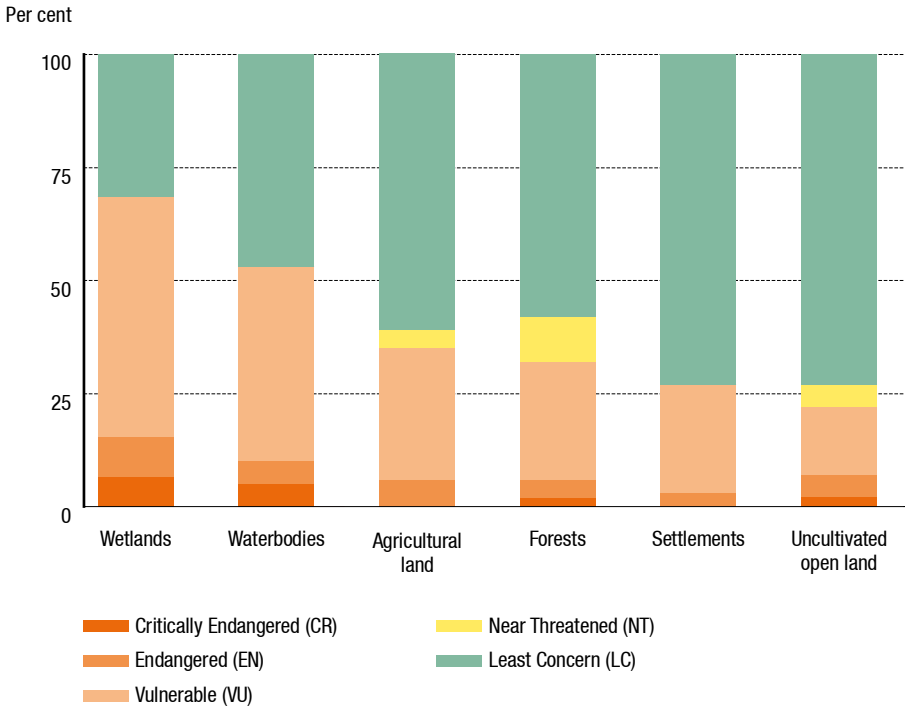
Wetlands and water bodies account for a high proportion of threatened habitat types

Results show that the proportion of threatened habitat types within macrohabitats (i.e. wetlands, water bodies, forests, agricultural land, settlements, uncultivated open land) varies greatly. The highest proportion is found in wetlands and waterbodies, the lowest in alpine and nival zones (Fig. 43). Interestingly enough, over a quarter of habitat types in urban areas are threatened. Essentially, habitats are threatened by the same causes as species (Fig. 44).

A recognised list of threatened habitats would provide an early indicator of threatened species. This is important because a few specimens of plant species, for example, can linger in a region for many years or decades after their habitat has been destroyed (Landolt 1991). That is why species initially appear less threatened than their habitats. However, their local disappearance and, hence, their assignment to a higher Red List category is only a matter of time. For this reason, in accordance with the prevention principle, measures should be taken that benefit all threatened habitats.

Fig. 43 Proportion of threatened habitat types by macrohabitat

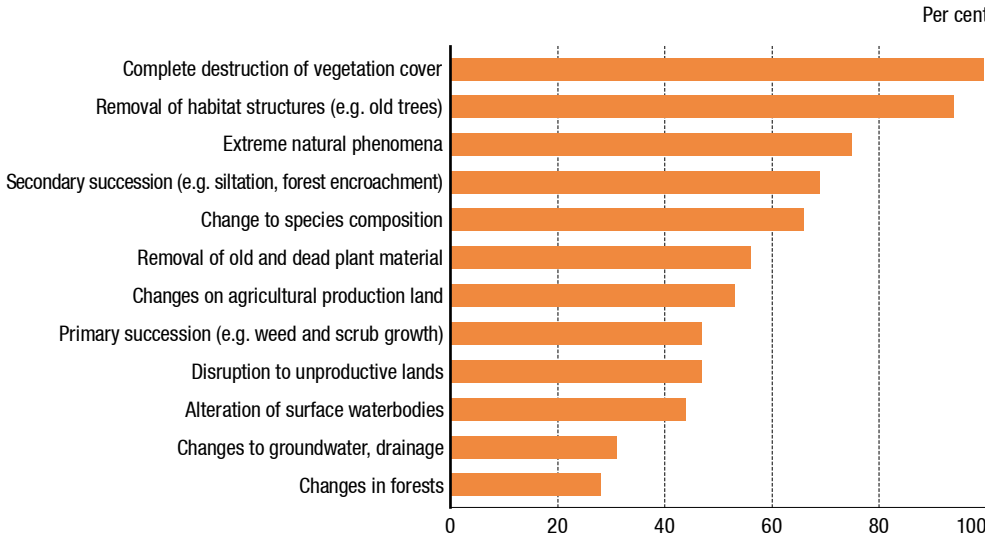
Multiple references are possible (e.g. semi-dry grassland both in agricultural areas and in uncultivated open land and settlement areas). The IUCN is currently working on standardised criteria for classifying ecosystems into endangerment categories.



Data Source: experts; Delarze & Gonseth 2008

Fig. 44 Causes of endangerment to habitats

Causes of endangerment specified in Delarze & Gonseth 2008 for 32 habitat types. Sample interpretation: the removal of habitat structures threatens 90 per cent of habitat types.



Data source: experts; Delarze & Gonseth 2008

2.6 Changes in endangerment levels

Persistent losses for birds

At present, Switzerland's breeding birds are the only species assessed by a Red List (Keller et al. 2010) that can be directly compared to an earlier version (Keller et al. 2001). The proportion of threatened species has remained almost the same, which means that many breeding birds continue to undergo declines in population size and area of occupancy. In addition, the number of species that needed to be reassigned to a higher endangerment category is higher than the number of species that could be downgraded. Species that were moved to a higher category include, for example, the Northern Lapwing *(Vanellus vanellus)*, the Eagle Owl *(Bubo bubo)* and the Ortolan Bunting *(Emberiza hortulana)*. Newly redlisted species include the Whinchat *(Saxicola rubetra)*, the Ring Ouzel *(Turdus torquatus)* and the Field Fare *(Turdus pilaris)*. Based on these results, the Swiss Bird Index for redlisted breeding birds is also negative (Keller et al. 2011). The Index reflects the overall trend for the population sizes of threatened bird species in Switzerland.

