The Fifth National Report of the Czech Republic to the Convention on Biological Diversity

Ministry of the Environment of the Czech Republic

Convention on Biological Diversity

Table of Contents

Date of submission of the report: 11 June 2014

Ministry of the Environment of the Czech Republic

EXECUTIVE SUMMARY

The Fifth National Report provides an overview of the present status and trends of biodiversity and its protection in the Czech Republic. The report is divided into three parts – the first one updates the previous Fourth National Report with the current status and trends of biodiversity in the Czech Republic. The second part provides information on the present National Biodiversity Strategy 2005 – 2015 and on its response to the current CBD Strategic Plan. The third part deals with the current performance and fulfilment of the Strategic Plan and the Aichi Biodiversity Targets at the national level.

Proper protection of biodiversity as well as landscape and environmental protection is a necessary prerequisite for any sustainable development of the Czech Republic. In this sense biodiversity protection is included /reflected in numerous national strategic documents and policies (Strategic Framework for Sustainable Development in the Czech Republic[1], State Environmental Policy of the Czech Republic[2], National Biodiversity Strategy of the Czech Republic 2005-2015[3] and Update of the State Programme for Nature and Landscape Protection[4]). Even though biodiversity protection is significantly covered by the key strategic documents, general awareness on the importance of biodiversity, especially due to its relationship to functionality of ecosystems and ecosystem services is still weak. The key change should arrive with the update of the present National Biodiversity Strategies and Action Plan 2005 - 2015 (hereinafter as the "Updated NBSAP"), which will take place within the next two years. The Updated NBSAP will among other focus on mainstreaming of biodiversity protection aiming at integrating it into the decision making processes at all levels of the state administration (see details in Chapter 2).

The key finding of this report is that no significant changes in biodiversity status and trends have been recorded since the submission of the Fourth National Report in 2009. Individual changes in status and trends as recorded e.g. by indicators of selected species population are reported in Chapter 1. These individual changes in biodiversity status and trends are mostly due to the following threats: 1) Breakdown, damaging and destruction of the original environment leading to its vanishing; 2) invasive alien species; 3) excess deposition of nutrients in the environment, especially nitrogen and phosphorus (eutrophication); 4) direct hunting by man and overexploitation of target species and other taxa; 5) climate change; 6) natural disasters; 7) contamination of the environment with pollutants; 8) diseases (see details in Chapter 1).

The main part of the National Report is the review of the current progress in implementation of the CBD Strategic Plan 2011-2020 and its Aichi Biodiversity Targets. Since the present NBSAP (2005-2015) does not directly reflect the CBD Strategic Plan

1 Strategic Framework for Sustainable Development in the Czech Republic, 2010

2 State Environmental Policy of the Czech Republic 2012-2020

3 National Biodiversity Strategy of the Czech Republic 2005-2015

4 The State Nature Conservation and Landscape Protection Programme of the Czech Republic, 2009

2011-2020 and most of the individual strategic objectives are reflected only partially, it was not possible to sum up, how the individual Aichi Targets are being fulfilled by the current NBSAP. The present status of the implementation of the Aichi Targets and their coverage by the national regulations and strategies is in detail described in Chapter 3. The updated NBSAP will cover all the Aichi Targets relevant for the Czech Republic, including the set indicators, allowing better monitoring of the implementation progress.

