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> The state of biodiversity in Switzerland

Overview of the findings of Biodiversity Monitoring Switzerland (BDM) as of May 2009

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Federal Office for the Environment FOEN

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Abridged version

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Contents

> Abstracts

This is the second report of the Federal Office for the Environment (FOEN) on the state of biodiversity in Switzerland. The publication summarises the findings of biodiversity monitoring (BDM) in Switzerland in a generally accessible way, and is illustrated with numerous graphics. BDM is a long-term programme of the FOEN to record biodiversity. After eight years of carrying out surveys, the first comparative data is available, enabling BDM to show both the current status of biodiversity as well as developments and trends. The report's cut-off date was the end of 2008 – current data on BDM can be found on the Website www.biodiversitymonitoring.ch.

Keywords:
Biodiversity Monitoring, BDM, biodiversity, biological diversity, development, indicators, comparative data, landscapes, habitats, Switzerland.

Dies ist der zweite Bericht des Bundesamtes für Umwelt BAFU zum Zustand der Biodiversität in der Schweiz. Die Publikation fasst die bisherigen Erkenntnisse des Biodiversitäts-Monitorings Schweiz BDM allgemein verständlich und mit vielen Grafiken illustriert zusammen. Das BDM ist ein Langzeitprogramm des BAFU zur Erfassung der biologischen Vielfalt. Nach acht Erhebungsjahren liegen erste Veränderungsdaten vor, womit das BDM in der Lage ist, neben dem aktuellen Zustand der Biodiversität auch Entwicklungen und Trends aufzuzeigen. Redaktionsschluss des Berichts war Ende 2008 – aktuelle Daten zum BDM finden sich auf der Website www.biodiversitymonitoring.ch.

Stichwörter:
Biodiversitäts-Monitoring, BDM, Biodiversität, biologische Vielfalt, Entwicklung, Indikatoren, Veränderungsdaten, Landschaften, Lebensräume, Schweiz.

Destiné à un large public et illustré de nombreux graphiques, le deuxième rapport de l'Office fédéral de l'environnement (OFEV) sur l'état de la biodiversité en Suisse résume les résultats obtenus jusqu'ici par le Monitoring de la biodiversité en Suisse (MBD). Le MBD est un programme permanent de l'OFEV dont la mission est de dresser l'état des lieux de la diversité biologique. Après huit ans de recueil de données, nous disposons des premières données comparatives, de sorte que nous pouvons non seulement faire le tour d'horizon de la biodiversité aujourd'hui, mais aussi identifier des tendances. La rédaction de ce rapport a été arrêtée à la fin 2008. Des données à jour se trouvent sur le site Internet www.biodiversitymonitoring.ch.

Mots-clés:
monitoring de la biodiversité, MBD, biodiversité, diversité biologique, évolution, indicateurs, données comparatives, paysages, habitats, Suisse.

Il presente documento è il secondo rapporto dell'Ufficio federale dell'ambiente (UFAM) sullo stato della biodiversità in Svizzera. La presente pubblicazione raccoglie le informazioni finora acquisite dal Monitoraggio della biodiversità in Svizzera (MBD) in un documento di facile comprensione e con l'ausilio di numerosi grafici. Il Monitoraggio della biodiversità (MBD) è un programma a lungo termine dell'UFAM per il rilevamento della diversità biologica. Dopo otto anni di indagini sono ora disponibili i primi dati di variazione, grazie ai quali il MBD è in grado di illustrare, oltre allo stato attuale della biodiversità, anche andamenti e tendenze. La chiusura redazionale per il presente rapporto è avvenuta alla fine del 2008 – i dati aggiornati sul MBD sono consultabili sul sito web www.biodiversitymonitoring.ch.

Parole chiave:
Monitoraggio della biodiversità, MBD, biodiversità, diversità biologica, andamento, indicatori, dati di variazione, paesaggi, habitat, Svizzera.

> Foreword

Biodiversity is one of the most important components of the natural resource base on which our life depends. However, thus far little has been known about how biodiversity in Switzerland is evolving. Since 2001 the programme for Biodiversity Monitoring in Switzerland (BDM) has increasingly been replacing assumptions with facts. Following the completion of a first cycle of surveys, first change values have been available since 2006. Although the second cycle of surveys has not yet been completed, the BDM can already reveal initial trends in biodiversity development in Switzerland. This report summarises the latest findings.

However, it may be risky to draw direct conclusions on the state and development of biodiversity on the basis of bare figures from the BDM. Thus, though initial findings point to a slow increase in the mean number of vascular plant species in the landscapes of the Northern Alps and the Jura, this trend is caused by nutrient-loving species. Species that are already widespread and have a wide range of tolerance in terms of their ecological requirements appear to be spreading further. As a result, species communities are becoming more and more uniform. This trend towards uniformity is no cause for celebration, even if species numbers are rising.

The BDM programme also has the potential to provide answers to new questions. One example would be the impact of climate change: the BDM has found that the distributional range of typical mountain plants has moved upwards in altitude. At the same time, the number of species of vascular plants on alpine monitoring sites has increased. Time will tell whether this means that poorly competitive species will be displaced in the long term.

In order to give a more refined picture of the situation, this report assesses the state of biodiversity separately for the different main ecosystems. It reports on the situation of forests, settlements, agricultural land, and the mountain regions. Three further chapters are dedicated to special and particularly topical issues: landscape change, climate change, and the special situation of endangered species and habitats. These contributions cover those topics in biodiversity which at present are most under discussion.

Today the BDM as well as results from other survey programmes are giving us a database which allows us to assess measures and develop effective promotion instruments. Further updates of the data series will show how the most recent political and economic developments impact on biodiversity and in how far objectives are being achieved.

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

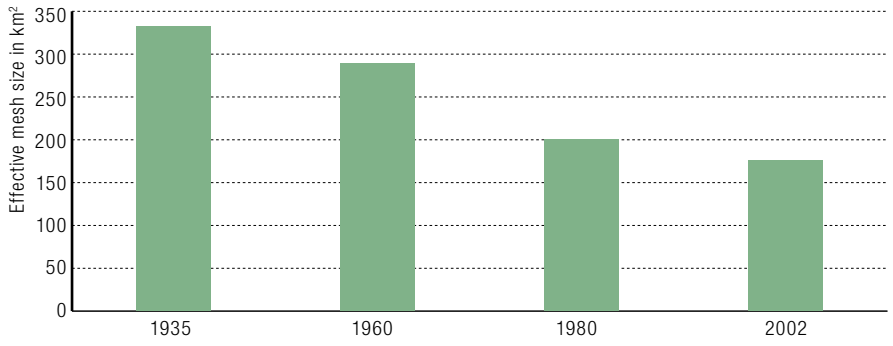
> Overview

Landscape and species diversity

The Swiss landscape has undergone major changes over the past fifty years. The area used for farming has declined while settlements and forest cover have expanded. Landscape quality has also changed. Strong building activity, for example, continues to fragment landscapes and causes problems for many species of fauna. Swiss landscapes differ considerably. These differences, which are both natural and due to land use, are reflected in their species diversity. On the Central Plateau (Mittelland) and in the Jura mountains, for example, a comparatively high number of breeding bird species can be found, while in the Alps there are particularly high numbers of plant species and species of butterflies. In the Jura and in parts of the Alps the diversity of vascular plants has seen a slight increase in recent years. In particular, vascular plants favouring nutrient-rich conditions have continued to spread.