Species that were moved to a lower endangerment category include birds that reacted favourably to recovery measures, for example the Middle Spotted Woodpecker *(Dendrocopos medius)*, the Common Whitethroat *(Sylvia communis)* and the Little Owl *(Athene noctua)*. However, although their risk of extinction has declined, the populations of these species remain small.

Unlike breeding birds, all other organism groups are covered by either only an initial Red List or by Red Lists that differ in terms of the methodology used and endangerment criteria applied (see chapter 1). Nevertheless, the authors of each revised edition look for points of comparison, and carefully discuss any changes in categorisation.

Further deterioration in the situation of reptiles

> **Reptiles** (Monney & Meyer 2005): The situation for the most highly threatened reptile species has continued to deteriorate since the publication of the first Red List of reptiles in Switzerland (Hotz & Broggi 1982). Prestudies conducted for the 2005 Red List in the cantons of Geneva and Vaud showed, among other things, a marked decrease in the populations and habitats of the Viperine Snake *(Natrix maura)* and of the nominotypical form of the European Asp *(Vipera aspis aspis)* which is widespread in the Jura and on the Central Plateau. The fact that even widespread and less endangered species are also on the decline is cause for alarm. Particularly affected is the Western Grass Snake *(Natrix natrix helvetica)*, which, according to field studies conducted from 2003 to 3002, is estimated as having declined by over 30 per cent. The Black Asp *(Vipera aspis atra)*, which has also declined by over 30 per cent, faces a similar fate. Most cantonal inventories also indicate a general decline for the Sand Lizard *(Lacerta agilis)*.

Dramatic losses for amphibians

> **Amphibians** (Schmidt & Zumbach 2005): Field work carried out for the update of the Red List of threatened amphibians yielded an unequivocal result: The situation has either worsened or remained unchanged for all species. Dramatic losses were recorded for species dependent on transitory bodies of water. The only improvements concern the rare Italian Agile Frog *(Rana latastei)* – and this only owing to numerous well-targeted measures to protect the species. Other improvements in Red List status must be attributed to changed criteria.

> **Fish and cyclostomes** (Kirchhofer et al. 2007): In comparison to the 1994 Red List, which was based on an assessment of roughly 5,200 data sets from 1,890 sites during the period 1984 to 1989, 17 taxa have been reclassified for the new Red List. 8 taxa were reassigned to a higher endangerment level and 9 species were downgraded. Some of these reassignments are due to new insights and a more comprehensive database, others are the result of a discernible change in endangerment situation.

Endangerment situation of vascular plants aggravated

> **Vascular plants (ferns and flowering plants)** (Moser et al. 2002): In the Red List compiled by Landolt (1991), the proportion of threatened species amounted to around one quarter. By 2002, this value had risen to just under one third. Even if the influence of a change in methodology and the greater number of taxa included are taken into account, there is an obvious trend towards an aggravation of the endangerment situation. In addition to the increase in threatened plant species across the whole of Switzerland, it should be noted that the share of threatened plant species has increased in the Alps and Ticino, in particular.

Grasshoppers and dragonflies feel the effects of climate change

> **Grasshoppers** (Monnerat et al. 2007): The proportion of grasshoppers threatened at national level increased from 36 per cent in 1994 to 37 per cent in 2007. The extremely severe endangerment of populations of species typically found on river floodplains is cause for alarm. Two opposing trends were revealed: while some species are retreating, others are extending their ranges. The latter are predominantly Mediterranean or Insubric species that prefer warm conditions.

> **Dragonflies** (Gonseth & Monnerat 2002): The situation of many species already listed as severely threatened in the old Red Lists (Maibach & Meier 1987, 1994) has deteriorated. Intensive search efforts failed to unearth two of Switzerland's rarest insect species: *Onychogomphus uncatus* and *Coenagrion lunulatum;* happily enough, the presence of *Nehalennia speciosa* was reconfirmed in 2007 and 2008 (status change from Extinct in Switzerland to Critically Endangered). A further five species recorded a dramatic decline between 1987 and 2002. Also worrying is the decline of several species whose status was previously less alarming. The surveys carried out also show that some dragonfly species managed to increase their population sizes in the last twenty years. The best example of this is *Crocothemis erythraea:* in the late 1960s, this originally Mediterranean species was found to have visited the warmest regions of Switzerland only sporadically. Since the 1980s, it has spread almost nationwide and now breeds throughout much of the lowlands. Observations conducted for the Red List further suggest that three out of four sporadic guests of Mediterranean origin reported for Switzerland have expanded their areas of occupancy appreciably, presumably as a result of global warming.

Declining species diversity as exemplified by butterflies

Butterfly experts estimate that, in the 1980s, the Central Plateau was populated by only around one hundredth of the number of butterflies that could be found flitting around there in 1900 (Lepidopterologen-Arbeitsgruppe 1987). However, not only has the general abundance of butterflies declined markedly, the ranges of many species have also shrunk discernibly. As a result, the Red List of this organism group is a long one (Gonseth 1994): 60 per cent of the 195 indigenous butterfly species are considered to be in the Near Threatened to Endangered range. Most affected by decreasing numbers are species typical of wetlands, flower meadows and open woods. The Lepidoptera Working Group (Lepidopterologen-Arbeitsgruppe, 1987) and Walter et al. (2010) have documented the decline of butterflies in Switzerland on the basis of numerous local and regional case studies:

- *The number of butterfly species on the floodplains of the river Thur plunged from 82 to 53 during the period 1918/30 to 1994. At the same time, the frequency of the remaining species declined by a factor of five to ten. Due to the loss of extensively cultivated fields in agriculture, 27 species disappeared, and a further 15 species became rarer.*
- *A 67 percent decline in species was observed for the period 1913 to 1976 in the commune of Weinfelden (canton of Thurgau). Of the 97 species once found there, 65 have disappeared.*
- *Between 1920 and 1980, the number of species in Bözingerweid near Biel (canton of Bern) decreased from 93 to 40.*
- *In the Three Lakes region of Bern, almost 40 percent of butterfly diversity was lost between 1945 and 1986.*
- *The change in large butterfly species in the region of Basel (1500 km²) is well documented. Since 1980 alone, around 20 per cent of species are considered to have gone missing.*
- *In the late 19th century, a 13-square-kilometre plot in the commune of Dombresson (canton of Neuchâtel) harboured 46 butterfly species typical of extensively cultivated land. 24 of these species have disappeared in the intervening period. 12 of these species no longer occur in the district of Val de Ruz (128 km²), in which Dombresson lies, and 5 species have been lost in the canton of Neuchâtel (716 km²).*

3 > Outlook

Thanks to Red Lists, Switzerland knows exactly where it stands as regards species conservation – that is to say at the very beginning of a long process. Given the current parameters (instruments, measures and their implementation), Red Lists will not get any shorter. For this reason, the FOEN is developing a comprehensive strategy for the long-term conservation and promotion of species diversity. Enormous efforts are required to establish awareness of the ethical, aesthetic and economic value of biodiversity in all sectors.

3.1 Goals not achieved

Overall, every single Red List documents a manifest and sustained loss of species diversity at national level. Most threatened species appear to be bound for further losses – with no likelihood of this trend being reversed in the short term. In other words, the requirement enshrined in the Swiss Constitution that animal and plant species be prevented from going extinct has not been fulfilled. Compliance with the Federal Act on the Protection of Nature and Cultural Heritage, which has the purpose of conserving the diversity of indigenous species and their natural habitats (Art. 1 para. d NCHA), is also inadequate. Two substantive objectives of Swiss Landscape Concept (Landschaftskonzept Schweiz, FOEN & ARE 1998), which was approved by the Federal Council under article 13 of the Federal Act on Spatial Planning, are not being fulfilled. These stipulate that:

- man-made impacts on biodiversity and the landscape be organised in such a way as to ensure that no more species are added to Red Lists, and threatened species and their habitats be conserved to the degree necessary to prevent any species from being assigned to a higher endangerment category;
- the number of redlisted species be reduced by 1 per cent each year.

In 2002, the signatory states of the Convention on Biological Diversity (CBD) adopted the target of significantly reducing the loss of biodiversity by 2010. Overall, Switzerland clearly failed to reach this target (FOEN 2010, Lachat et al. 2010). None of the eleven subgoals were completely fulfilled: five were achieved in part and six were not achieved at all.

The UN is deeply concerned about the social, economic, ecological and cultural consequences of the loss of biodiversity. Both the CBD's "Global Biodiversity Outlook 3" and the "OECD Environmental Outlook to 2030" assume that the loss of biodiversity will continue unless drastic countermeasures are taken (FOEN 2010).

If biodiversity is of such paramount importance (see section 3.2), why have the goals not been reached? There are a number of explanations:

- Instead of being eliminated, the causes of endangerment still prevail. Moreover, new threat factors such as climate change and invasive alien species have emerged.
- Because losses in biodiversity happen gradually and the general public knows little about nature and species, losses are not perceived as such and therefore not recognised as being a problem.
- People adapt quickly to a bad situation – and, with time, no longer perceive it as being so bad.
- Those working in species conservation know exactly what needs to be done to preserve biodiversity. However, general awareness, funds, land and political will are lacking.
- Conservation and the promotion of biodiversity continue to be seen as a nature conservation issue and task when they are actually a matter of the sustainable use of natural resources. Other actors whose behaviour and practices have an impact on biodiversity are very reluctant to take responsibility.

3.2 We need species diversity

Legal and moral obligation

Conservation of species diversity is not only a legal obligation, but also a moral one. And yet the question always arises – particularly in regard to rare and threatened species – as to whether it is necessary to conserve all of the species in Switzerland that are threatened due to human activity. As clearly illustrated by the arguments presented below, the answer to this question should be a resounding yes.

3.2.1 Ethical and moral obligation

Today's great diversity of species is the product of three billion years of evolution. Each species is unique and, thus, worthy of preservation. Furthermore, species diversity is part of our natural heritage that we must pass on undiminished to future generations – not only in zoos and botanical gardens, but also within natural ranges at local, regional and national levels. This is an ethical responsibility that must be borne by society. This requirement is formalised in the first point of the Preamble to the Swiss Federal Constitution ("responsibility towards creation") and also expressed as respect for the "dignity of living beings" in the sense that all creatures are important in their own right.

3.2.2 Aesthetic well-being

Studies have shown that species-rich areas are considered to have greater aesthetic value than species-poor areas within the same habitat (Lindemann-Matthies et al. 2010). Even six-year-old children express a preference for species-rich, colourful meadows. It would appear that people have an innate proclivity for species diversity. It contributes to man's aesthetic well-being.

3.2.3 Economic value

"The Economics of Ecosystems and Biodiversity TEEB", an international study commissioned by the United Nations Environment Programme (UNEP) demonstrated the central economic importance of conserving and promoting biodiversity. For this reason, the experts urge that the cost of losses in biodiversity be taken into account in political and economic decision-making.

Example tourism: A diverse and distinctive natural environment is a draw for tourists. Attractive landscapes are usually also landscapes with extensive and distinctive species diversity. These assets are of enormous value for tourism.

Example healthcare: More than half of all drugs are based either directly or indirectly on substances produced by plants, animals, fungi or bacteria (Sukhdev et al. 2010). Over the course of evolution, nature created numerous active substances that provide protection against predators, for example. This diversity is a godsend for humans: poisons are also active substances – in many cases, medically effective ones. Every

species may contain important raw materials suitable for use in medications. Incidentally, new active substances are by no means found only remote rainforests; they can also be discovered on our own doorstep. For example, the Common Midwife Toad *(Alytes obstetricans)* has skin peptides that protect it against pathogens and one of these peptides is also effective against a human pathogen.