CHAPTER 1

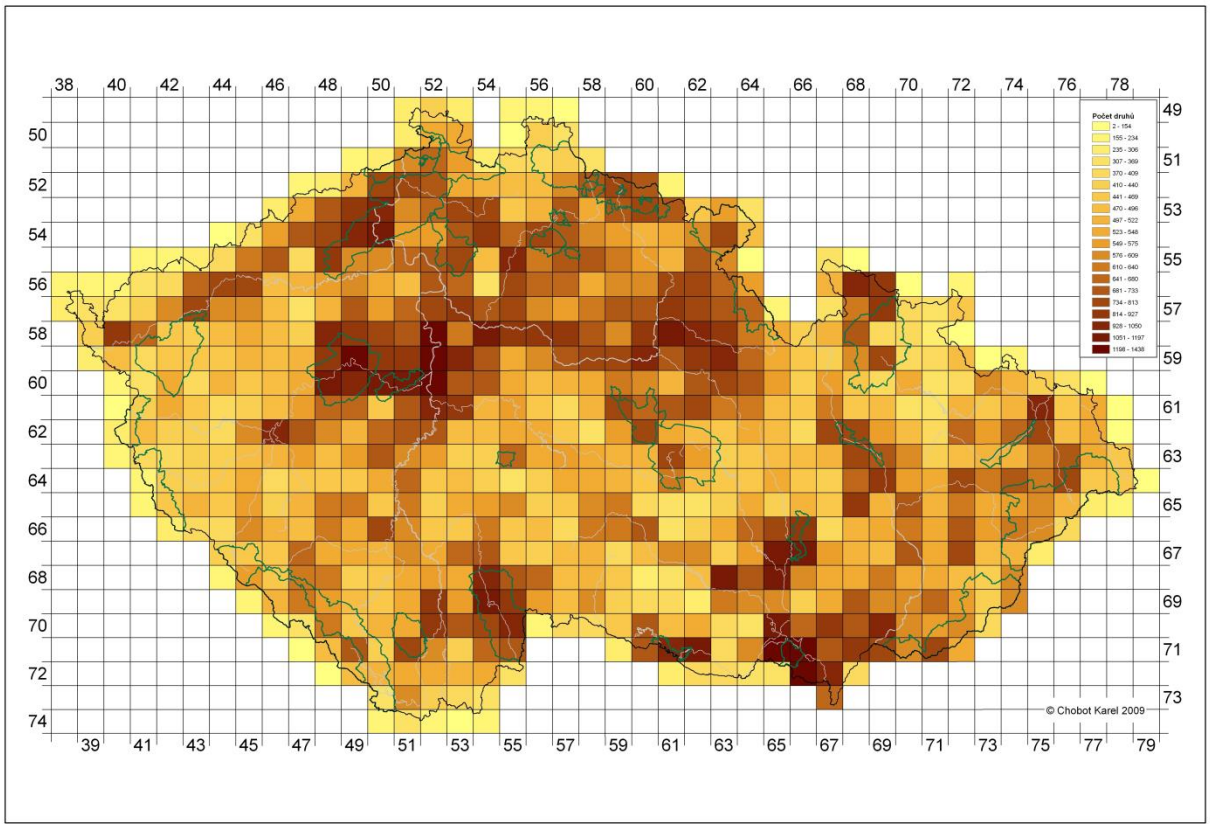
AN UPDATE ON BIODIVERSITY STATUS, TRENDS, AND THREATS

1.1 General overview of biodiversity status, trends and threats

Biodiversity means the variability of living organisms (plants, fungi, animals, and unicellular organisms, members of the kingdoms of nature) at the levels of genes, species, habitats and ecosystems. The most thoroughly known are the levels of species and habitats. The state of knowledge if biodiversity in the Czech Republic is rather good, especially thank to long research tradition and active recent research.

Thanks to its location on the boundaries of four biogeographical subprovinces (Hercynian, Polonian, West Carpathian, and North Pannonian) and its geological diversity, the Czech Republic can be proud of its relatively wide range of animal and plant species and habitats, formed by them. Nearly 80 000 species have been recorded on the Czech territory. The number of recorded species might still grow along with our knowledge of the living world. In some areas, the numbers of species populations are increasing (e.g., introduced species); whereas in other parts of the country species are disappearing for various reasons, usually as a direct or indirect consequence of human activities. Around 2 500 out of total 3 500 vascular plant species known in the Czech Republic are native and/or archeophytes, i.e. species introduced until about the 15th century. Furthermore, 886 species of bryophytes, 1 500 of lichens, and up to 40 000 species of fungi (about 4 000 species of macromycetes – higher fungi) have been recorded. Over 24 000 species of insects, about 8 000 species of other invertebrates, and 711 species of vertebrates have been documented.

Figure 1- Map of the species richness in the Czech Republic



Naturally, species diversity is not evenly distributed around the country. In addition to poorer areas, we can also find several sites with above average species diversity. Their existence depends on many natural factors and human activities in the landscape. Such sites are particular to Podkrušnohoří, Polabí, Central Bohemia including Prague, the canyon of the Vltava River, the Třeboň region, Podyjí, the Brno region, and south-eastern Moravia – especially in Pálava and the junction of the Morava and Dyje Rivers.

According to the recently used system of habitat-biotope classification there are 157 natural biotopes distinguished and incorporated into EU legislation as 60 habitats of Community interest. Despite the overwhelming size of non-natural habitats (e.g., fields or forest monocultures covering 83% of the country), the status is based on the data on these types of natural or near-natural habitats.