Figure 1 > Landscape fragmentation in Switzerland

The graphic depicts the changes in effective mesh size in Switzerland between 1935 and 2002. Mesh size stands for the average size of unfragmented areas between barriers. Effective mesh size has declined steadily since 1935. This means that the Swiss landscape has increasingly been fragmented over the past 70 years.



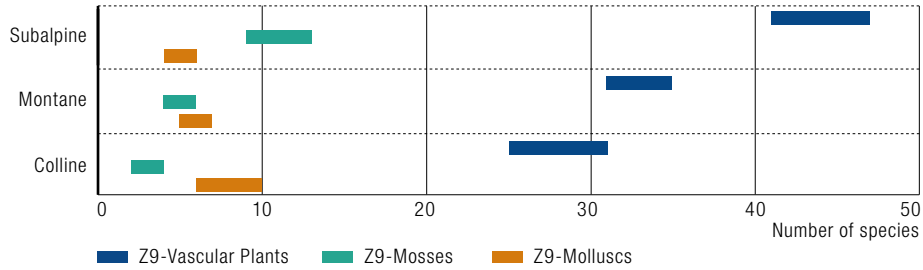
Sources: Bertiller et al., 2007, BDM indicator "Landscape Fragmentation (E15)".

Farming and the open landscape

Agricultural yields on Swiss soils are among the best in the world, resulting from favourable climatic conditions, fertile soils, and intensive farming. Soil nutrient levels are correspondingly high and entail low species diversity on the arable fields and meadows of the Central Plateau. The increasing spread of nutrient-loving plant species also points to the intensification of meadow and pasture management. The Swiss Confederation counteracts these developments, which are negative for species diversity, by promoting ecological compensation schemes, organic farming and the genetic diversity of crop plants and livestock species.

Figure 2 > Species diversity on meadows/pastures

Mean number of species on BDM sampling plots of 10 m² in meadows/pastures in different altitudinal zones (95% confidence interval). Mean diversity of vascular plants and mosses is significantly higher in meadows and pastures of the subalpine zone than in zones at lower altitudes. However, mollusc diversity decreases with increasing altitude, which corresponds to their natural pattern of distribution.



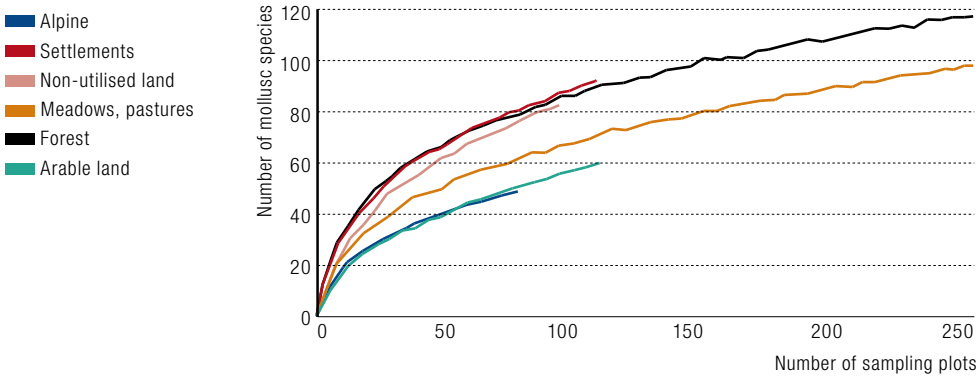
Source: BDM indicator «Species Diversity in Habitats (Z9)".

Species diversity in forests

Even though the BDM only records certain groups of species, the data demonstrate the major importance of forests for biodiversity. Diversity in some groups, such as snails/slugs and mosses, is even higher in forests than in meadows and pastures which are considered exceptionally species-rich. Forests in the subalpine zone today host a particularly high number of species. Support for species diversity in forests requires both open, thinned forest stands and large-scale unutilised woodlands where natural dynamic processes can operate.

Figure 3 > Species diversity in different ecosystems

Number of mollusc species in relation to increasing numbers of BDM sampling plots of 10 m² being taken into account. The more steep the curve, the more divergent are the sampling plots in their species composition. Forests host a large number of mollusc species compared to other habitat types.



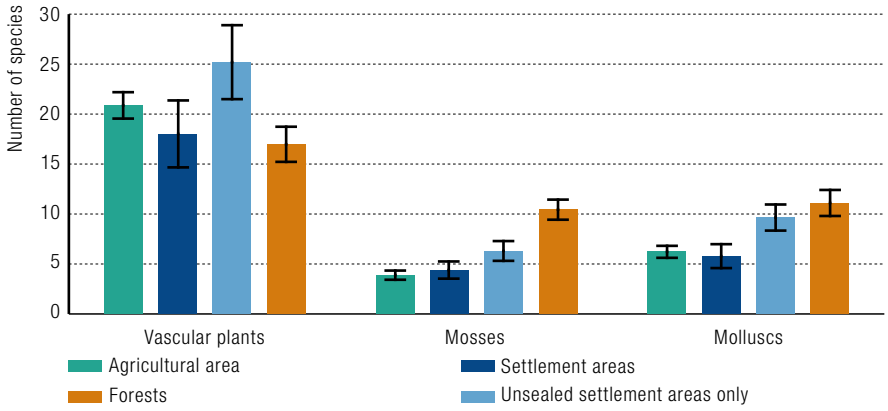
Source: BDM indicator "Species Diversity in Habitats (Z9)".

Species diversity in settlements

The area under settlements has continuously increased during the 20th century, with the strongest increase between 1960 and 1980. Settlements expanded primarily on the Central Plateau but expansion was also evident in the Alpine region. Settlements are often considered as hostile to nature but the BDM data put this view into perspective: while settlements on average do not show particularly high species diversity, unsealed surfaces tend to host surprisingly high numbers of species. Some species of vascular plants, breeding birds and mosses are even specialised on settlements and have a preference for such habitats. Settlements also host a particularly high number of non-indigenous plant species (neophytes).