3.2.4 Safety net

We would do well to apply the precautionary principle rather than allowing species to become rare in the first place as science does not know the functions that most species fulfil in the fabric of life. We know even less about the roles that species might play in the future and the ways they might benefit us. Species diversity guarantees that there will always be organisms that are able to cope with environmental changes. The probability that one or more species can survive an extreme natural event like a storm and continue to yield a harvest or stabilise a slope rises with increasing diversity (Fig. 45). Furthermore, diversity is the "modelling clay", on which evolution and the autoregulation of biodiversity are based. Therefore, biological diversity as a whole is a safety net.

Fig. 45 Slope stabilisation through species-rich communities

Species-rich plant communities with their manifold root systems ensure that the soil stays put, particularly in mountain regions.

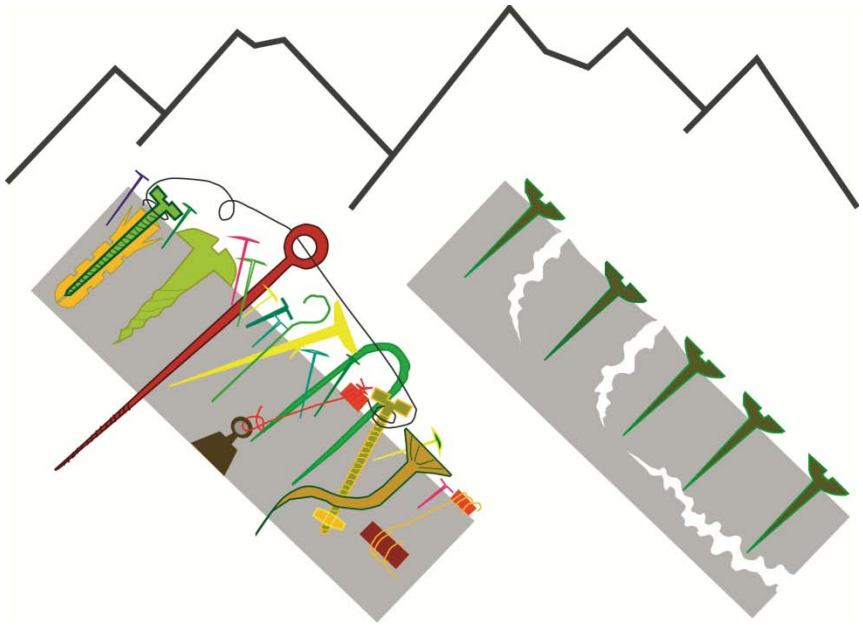


Illustration: Christian Körner and Susi Pelaez-Riedl, University of Basel

3.3 Increasing efforts to conserve and promote species diversity

Switzerland has realised that it needs to act to safeguard biodiversity. On 18 September 2008, the Swiss parliament incorporated the development of a strategy for the conservation and promotion of biodiversity into its legislative programme for 2007 to 2011. On 1 July 2009, the Federal Council set the following long-term goal: "Biodiversity is rich and capable of reacting to change. Biodiversity and its ecosystem services are conserved in the long term." It is intended to achieve these goals by allocating sufficient space to biodiversity, using it in a sustainable manner and recognising the value of ecosystems. In addition, Switzerland is expected to assume greater responsibility for global biodiversity. Whether this biodiversity strategy will be capable of providing the impetus required for the conservation and promotion of species depends critically on whether all areas of society and policy fields will accept their responsibility for biodiversity.

In the area of species conservation, the FOEN is currently working on a concept for species recovery in Switzerland that will form the basis of future federal policy on species recovery. Specific recovery programmes for National Priority Species (see section 1.8.3) form the centrepiece of this concept.

3.4 Strengthening the scientific basis for future Red Lists

3.4.1 Taxonomy

Around 1.8 million species of microorganisms, plants, animals and fungi throughout the world have been described scientifically. However, this represents only a small part of the actual species diversity. It is estimated that some 10 million species exist throughout the world (Millennium Ecosystem Assessment 2005, Mora et al. 2011).

Identifying and naming a species is a fundamental process, as anyone dealing with species can only communicate the knowledge associated with an organism if they know its correct name (SCNAT 2006). The compilation and revision of Red Lists of threatened species also requires the thorough and correct taxonomic identification and mapping of species.

Immense research needs

As an integrative science, taxonomy names organisms, analyses relationships within groups and compiles species descriptions and identification keys. However, along with its object of study, this fundamental discipline is threatened with extinction. The millions of unknown species and billions of voucher specimens sitting in biological collections are matched by a mere 10,000 or so taxonomists around the world (SCNAT 2006). The available personnel and financial resources stand in stark contrast to the importance of classification and taxonomy. The research requirement is immense. It is assumed that, in addition to the 45,890 known species in Switzerland, there are a further 20,000 species not yet discovered by scientists (Tab. 12).

Tab. 12 > Known and estimated numbers of species in Switzerland

A quarter of all known species have been assessed for Red Lists.