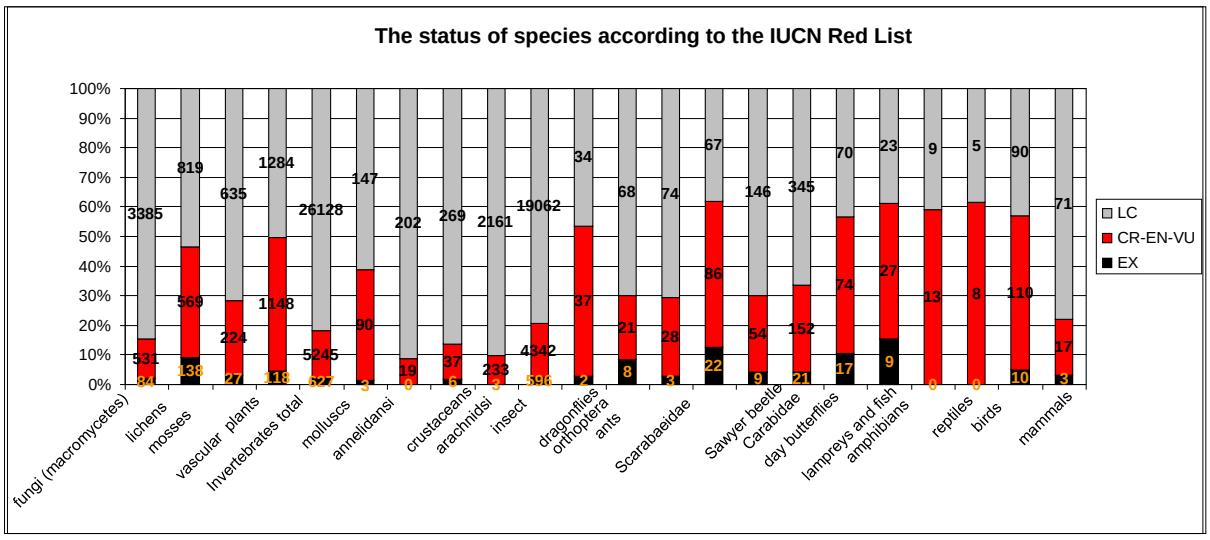
Most natural and near-natural habitats occur in areas with limited agricultural production, i.e. less intensive or specialised utilization. Many of them are of a larger size. On the other side, natural habitats are rare and usually quite small, in fertile and intensively utilised areas (lowlands, areas with heavy traffic, high rate of urbanisation and industrial production). Moreover, the quality and diversity of natural habitats is notably influence by fragmentation. The individual parts of such a habitat then lose their capacity for mutual communication, i.e. migration of fauna and flora species, the communities of which actually form the given habitat.

1.1.1 Assessment of state of species and habitats

The state of species and habitats is assessed in two distinct ways.

The Red Lists of Threatened Species/Habitats represent an older and broader method assessing the level of threat according to the standard IUCN criteria. Such lists classify species in the following categories: EX – Extinct or RE – Regionally Extinct; CR – Critically Endangered; EN – Endangered; VU – Vulnerable; DD – Data Deficient; and LC – Least Concern. The Czech Republic has produced Red Lists of vascular plants, bryophytes, fungi, invertebrates, and vertebrates. The results based on long-term monitoring and large amounts of data are alarming (Figure 2).

Figure 2 – The status of species according to the IUCN Red List



The smaller a certain group of species (taxa) is the higher is the risk it faces. In some cases, such groups comprise a higher share of extinct species. The charismatic groups of vertebrates, which show a low variety of species but are of great attractiveness for the general public, constitute more than half of the endangered taxa, as well as vascular plants. The less explored groups of fungi or bryophytes seem to be in a better state. However, this may only be a result of insufficient data. The situation regarding numerous invertebrates appears optimistic, but a closer look at the more researched groups raises serious concerns. For example, over 50% of the species of butterflies, lamellicorn beetles (chafers, dung beetles, stag beetles), or dragonflies are classified into one of the categories of endangered species (Figure 2).