Figure 4 > Species diversity in settlements, forests and agricultural areas

Species diversity of vascular plants, mosses and molluscs (snails) on BDM monitoring sites in settlements (including both sealed and unsealed sites) compared to agricultural areas and forests. The graphic depicts mean values (95% confidence interval).



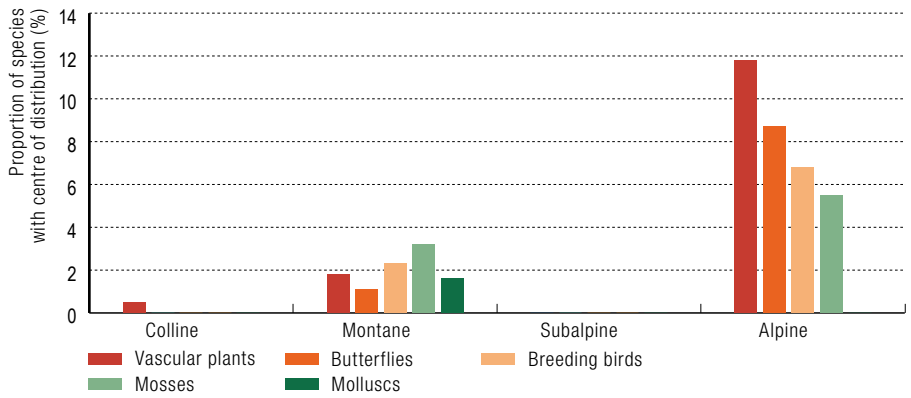
Source: BDM indicator "Species Diversity in Habitats (Z9)".

Biodiversity in the mountains

Alpine wildlife is clearly different from wildlife in the rest of Switzerland. Nowhere else in Switzerland can so many species with a limited distribution be found. Most of the vascular plants for which our country has a special responsibility grow on alpine pastures and in other alpine habitats. Agriculturally used grassland at higher altitudes is clearly more species-rich than lowland grassland. In Switzerland, wilderness areas are almost exclusively limited to the mountain regions. These facts show how important the Alps are for wild flora and fauna in this country.

Figure 5 > Species with limited altitudinal distribution

The term "centre of distribution" is used if at least 75% of the BDM records for a species are confined to a certain altitudinal zone. The graphic shows the proportion of such species out of all species recorded in an altitudinal zone. Only species recorded at least ten times in a zone are considered.



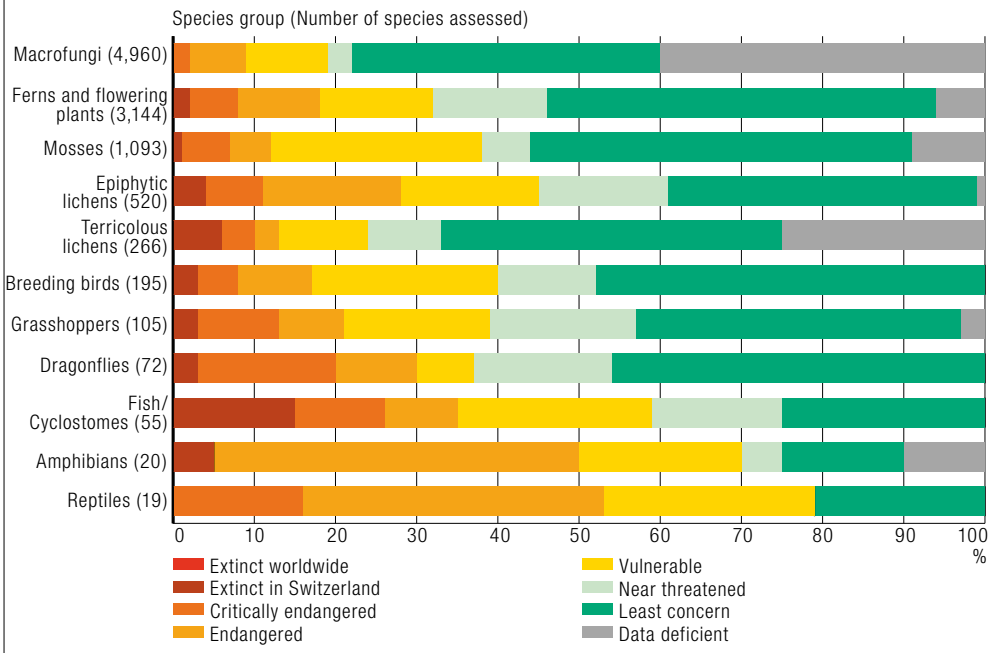
Source: BDM indicators "Species Diversity in Landscapes (Z7)" and "Species Diversity in Habitats (Z9)".

Endangered species and habitat types

Numerous species and habitat types in Switzerland are endangered. As many as four out of five species in some groups are on the Red List. Knowledge about the population development and distribution of many of the endangered species is still limited. Thanks to the BDM, knowledge on the distribution of mosses, molluscs and also of some butterfly species has much improved. Apart from four bird species, none of the endangered species have been lost of late. However, the development of some rare habitats gives cause for concern. This is particularly true for peatlands and some xeric habitats.

Figure 6 > Assessments of threat status

Endangered species, divided into species groups and threat categories. Species are considered Red List species if they are assigned to one of the five threat categories between red and orange. Reptiles and amphibians are particularly threatened: 79 % of reptile species and 70 % of amphibian species are on the Red List.



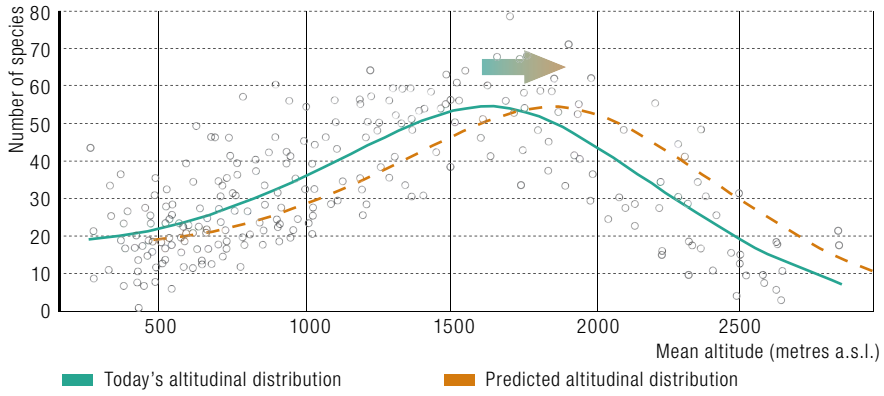
Source: BDM indicator "Change in the Endangerment Status of Species (Z5)"

Impacts of climate change

The BDM can demonstrate that climate change is already having an effect on flora and fauna in Switzerland. For example, butterfly and dragonfly species as well as bird species from the Mediterranean are spreading here. Climate-related changes are particularly striking in the Alps: today subalpine and alpine plant species grow at an altitude 13 metres higher than in 2001 on average.