Classification (Phylum, Class, Order)	Estimated no. species	Known no. species
Animals, total	41 300	32 343
Vertebrates	396	394
Mammals	84	83
Birds	199	199
Reptiles	19	19
Amphibians	20	20
Fish	74	73
Arthropods	34 480	25 595
Etnognatha (e.g. springtails)	280	275
Insects	30 500	22 330
Myriapoda	200	200
Arachnids	3 000	2 375
Crustaceans	500	415
Molluscs	277	270
Bivalves	29	29
Gastropods	248	241
"Worms" et al.	6 120	6 063
Water bears	60	60
Ring worms	255	225
Round worms	3 200	3 175
Ribbon worms	5	3
Flat worms	2 600	2 600
Bryozoans	15	11
Cnidarians	6	5
Hydrozoa	6	5
Sponges	6	5
Plants, total	5 575	5 275
Vascular plants	2 592	2 592
Flowering plants	2 504	2 504
Ferns, clubmosses and horsetails	88	88
Bryophytes	1 093	1 093
Liverworts	259	259
Moss	832	832
Hornworts	2	2
Algae	1 890	1 590
Macroalgae (e.g. stoneworts)	90	90
Microalgae	1 800	1 500
Lichens and Fungi, total	17 200	8 272
Lichens	1 770	1 770
Epiphytic lichens	521	521
Terricolous lichens	265	265
Deadwood and stone lichens	984	984
Fungi	15 430	6 502
Macrofungi	6 016	4 959
Microfungi (e.g. yeasts, rusts, smuts)	9 414	1 543
Total	64 075	45 890

Data source: Red Lists, FOEN; experts

3.4.2 Specialists

The compilation and revision of Red Lists requires species experts. The sightings reported by specialists, associations (e.g. entomological associations, botanical and natural research societies) and organisations (e.g. SVS/BirdLife Switzerland) are particularly valuable.

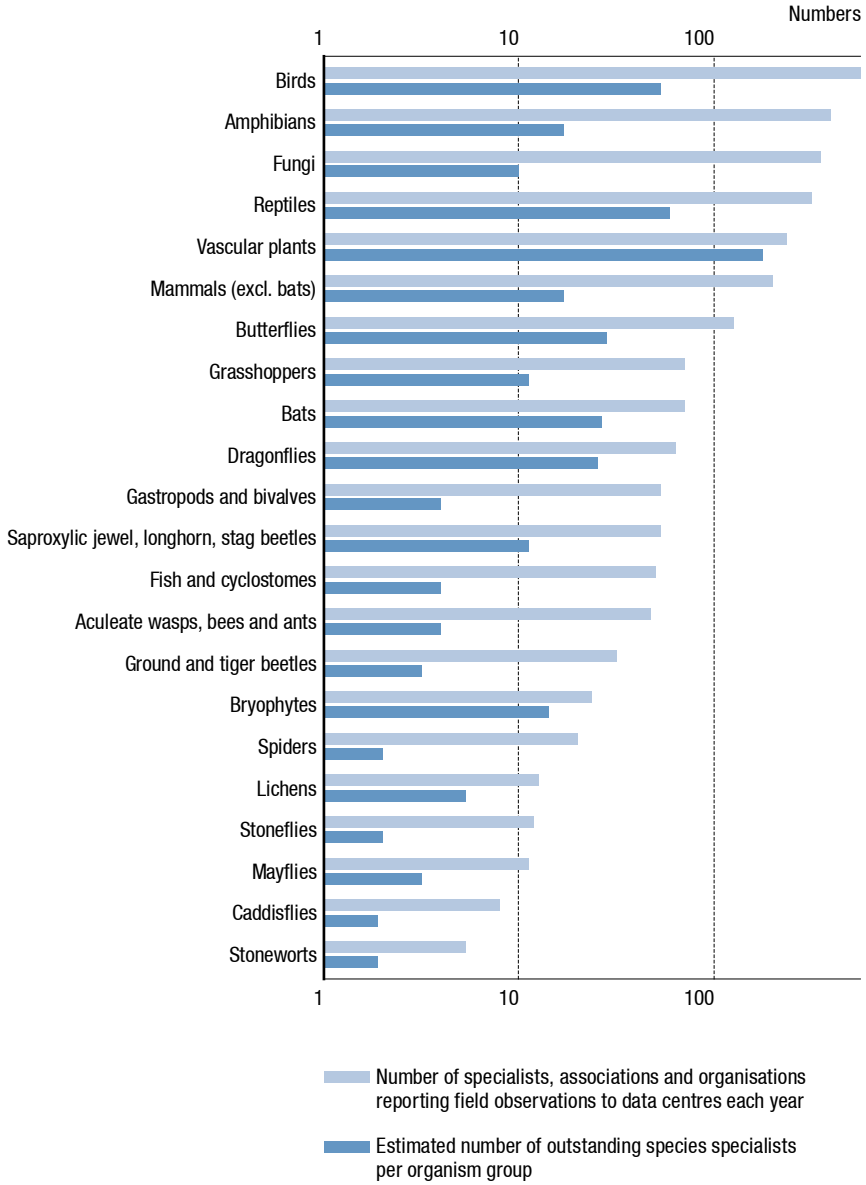
Certain organism groups attract extensive attention: macrofungi are reported by cantonal checkpoints for edible mushrooms, and birds, bats and amphibians receive support from a network of volunteers. However, for many organism groups there are only a few qualified experts with sufficient expertise to enable them to report data on an organism group to national databases (Fig. 46). As a result, many organism groups found in Switzerland cannot be investigated adequately.

Acute need for species specialists and experts

Moreover, specialists with outstanding knowledge of species are becoming increasingly rare. The absence of a young generation with in-depth knowledge of species and their ecology has implications for the medium- to long-term capacity for monitoring biodiversity. Therefore, it is essential that future generations be equipped with skills in species identification and that their knowledge of species be enhanced. The education and training necessary to achieve this should be integrated on an interdisciplinary basis into universities, museums, botanical gardens and zoos.

Fig. 46 Species specialists

The graph shows the median for the period of 1999 to 2008.
Numbers plotted on logarithmic scale.



Data source: FOEN 2009 survey conducted at national data centres for flora and fauna

Premature all-clear

*The natural range of the Weatherfish or Weather Loach (*Misgurnus fossilis; *Fig. 47) extends from the north-west of France to the river Volga. It no longer occurs in the Basel area due to river engineering measures, among other things. Since the CSCF fish distribution atlas revealed two new populations in the Rhone Valley near Martigny (canton of Valais), the Weatherfish was assigned the status Critically Endangered. As a result of recent investigations, however, it had to be conceded that the Rhone Valley actually harbours populations of an Asian species of loach* (Paramisgurnus dabryanus).

Fig. 47 > The Weatherfish and its habitat

Misgurnus fossilis; *endangerment status: Critically Endangered.*
According to latest findings (2010) the species has been extinct since the 1940s.

Photos: Michel Roggo / www.roggo.ch (left); Francis Cordillot (right)

3.4.3 Conservation biology

Conservation requires not only taxonomists and species specialists, but also conservation biologists and ecologists who are able to correctly assess the range of a species, its population size and its population trends. Although people with such skills are indispensable for the compilation of Red Lists based on the IUCN criteria, they are rarely trained any more in Switzerland.

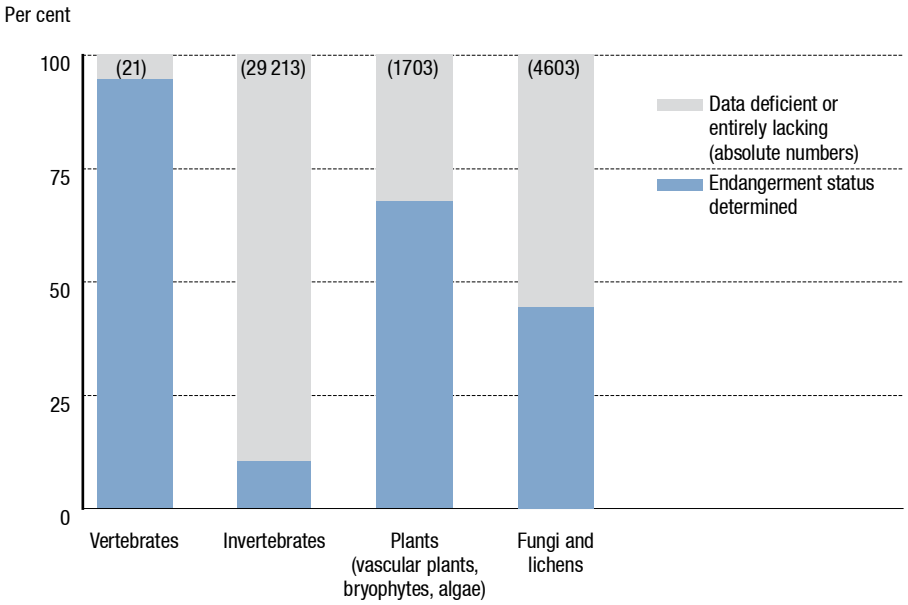
Developing practice-oriented information

Conservation biologists are also needed for the development of practice-oriented information regarding the ecology and habitat requirements of species, the early detection of changes, and species conservation measures. Methods need to be developed for monitoring programmes and effectiveness monitoring and answers need to be found to the following questions: What is the minimum population size? To what extent do individual populations need to be interconnected in order to ensure their long-term survival? What role do inbreeding and other genetic problems play in small and isolated populations? Which human-induced losses can be compensated by a population? Can a frog population, for example, survive in the long term if 20 per cent of individuals are run over every year? How can alien invasive species be dealt with?

The Data Deficient (DD) category in the Red Lists and the total absence of Red Lists for many organism groups clearly indicate that we still do not know very much about the ranges and general ecology of many species. The percentage of species whose endangerment level cannot be determined yet is especially high for invertebrates (Fig. 48).

Fig. 48 Proportion of species affected by deficient or lacking data

Population: Redlisted species assigned to the Data Deficient (DD) category and species from organism groups not covered by Red Lists (cf. Tab. 9 and Tab. 12). Figures in columns state absolute number of species for which data are deficient or entirely lacking. The endangerment level of many invertebrate, fungus and lichen species in particular cannot be assessed due to inadequate information.



Data source: Red Lists with IUCN criteria, FOEN

3.5 The Red List Programme up to 2020

The Red List Programme operates under a separate but complementary system to that of Biodiversity Monitoring Switzerland (BDM), which investigates selected organism groups based on a systematic sampling grid. Both programmes benefit from each another: as important status indicators, the Red List results are incorporated into the BDM reports (e.g. "Change in the Endangerment Status of Species" Z5). Conversely, BDM field data (status indicators "Species Diversity at National and Regional Level" Z3, "Species Diversity in Landscapes" Z7, "Species Diversity in Habitats" Z9) supplement the field work conducted for the Red Lists. However, BDM primarily records the population trends of common species.

By 2020, the revision of at least 13 organism groups will be due

The Red List Programme is due to start work on at least 13 organism groups from 2011 (Tab. 13), which mainly involves the revision of older Red Lists. Despite the fact that various federal and cantonal monitoring programmes (e.g. BDM, monitoring of watercourses and water bodies using bioindicators of the Modular-Stepwise-Procedure (MSP), monitoring of soil ecology functionality) require current data, the varying and partly decreasing availability of species specialists combined with the ever-present budgetary constraints are bound to extend production times – in some cases – far beyond the desired ten-year updating period needed for the complete evaluation of a defined organism group (12- to 15-year cycles).

Red List projects by organism group are well suited to the development of skills in species identification and applied field methods. They create opportunities for continuing professional education, which we should try to take up more often. Participation in workshops run by the IUCN, which compiles European Red Lists for a number of organism groups, promotes critical exchange between specialists as well as the continued enhancement of the Red List methodology.

Quality management in the Red List Programme is reviewed periodically to ensure that the needs of all stakeholders are met. In future, this may take the form of a checklist covering not only general requirements, but also aspects of management responsibility, resource management and performance, and also concretely address risks and possibilities for improvement (Cordillot 2005).

The FOEN's internet presence has an important role to play. In addition to providing an overview of the situation of all assessed fauna and flora groups, it provides easy access to publications and other useful information (e.g. special analyses, references to enforcement tools and best practice).

Since the survival of threatened species is closely tied to the extent and quality of the habitats in which they live, an official Red List of threatened habitat types would be a useful addition to the Red Lists of organism groups. Some steps have already been taken in this direction and include a look at approaches to the evaluation of forest communities (Steiger 2009), an assessment of types of vegetation meriting protection in Switzerland (Hegg et al. 1993) and an unpublished expert report commissioned by the FOEN (1999) on the endangerment of habitats in accordance with Delarze et al. 1998 (see also section 2.5). At international level, a group of IUCN experts is working

on (quantitative) threshold values, categories and criteria for a Red List of ecosystems ("Ecosystems Red List").