Figure 7 > Number of butterfly species by altitude

Number of butterfly species on BDM monitoring sites (1 km²).The landscapes with the highest diversity of butterflies can be found at an altitude of about 1600 metres above sea level. If the climate warms it is to be expected that the maximum of the distribution curve will move upwards (schematic representation).



Source: BDM indicator "Species Diversity in Landscapes (Z7)".

Synthesis

> Goal not yet achieved

Our landscape and species diversity are perpetually evolving. Changes in ecosystems, the growth of settlements, globalisation and global warming are an expression of such change and in part also its cause. Our efforts to support biodiversity are showing first signs of success, especially in forests. The most important goal, however, is to halt the general loss of biodiversity. That goal has not yet been achieved. Especially in the Alps, with their in many respects outstanding natural assets, it is vital that the emerging negative developments will be averted.

The concept of biodiversity embraces the diversity of plant and animal species as well as their genetic variability, and also encompasses the wealth of their habitats. The mutual relationships and dependencies among organisms and the diversity of ecological processes (e.g. biomass decomposition or nutrient cycles) are further components of biodiversity. If we wish to maintain and promote biodiversity all these aspects must be considered. Given that across Switzerland there are well over 40,000 species of flora and fauna in an area of 41,000 square kilometres, it is clearly difficult to make reliable pronouncements on the state of biodiversity.

The programme for Biodiversity Monitoring in Switzerland (BDM) records developments in biodiversity largely on the basis of breeding birds, butterflies, vascular plants, mosses and molluscs. This selection is sufficient to reveal significant trends in biodiversity. Moreover, the BDM data can be supplemented with and linked to data recorded in other programmes. The BDM methodology is intentionally based on entire species groups rather than individual indicator species.

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Mountain landscapes under pressure

Current figures on construction activity emphatically confirm that Switzerland is undergoing thoroughgoing change. It is well known that industrialisation radically transformed our landscapes until the middle of the last century. However, it comes as more of a surprise that the shift from a subsistence and industrial society to a service economy from about 1970 as well as increasing urbanisation are causing landscape changes of equal dimensions. During the 1980s and 1990s settlements expanded by about 13 per cent, also affecting alpine valleys. Settlements in the Western Central Alps expanded particularly rapidly – by more than 20 per cent over that period.

Settlements are expanding at the expense of agricultural land. Agriculturally used land is under pressure from two sides (see Figure 10). On the one hand farmland represents the largest reserve of land for construction and transport infrastructure in the proximity of existing settlements. On the other hand farmers increasingly abandon land use in unprofitable areas, leading to the swift expansion of forest cover. This has repercussions for biodiversity in the open landscape: remaining farm holdings concentrate on lands in favoured areas which can be managed economically and they utilise these lands up into the high montane zone, strongly aided by machinery and nutrient inputs. Marginal lands on nutrient-poor soils and with a rich flora and fauna, such as dry meadows, are maintained with the aid of direct payments and conservation measures or they fall victim to either abandonment or intensification. Surprisingly this process is still advancing! It is scarcely possible to draw any other conclusion from land use and habitat conservation data. In this setting of land uses driven by economic forces, biodiversity continues to be under severe pressure. Whether the mountain areas of the Alps and the Jura will suffer a similar depletion as the Central Plateau did in the past century will be decided in the coming decades.

Settlement expansion has mixed repercussions

Settlement expansion at the expense of farming – that sounds like loss of nature. Undoubtedly soils sealed with buildings and roads are largely lost to nature. In contrast, however, unsealed soils in settlements are more species-rich than agricultural lands – at least as far as the groups of plant and animal species are concerned that are monitored by the BDM. This demonstrates the importance of settlements as refuges and substitute habitats, especially for plants and animals of the open countryside. If this is to remain so in the future, newly built-up areas must be carefully designed in a way that considers biodiversity (see Figure 11).

Settlements can also be important refuges for specialised or rare species, such as pioneer and ruderal plants, for mosses thriving on rocky surfaces, for wild bees, bats or amphibians. At the same time however settlements have become gateways and areas for the disper-

Figure 10 > Farmland under pressure

Left: Pratteln, Basel agglomeration: On the margins of major urban centres the landscape is under pressure (Photo: Christoph Bühler). Right: Expansion of forests in the Alps: Spruce trees growing at Val Bugnei (Tujetsch, Grisons) in previously open countryside (Photo: Claudia Schreiber).

Figure 11 > Differences in urban design

Two examples of designs of private gardens – one unfavourable (left) and one favourable (right) for biodiversity (Photos: www.plant2day.nl; Yvonne Steiner Ly).

sal of non-indigenous plants and animals which have undeniably and in some cases problematically taken hold in our landscapes. While assessments of these developments vary, the potential of settlement areas for biodiversity should not be underestimated.

The economic setting is key

Change is an inherent part of life and human culture. Man's influence on the environment has been evident for thousands of years. Only in recent times have we begun to reflect upon the consequences of our actions on nature and to influence outcomes through targeted actions. This has resulted in new acts and ordinances such as the Swiss Forests Act (Waldgesetz), the Nature and Cultural Heritage Protection Act (Bundesgesetz über den Natur- und Heimatschutz, NHG), federal habitat protection schemes and the Federal Inventory of Landscapes and Natural Monuments of National Importance (Bundesinventar der Landschaften und Naturdenkmäler von nationaler Bedeutung, BLN). Conservation efforts have intensified considerably over the past 15 years. Examples of such efforts include ecologically focused direct payments to farmers, organic farming, the NHG-based contributions system for habitat protection, the Landscape 2020 programme and the forest programme for 2004–2015. As outlined in the chapters on forests and agriculture in this report, positive impacts of these measures have meanwhile become evident. However, economic conditions continue to fundamentally shape the type and intensity of land use to a greater extent than the mostly governmental steering measures. It is these economic conditions which explain the differences in the state of biodiversity in farmland and forests.

Signs of hope in the forests

Swiss forests now contain more near-natural stands than just ten years ago. However, significant areas of forest wilderness continue to be present only in the mountain regions.

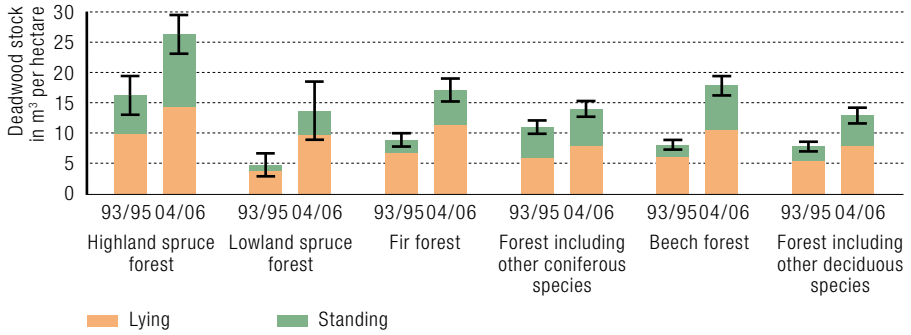
Swiss forests now contain more near-natural stands than just ten years ago. However, significant areas of forest wilderness continue to be present only in the mountain regions. And it is only in those regions that forest wilderness has expanded. The area of forest reserves has also increased over the past ten years. These reserves are not subject to any form of utilisation or there may be intervention solely for nature conservation purposes. There has also been a major increase in the proportion of forests where natural regeneration is practised, including on the Central Plateau. Moreover, significantly greater quantities of deadwood can now be found in all regions compared to ten years ago (see Figure 12). Deadwood is an important resource for forest wildlife.

These developments have a favourable impact on species diversity in forests, and especially on the diversity of shade-tolerant and deadwood-inhabiting organisms such as fungi, lichens, mosses and molluscs. Following the completion of the second census, the BDM will be able to assess these developments in a few years.

It can already be noted that the Swiss forests are developing in the direction set out in the Swiss Forest Programme for 2004–2015 (WAP-CH) and in other programmes for biodiversity conservation and promotion. It would appear that the first stage on the path towards biologically more diverse forests has been completed successfully.

Figure 12 > Deadwood in Swiss forests

Development of deadwood stock in Swiss forests from the 1993/95 survey to the 2004/06 survey. Figures show the stock of standing and lying deadwood in m³ per hectare. Forests were classified into six types based on predominant tree species. Bars depict mean values (95% confidence interval).



Sources: WSL, 2008: Swiss National Forest Inventory (NFI). Special evaluation of the 1983–85, 1993–95 and 2004–06 surveys. Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), CH-8903 Birmensdorf. BDM indicator "Deadwood (E10)".

Mixed results in the farming sector

Overall only about a quarter of the notified ecological compensation areas are of the quality prescribed by the Ecological Quality Ordinance.

There has also been some degree of progress in the farming sector in terms of environmental objectives as recently set out by the Swiss Confederation[1]. However, the overall result is still deficient. At first glance, an area of 121,000 hectares of ecological compensation areas – i.e. 11.4 % of the utilised agricultural area – appears impressive. However, farmers often pick the location of compensation areas solely based on economic considerations; therefore their benefit in terms of biodiversity is somewhat limited. Overall only about a quarter of the notified meadows, Streueflächen (meadows mown for animal bedding), traditional standard fruit tree orchards and hedges are of the quality prescribed by the Ecological Quality Ordinance (Ökoqualitätsverordnung, ÖQV; see Figure 13).

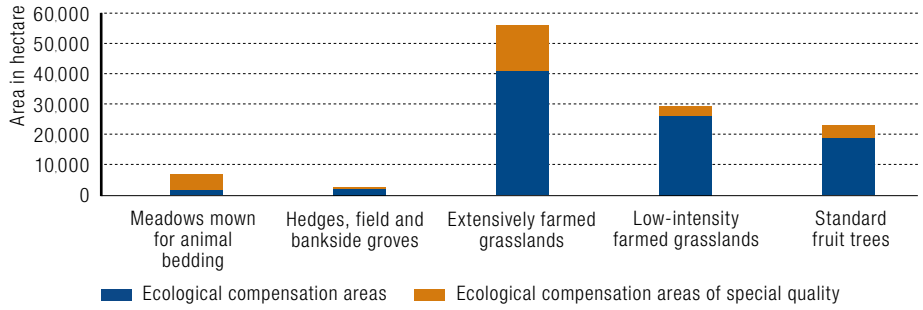
While it is encouraging that the BDM has recorded a slight increase in mean species richness in Swiss meadows since 2001, first analyses show that this increase is mostly due to the continued spread of common plant species of fertilised meadows. There are as yet no indications that the diversity of characteristic, rare, or endangered species on agricultural lands has increased, which would be the actual aim of the Confederation. Quite the opposite is the case: population decreases in many bird species of the cultural landscape as documented by the Swiss Bird Index SBI® point in the opposite direction[2]. Moreover, there have been serious losses in both quality and area of fens and dry meadows.

[1] BAFU und BLW, 2008: Umweltziele Landwirtschaft. Hergeleitet aus bestehenden rechtlichen Grundlagen. Umwelt-Wissen Nr. 0820. Bundesamt für Umwelt, Bern: 221 pp.

[2] Keller, V., Kéry, M., Schmid, H., Zbinden, N., 2008: Swiss Bird Index SBI®: Update 2007. Faktenblatt. Schweizerische Vogelwarte Sempach.

Figure 13 > Quality of ecological compensation areas

Proportion of notified ecological compensation areas of the quality required by the Ecological Quality Ordinance (ÖQV) in total ecological compensation areas. Only about a quarter of the areas are of ÖQV quality. However, the proportion of areas of ÖQV quality tends to be underestimated as the farmers themselves are in charge of assessing their meadows. Data as of 2007.



Source: BDM indicator "Ecological Compensation Areas (M4)".

Alps are of conservation concern

The Alps are of outstanding importance for biodiversity in Switzerland, especially the high altitude zones.

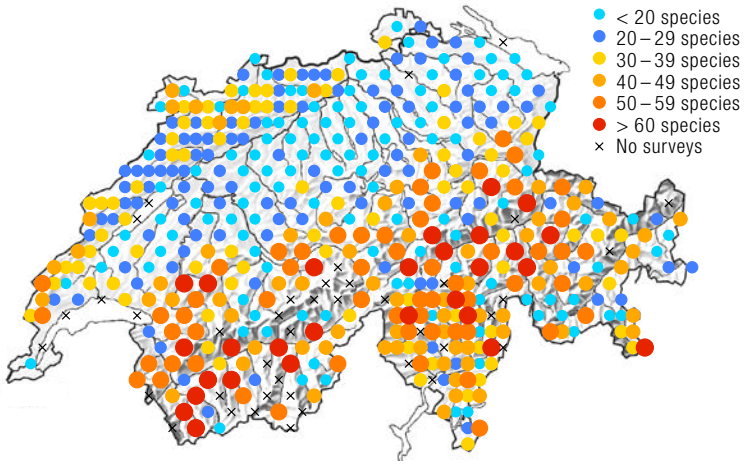
The Alps are of outstanding importance for biodiversity in Switzerland, especially the high altitude zones. Despite all modern developments the Alps have maintained most of their biodiversity, not least due to their extreme topography. The species richness of meadows and pastures as well as forests in the subalpine and alpine zones clearly stands out from those at lower altitudes. And nowhere else but in the Alps can such expanses of largely natural habitats be found: rocks and boulder fields and also dwarf-shrub communities, peatlands, and forests that are hardly subject to human interventions.