There is no alternative to Red Lists

Anthropogenic climate change presents an ever-increasing challenge as it causes substantial changes in living, growth and competitive conditions and hence gives rise to marked alterations in the areas of occupancy of plants, animals and fungi. While species needing warmer temperatures – i.e. above all Mediterranean species – will extend their ranges, specialist Alpine species will come under pressure (Plattner & Altermatt 2010, Van Swaay et al. 2010). We will soon need to address the question as to whether the endangerment status of originally non-native species immigrating into Switzerland should also be assessed after a certain period of time. This in turn raises the fundamental question as to whether Red Lists are still relevant in view of climate change. Blab & Schröder (2005) answer this question with a resounding yes for the simple reason that there is no alternative to the Red Lists. They recommend, however, that the lists be revised more frequently and that the methodology be adapted to changing parameters.

Tab. 13 > The Red List Programme up to 2020

*Red Lists published prior to 2011 (for details see Tab. 6: The federal Red List Programme) and planned until 2020. To comply with updating cycles of the individual Red Lists, 13 organism groups will need to be revised from 2012. Red Lists for new species groups are under review. Pale orange: Preparation Phase Red List Project (see Fig. 16); orange: production period; red: publication; RL = first edition; rRL = revised edition. Availability of experts: +++ = good, ++ = (just) sufficient, + = insufficient. * = under review for planning post 2012.*

Red Lists	Latest edition	2012	2013	2014	2015	2016	2017	2018	2019	2020	Availability of experts
Mammals under Hunting Act	1994	rRL									+++
Bats	1994	rRL									+++
Other mammals	1994					rRL					+++
Breeding birds	2010									rRL	+++
Reptiles	2005						rRL				+++
Amphibians	2005						rRL				+++
Fish and cyclostomes	2007						rRL				++
Craneflies*	1994										+
Butterflies	1994	rRL								rRL	+++
Other Lepidoptera*	new									RL	++
Wood-dwelling beetles	new		RL								+++
Rove beetles*	new									RL	++
Caddisflies	2012	rRL								rRL	++
Ants*	1994								rRL		++
Bees*	1994							RL			+++
Wasps*	new							RL			+++
Ground & tiger beetles*	1994									RL	+++
Water beetles*	1994										+
Lacewings*	1994										+
Stoneflies	2012	rRL								rRL	++
Grasshoppers	2007						rRL				+++
Dragonflies	2002					rRL					+++
Mayflies	2012	rRL								rRL	++
Decapods	2011						rRL				+++
Spiders*	new									RL	+++
Gastropods & bivalves	2012	rRL									++
Vascular plants	2002						rRL				+++
Bryophytes	2004						rRL				+++
Stoneworts	2012	rRL									++
Terricolous and epiphytic lichens	2002								rRL		++
Macrofungi	2007									rRL	++

Source: FOEN

> Annexes

A1 Endangerment Categories

Extinct (EX)
A taxon is *Extinct* when there is no reasonable doubt that the last individual has died. A taxon is presumed *Extinct* when exhaustive surveys in known and/or expected habitats, at appropriate times (diurnal, seasonal, annual), throughout its historical range have failed to record an individual. This category is not applicable to national or regional lists.

Extinct in the Wild (EW)
A taxon is *Extinct in the Wild* when it is known only to survive in cultivation, in captivity or as a naturalised population (or populations) well outside its previous range. A taxon is presumed *Extinct in the Wild* when exhaustive surveys in known and/or expected habitats, at appropriate times (diurnal, seasonal, annual), throughout its historical range have failed to record an individual. This category is replaced by *Regionally Extinct* (RE) in national and regional Lists.

Regionally Extinct or Extinct in Switzerland (RE)
A taxon is *Regionally Extinct* or *Extinct in Switzerland* when there is no reasonable doubt that the last breeding individual in the country or in the region being evaluated has died.

Critically Endangered (CE)
A taxon is *Critically Endangered* when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Annex A2), and it is therefore considered to be facing an extremely high risk of extinction in the wild.

Endangered (EN)
A taxon is *Endangered* when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Annex A2), and it is therefore considered to be facing a very high risk of extinction in the wild.

Vulnerable (VU)
A taxon is *Vulnerable* (synonym in pre-2001 Red Lists and in the Ordinance on Fisheries FFO; SR 923.01) when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Annex A2), and it is therefore considered to be facing a high risk of extinction in the wild.

Near Threatened (NT)
A taxon is *Near Threatened* when it has been evaluated against the criteria but does not qualify for *Critically Endangered*, *Endangered* or *Vulnerable* now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

Least Concern (LC)
A taxon is of *Least Concern* when it has been evaluated against the criteria but does not qualify for *Critically Endangered, Endangered, Vulnerable* or *Near Threatened*.

Data Deficient (DD)
A taxon is *Data Deficient* when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. *Data Deficient* is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research may show that a threatened classification is appropriate. It is important to make use of whatever data are available. In many cases great care needs to be exercised in choosing between *Data Deficient* and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

Not Evaluated (NE)
A taxon is *Not Evaluated* when it has not been evaluated against the criteria.

Endangered or threatened species on Red Lists

Red Lists comprise all species assigned to EX, EW or RE, CR, EN and VU categories. NT represents an intermediate category between the Red List as such and the List of non-threatened species (LC).

IUCN 2003, 2010, www.iucn.org/redlist

A2 Evaluation criteria

IUCN criteria for classificaiton in the endangerment categories CR, EN and VU

The classification criteria for the endangerment categories CR, EN and VU are the same, only the threshold values vary. Only the criteria for CR and the corresponding threshold values for EN and VU are listed below.