Not only individual ecosystems but whole landscapes in the Alpine regions host greater biodiversity than the Central Plateau, at least as far as vascular plants and butterflies are concerned. Butterfly-rich landscapes occur almost exclusively in the Alps, with some occurring in the Jura (see Figure 14). The great diversity of butterflies at higher altitudes is due to grassland quality and not to these insects' natural altitudinal distribution. Butterflies are strongly dependent on both the food supply offered by flowers and on suitable host plants. Therefore, the relatively species-rich mountain meadows have become much more suitable habitats than the valleys.

Switzerland has a special responsibility for the Alps as a biodiversity hotspot. Alpine plants and animals have a limited distribution more often than species of lower altitudinal zones, and are therefore generally at a greater risk of extinction. While there are very few plant and animal species which exclusively occur in Switzerland, about a quarter of the range of some 150 vascular plant species which are endemic to Central Europe lies on Swiss soil. These endemic species are predominantly mountain plants growing at high and highest altitudes. They occur on both farmed and natural sites.

Figure 14 > Butterfly species in the Alps

Species diversity of butterflies on BDM monitoring sites in 2003–2007. Each dot symbolises one BDM monitoring site. The larger the dot the more species were recorded. Today the Alps have a much greater species diversity of butterflies than the Central Plateau or the Jura.



Source: BDM indicator "Species Diversity in Landscapes (Z7)".

In this context it gives cause for concern that the Alps are currently subject to major change. This is not only a matter of landscape change, especially in connection with farming, as described above: climate change is also particularly noticeable in the Alps. For the time being one can only speculate as to what climate change will mean for biodiversity in the mountains. However, rising temperatures may soon have repercussions for the special alpine species and for the altitudinal distribution of many species. There are already first signs: the BDM has recorded a mean rise of 13 m in the altitudinal distribution of subalpine and alpine plant species within the span of a mere five years. It remains to be seen whether this development will continue in coming years and what repercussions it will have for the biodiversity of alpine ecosystems.

However, rising temperatures may soon have repercussions for the special alpine species and for the altitudinal distribution of many species.

Species richness in Switzerland

When looking at individual ecosystems, one should not lose sight of Switzerland as a whole. The number of wild species of fauna in Switzerland recorded by the BDM has largely remained unchanged between 1997 and 2006. Influxes – including non-indigenous species – and disappearances were roughly at par. However, there have definitely been changes in species numbers in the various Swiss regions. The addition of four breeding bird species in the Eastern Central Alps is particularly noticeable. These include the common rosefinch (*Carpodacus erythrinus*), tufted duck (*Aythya fuligula*), black kite (*Milvus*

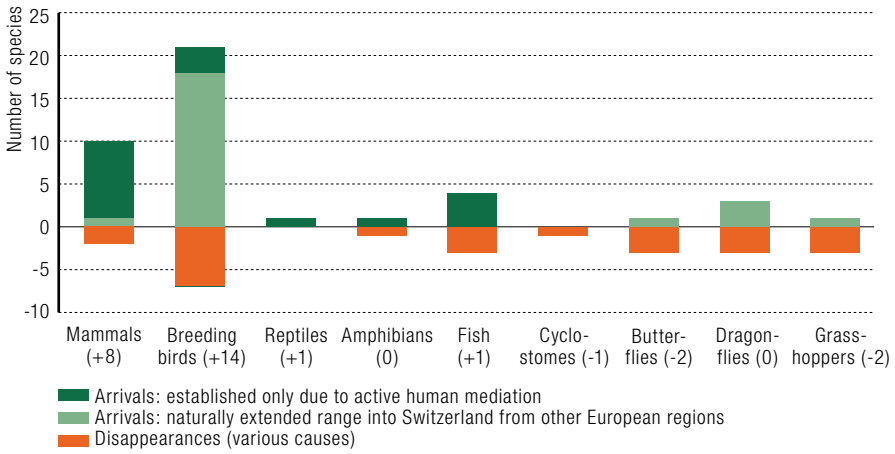
migrans) and willow warbler (*Phylloscopus trochilus*) (see BDM indicator "Species Diversity at National and Regional Level [Z3]").

If one looks at longer time periods however, an unexpected dynamic can be seen. Despite the increasing threats to many animal species, the total number of wild species of fauna has on balance increased since 1900. This is due to the fact that apart from the many endangered species there are also those which have naturally extended their range or have been introduced by human action (see Figure 15). The latter include problematic species such as the marsh frog (*Pelophylax ridibundus*) and the topmouth gudgeon (*Pseudorasbora parva*).

Of a total of 715 animal species in nine selected groups which have been assessed, 23 species have demonstrably disappeared from Switzerland since 1900. During the same period, 42 species have entered the country. Particularly noticeable increases can be seen in breeding bird species (+14 species) and mammals (+8 species). In accordance with BDM criteria species are taken to be "present" if they have been found living in the wild in Switzerland in at least nine out of 10 consecutive years. It must also be noted that the BDM only monitors a small number of selected groups of animal species. This limitation entails that non-indigenous new arrivals of recent years, such as the Harlequin ladybird (*Harmonia axyridis*), the garage spider (*Zoropsis spinimana*) and the river clubtail (*Gomphus flavipes*) have not yet been considered in the assessment. Experts are currently discussing which of these species may be enriching the native fauna and which ones may represent a threat.

Figure 15 > Changes in the Swiss fauna since 1900

Increases and decreases in species numbers in nine selected groups of animal species in Switzerland since 1900. Numbers in brackets are net balances. In total the groups comprise just over 700 species.



Source: Extended analysis of BDM indicators "Species Diversity at National and Regional Level (Z3)".

Be this as it may, the observed trend is not solely due to conservation efforts. The increase in species numbers must also not obscure the fact that species and habitat conservation efforts have not yet succeeded in reversing adverse trends. The quality of the remaining peatlands has declined significantly and the area of dry meadows of national importance continues to contract. Moreover, the latter have still not been given comprehensive legal protection. In addition, the data on species richness yield no information on population increases or decreases. The assessment of the threat status of individual groups of organisms continues to give cause for concern: one out of three species in these groups is red-listed in Switzerland.

Species richness in ecosystems and landscapes

The BDM is now in a position to provide initial indications of current changes in species richness in Switzerland.

Changes in land use, changes in farming, and climate change have been described above as strong forces impacting on biodiversity. With its core indicators on the state of species diversity in habitats and landscapes the BDM is designed to directly document how organisms are affected by such impacts. Between 2001 and 2005 more than 2000 monitoring sites were surveyed. Since 2006 the first round of repeat surveys has been conducted on the same sites. Meanwhile two fifths of the total sample have been surveyed twice. Therefore the BDM is now in a position to provide initial indications of current changes in species richness in Switzerland.

Using the already available data of the BDM indicator "Species Diversity in Habitats (Z9)" it is evident that mean vascular plant species numbers in Swiss meadows and pastures have increased, especially in the montane zone. This increase is due to many different plant species. However, particularly frequent newly occurring plant species on BDM monitoring sites include dandelion (*Taraxacum officinale*), rough meadow-grass (*Poa trivialis*), white clover (*Trifolium repens*) and common bugle (*Ajuga reptans*). These are common, nutrient-loving species. It appears that such species have continued to spread over the past five years and now also occur in areas and habitats where they were not previously recorded.

In contrast to the vascular plants, there are as yet no discernable trends for mosses and molluscs.

Initial results from the BDM indicator "Species Diversity in Landscapes (Z7)" show that the number of vascular plant species has also increased in whole landscape sections over the past five years. Species numbers are recorded on sites of a size of one square kilometre. Mean increases for the "Jura" and "Northern Alps" biogeographical regions have been statistically backed up. The BDM has not yet been able to substantiate changes in other regions. Initial assessments show that primarily characteristic nutrient indicator species of fertilised meadows and pastures have become more frequent.

For breeding birds there has been no change of species numbers at the landscape level since monitoring commenced in 2001, neither in Switzerland overall nor in the regions. In terms of population sizes of native bird species regularly breeding in Switzerland, the Swiss Bird Index SBI® compiled by the Sempach ornithological station shows a slight positive trend since the 1990s[3].

[3] Keller, V., Kéry, M., Schmid, H., Zbinden, N., 2008: Swiss Bird Index SBI®: Update 2007. Faktenblatt. Schweizerische Vogelwarte Sempach.

Table 1 > Trends in biodiversity

The most important findings from BDM core indicators.

Species richness	Initial trends
in Switzerland	Since 2001: occasional decreases and increases. Since 1900: net increase by 19 species, primarily breeding birds and mammals. Since 1900: 18 of 42 new species were only able to establish due to human activities (includes alien species)
in landscape sections since 2001	Slight increase in the number of vascular plant species per square kilometre in the Jura and Northern Alps. No demonstrable trends as yet for other regions or generally for breeding birds. Trends for butterflies will be able to be shown from 2010 at the earliest.
in habitats (or land-use types) since 2001	Increase in the number of vascular plant species on meadows and pastures. Statements can not yet be made with regard to other land-use categories or for mosses and molluscs.
Variability	**Initial trends**
of species communities since 2001	Species composition on the approx. 2000 BDM monitoring sites has generally become more similar between sites. This trend is primarily detectable in meadows and pastures (not including alpine grasslands).

Source: BDM

Enrichment or uniformity?

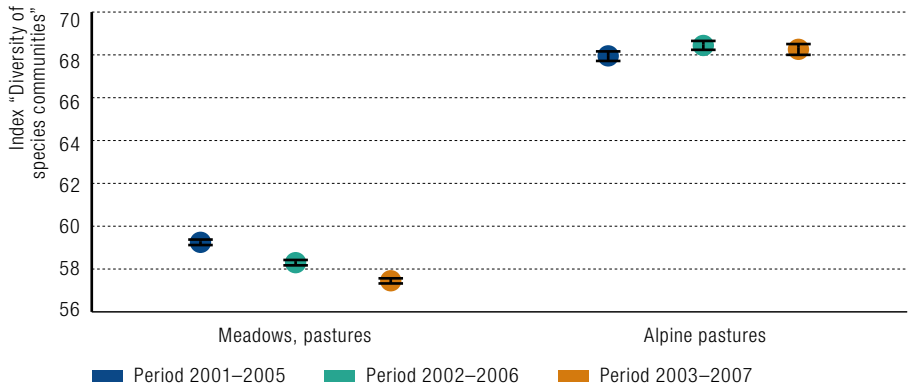
However, species richness alone does not say anything about the ecological quality of the species present.

In many parts of the Swiss countryside, with its intensively used soils, high species richness is generally seen as positive, low species richness as negative. However, species richness alone does not say anything about the ecological quality of the species present. It is primarily species with special ecological requirements which are characteristic of a certain habitat and give it its distinctiveness. This aspect must not be ignored. In a globalised world driven increasingly by the dictates of economic efficiency, land-use methods as well as landscape design and management become more and more uniform. If such developments entail that special cultural and site-specific features of habitats disappear, then this is a bitter loss for biodiversity – even if species numbers remain constant or even increase. At the end of this process we would have standard meadows, standard forest margins and standard hedges which would look the same all over Switzerland.

This homogenisation of biocoenoses is now also being recorded by the BDM with its "Diversity of Species Communities (Z12)" indicator, which provides a meaningful monitoring instrument for a central aspect of biodiversity. The index should show whether the composition of flora and fauna at the various BDM monitoring sites is becoming more uniform or more diverse over time. The index is based on surveys of species richness in landscapes and ecosystems and compares the monitoring sites' species lists. Using data recorded between 2001 and 2007 it has been possible to calculate initial changes. At present a trend towards more uniformity in species composition has only been found for meadows (see Figure 16). No clear trends are yet discernable for other land-use categories.

Figure 16 > Diversity of species communities, exemplified by meadows and alpine pastures

The species composition of permanent grassland sites is becoming increasingly uniform in lowland and upland areas (excluding farmed alpine areas); in alpine pastures, in contrast, no such trend has yet been observed. An identical species composition gives an index value of zero, while a completely diverse species composition gives a value of 100. Bars depict the 95% confidence interval of mean values. Alpine pasture means utilised grassland above the timberline.



Source: BDM indicator "Diversity of Species Communities (Z12)".

Outlook

> Protection alone is not enough

The preservation of biodiversity in Switzerland requires measures at various levels. It does not suffice to limit these measures to outstanding, near-natural landscapes and recorded habitats, for many species of cultural landscapes are already red-listed. The inward migration of invasive species, climate change and also the manner and intensity with which man uses natural resources will gain importance in the development of biodiversity.