A taxon is *Critically Endangered* (or *Endangered* or *Vulnerable*) when the best available evidence indicates that it meets any of the following criteria (A – E) and is therefore considered to be facing an extremely high risk of extinction in the wild:

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

1. An observed, estimated, inferred or suspected population size reduction of ≥90 % (EN 70 %, VU 50 %) over the last 10 years or three generations, whichever is the longer, where the causes of the reduction are clearly reversible AND understood AND ceased, based on (and specifying) any of the following:
   a) direct observation
   b) an index of abundance appropriate to 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, hybridization, pathogens, pollutants, competitors or parasites.
2. An observed, estimated, inferred or suspected population size reduction of ≥80 % (EN 50 %, VU 30 %) over the last 10 years or three generations, whichever is the longer, 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.
3. A population size reduction of≥ 80 % (EN 50 %, VU 30 %), projected or suspected to be met within the next 10 years or three generations, whichever is the longer (up to a maximum of 100 years), based on (and specifying) any of b) to e) under A1.
4. An observed, estimated, inferred, projected or suspected population size reduction of≥ 80 % (EN 50 %, VU 30 %)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 estimated to be less than 100 km² (EN 5000 km², VU 20 000 km²), and estimates indicating at least two of a – c:
   a) Severely fragmented or known to exist at only a single (EN 5, VU 10) location
   b) Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals
   c) Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals

2. Area of occupancy estimated to be less than 10 km² (EN 500 km², VU 2000 km²) and estimates indicating at least two of a – c under B1:
   a) Severely fragmented or known to exist at only a single (EN 5, VU 10) location
   b) Continuing decline, observed, inferred or projected, in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) area, extent and/or quality of habitat
      (iv) number of locations or subpopulations
      (v) number of mature individuals
   c) Extreme fluctuations in any of the following:
      (i) extent of occurrence
      (ii) area of occupancy
      (iii) number of locations or subpopulations
      (iv) number of mature individuals

C. Population size estimated to number fewer than 250 mature individuals (EN 2500, VU 10 000) and either:

1. An estimated continuing decline of at least 25 % within 3 years or 1 generation, whichever is longer (EN 20 % within 5 years or 2 generations, VU 10 % within 10 years or 3 generations), OR
2. A continuing decline, observed, projected, or inferred, in numbers ofmature 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 than50 mature individuals (EN 250, VU 1000) OR
      (ii) at least 90 % (EN 95 %, VU all) of mature individuals in one subpopulation
   b) Extreme fluctuations in number of mature individuals.

D. Population size estimated to number fewer than 50 (EN 250) mature individuals.

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

1. Population size estimated to number fewer than 1000 mature individuals.
2. Population with a very restricted area of occupancy (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.

E. Quantitative analysis showing the probability of extinction in the wild is at least 50% within 10 years or three generations, whichever is the longer (up to a maximum of 100 years). (EN 20 % within 20 years or 5 generations, VU 10 % within 100 years).

IUCN 2003, 2010, www.iucn.org/redlist

A3 Valid Red Lists for Switzerland

Red Lists exist for 27 organism groups (status: January 2012) and are presented in 14 publications. The endangered crustaceans are listed in Annex 1 of the *Ordinance to the Federal Act on Fish and Fisheries*.

Amphibians	Schmidt B.R., Zumbach S. 2005: Liste rouge des amphibiens menacés en Suisse. Ed.: Office fédéral de l'environnement, des forêts et du paysage, Berne; Centre de coordination pour la protection des amphibiens et des reptiles de Suisse (karch), Berne. L'environnement pratique: 46 p.
Ants	Agosti D., Cherix D. 1994: Liste rouge des fourmis menacées de Suisse. In: Duelli P. (réd.). Listes rouges des espèces animales menacées de Suisse. Ed.: Office fédéral de l'environnement, des forêts et du paysage, Berne. L'environnement pratique: p. 45–47.
Bats	Centres de coordination pour l'étude et la protection des chauves-souris 1994: Liste rouge des chauves-souris menacées de Suisse. In: Duelli P. (réd.). Listes rouges des espèces animales menacées de Suisse. Ed.: Office fédéral de l'environnement, des forêts et du paysage, Berne. L'environnement pratique: p. 22–23.
Bees	Amiet F. 1994: Liste rouge des abeilles menacées de Suisse. In: Duelli P. (réd.). Listes rouges des espèces animales menacées de Suisse. Ed.: Office fédéral de l'environnement, des forêts et du paysage, Berne. L'environnement pratique: p. 38–44.
Birds	Keller V., Zbinden N., Schmid H., Volet B. 2010: Liste rouge oiseaux nicheurs. Espèces menacées en Suisse, état 2010. Ed.: Office fédéral de l'environnement, Berne; Station ornithologique suisse, Sempach. L'environnement pratique n° 1019: 53 p.
Bivalves	Rüetschi J., Stucki P., Vicentini H., Müller P. 2012: Liste rouge mollusques. Espèces menacées en Suisse, état 2010. Ed.: Office fédéral de l'environnement, Berne; Centre suisse de cartographie de la faune, Neuchâtel. L'environnement pratique (in print).
Bryophytes	Schnyder N., Bergamini A., Hoffmann H., Müller N., Schubiger-Bossard C., Urmi E. 2004: Liste rouge des bryophytes menacées en Suisse. Ed.: Office fédéral de l'environnement, FUB, NISM. L'environnement pratique: 100 p.
Butterflies	Gonseth Y. 1994: Liste rouge des lépidoptères diurnes menacés de Suisse. In: Duelli P. (réd.). Listes rouges des espèces animales menacées de Suisse. Ed.: Office fédéral de l'environnement, des forêts et du paysage, Berne. L'environnement pratique: p. 48–51.
Caddisflies	Lubini V., Sartori M., Wagner A., Vicentini H. 2012: Listes rouges des espèces d'éphémères, de plécoptères et de trichoptères menacées en Suisse, état 2010. Ed.: Office fédéral de l'environnement, Berne; Centre suisse de cartographie de la faune, Neuchâtel. L'environnement pratique n° 1212: 112 p.
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