During the second half of the 20th century the majority of ecologically important habitats lost area. The populations of many species declined. The BDM with its new, standardised surveys only commenced in 2001. Therefore long-term data series and exact baseline data going back to the last century are not available and it is thus difficult at present to identify long-term trends or to use BDM data to conclusively assess whether negative developments have been halted. The first BDM repeat survey is still ongoing. As soon as all the data from the second survey are available in a few years, trends in species diversity will be more clearly evident.

However, existing data already point to important aspects and possible developments which are likely to gain greater importance over the coming years (see Table 7).

Physiographic conditions (geography, climate) provide the framework for biodiversity. In addition, the manner and intensity with which man uses natural resources shapes much of Switzerland. We have a decisive influence on which habitat types occur, their extent and quality, and which species they host.

Whether they are intentionally introduced, inadvertently brought in or naturally extend their range into our country: time and again new species from other European regions as well as other parts of the world have established in Switzerland. The intensive movement of goods, increased travel activity and climatic changes have accelerated this process and it will continue at a fast pace for the time being. Some of the new arrivals will impact ad-

Figure 64 > Pastures of low and medium altitudes

In much of Switzerland it is man who determines the manner and intensity with which natural resources are utilised.

Foto: Beat Ernst

Table 7 > Likely key issues in coming years

Species richness	Key issues in coming years
in Switzerland	Accelerated establishment of new species, especially due to spread by vectors or due to warmer and drier climatic conditions. Further spread of known and new invasive neobiota into all biogeographic regions. Ongoing contraction of habitats of specialised species due to climate change, especially in the alpine ecosystems which so far have not faced many threats. Further decline in numbers of individuals, especially for species of traditional cultural landscapes.
in landscape sections	Increase in species diversity due to various conservation and promotion measures, especially ecological compensation in agriculture. Probable decline in species diversity in mountain regions. Large-scale wilderness areas establish due to land abandonment, especially at high altitudes and in the Southern Alps. This may entail a regional decline in species diversity. Uncertain developments in the Central Plateau and other intensively used parts of the country: More species again and population recoveries or further losses?
in habitats (or land-use types)	Probably divergent developments in different ecosystems. Further increase in species richness of grasslands due to ecological compensation in agriculture. Improved habitat conditions and more species in forests due to adapted management. Developments in settlements uncertain: Loss of refuge habitats or exploitation of available ecological potential? Decrease in pioneer habitats, ephemeral waters, and small-scale structures.
Variability	**Explanatory note**
of species communities	Standardisation of species composition in the different habitat types. Loss of site-specific variability.

Source: BDM.

versely on existing biodiversity, at least at the local level, and generate costs, for example for increased maintenance of infrastructure, prevention of health risks, and protection measures for the benefit of habitats and species under pressure. Such invasive neophytes and neozoa (collectively termed neobiota) will initially establish alongside infrastructure and linear landscape elements such as watercourses and in the vicinity of settlements.

On account of the predicted warming of the climate (higher mean temperatures, fewer frost days) the habitats of some species which at present occur at high alpine levels will shrink. At low altitudes it is to be expected that the number of presently typical species will decline. Instead, favoured by a warmer and drier climate, Mediterranean species will increasingly spread, including to areas north of the Alps.

Biodiversity in Switzerland already benefits from an established system of protected areas. Protected areas are important as they predominantly include isolated patch habitats which hardly exist anymore in the normal landscape, such as raised bogs or fens. However, the protected areas do not sufficiently cover the habitats of many species. Moreover, they are mostly located at higher altitudes. Therefore, this traditional approach to nature conservation is not sufficient on its own to maintain biodiversity. For example, many species typical of cultural landscapes are now red-listed. For these species it is important that a major proportion of the country's area is managed in an ecologically compatible manner. Measures for the preservation of biodiversity must not be limited to outstanding, near-natural landscapes and recorded habitats. They must rather be expanded increasingly to the inten-

Figure 65 > Ecological compensation areas

Location and quality of ecological compensation areas are often unsatisfactory and therefore of limited benefit to biodiversity.

Foto: Blickwinkel.de

sively used areas of the Central Plateau and the lower mountain valleys. Over the next years it will become evident how instruments already implemented, such as the Swiss Forest Programme, targeted species protection programmes and ecological programmes in the farming sector, are impacting on species and habitats.

Ecological compensation areas are an important component of ecological programmes in the farming sector. Today they cover 11 per cent of the utilised agricultural area. At first glance this appears impressive. However, farmers often pick the location of compensation areas solely according to economic considerations. Therefore, the location and quality of these areas are often unsatisfactory. This must be improved if the biodiversity objectives set out by the Confederation are to be met. Overall, the ecological programmes in the farming sector have not yet yielded the results desired. The measures planned to achieve environmental objectives in agriculture must therefore urgently be implemented. [1]

The manner in which we build our settlements also impacts on biodiversity. Due to population growth and increasing individual aspirations our demand for space will continue to grow over the coming years. Whether the required space is obtained by increasing the density of urban areas or whether settlements continue to spread into greenfield sites – the crucial issue is how current and additional settlement areas are designed, as this harbours great potential for the preservation and promotion of biodiversity. Data obtained by the

[1] BAFU und BLW, 2008: Umweltziele Landwirtschaft. Hergeleitet aus bestehenden rechtlichen Grundlagen. Umwelt-Wissen Nr. 0820. Bundesamt für Umwelt, Bern: 221 pp.

BDM and other studies show that many species find substitute habitats and refuges in settlements. The design of future settlement areas should give due consideration to biodiversity as otherwise important habitats will be lost.

Future developments in the mountain regions require special attention, as in Switzerland these regions are the greatest reservoir of species diversity. Altered economic conditions and demographic change pose an increasing challenge to traditional land-use methods. While areas which are relatively easily managed are threatened by further intensification, marginal lands which are difficult to access and can only be managed with great difficulty are being abandoned. Intensification leads to similar impoverishment in terms of species composition as can be seen, for example, on the Central Plateau. Land abandonment leaves previously species-rich open lands to vanish under woodland. Mountain areas still host great species diversity and an impressive range of typical habitats; land-use changes can therefore have serious repercussions for biodiversity.

In addition to the number of species occurring, the composition of species communities is also an important aspect of biodiversity. Standardised land-use types and generally high nutrient inputs pose the danger that ecologically undemanding ubiquitous species which can thrive in a range of different habitats will continue to spread at the expense of rare and characteristic species. This could also put increasing pressure on patch habitats. Under these conditions there is a danger that regional characteristics of habitats and species communities may disappear.

Figure 66 > Sheep pasture in Engadin

Land-use change in mountain areas can impact greatly on biodiversity. Both intensification and abandonment can cause biodiversity loss.

Foto: Christoph Bühler, BDM