Assessment reports under Article 17 of the Habitats Directive represent the second system of assessment of the state (conservation status) of species and habitats. The Habitats Directive lays down an obligation for the Member States to survey the conservation status of habitats and species (other than birds) on their territory and to report it in six year periods (terms 2007, 2013). The conservation status of species also distinguishes four categories: 'favourable' – FV, 'unfavourable – inadequate' – U1, 'unfavourable – bad' – U2, or, in case of insufficient data, 'unknown' – XX. In contrast to the Red Lists, the assessment involves a shorter list of selected species.

Figure 3 - Current State of animal and plant species of Community importance in the Czech Republic according to taxonomic groups (%), 2014

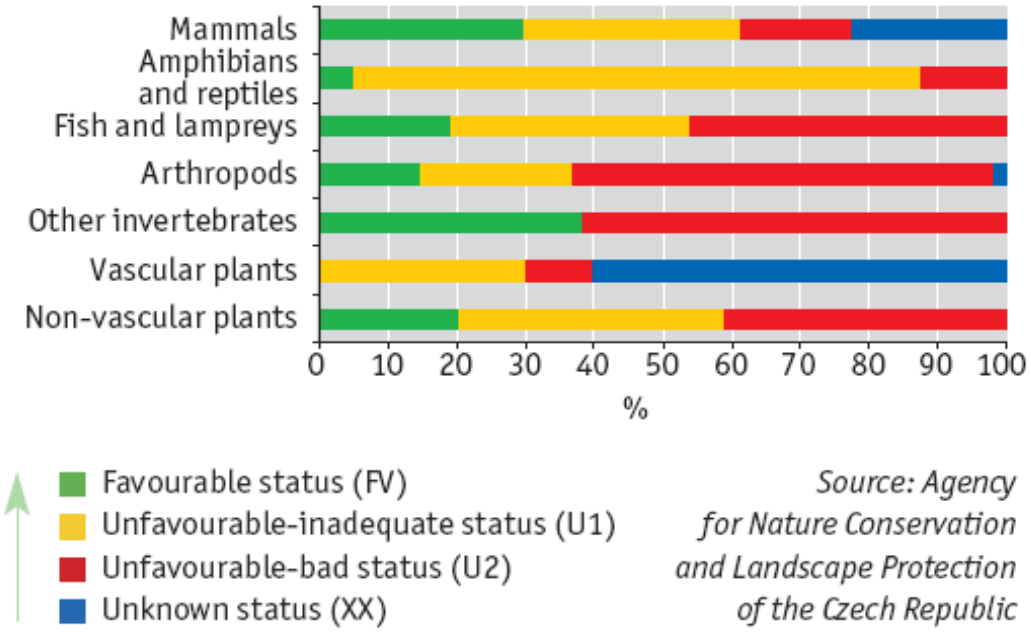
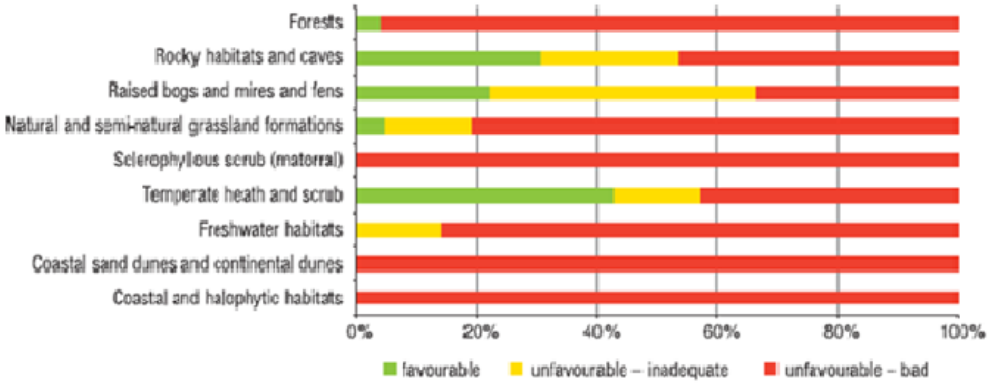


Figure 4 - *Assessment of the conservation status of individual groups of habitats of Community interest in the Czech Republic (% of an assessed status in a given group; names of groups are in accordance with the official European terminology), 2014*



1.1.2 Overall assessment of the conservation status of species of Community importance

Plants and invertebrates

The Red List of Vascular Plants from the year 2000 indicates a serious problem: half of the species occurring on the territory of the Czech Republic are considered as threatened at various levels. This is a direct consequence of changes that took place in the second half of the 20th century, i.e. rather intensive utilisation of the landscape and a loss of sites previously

harbouring such species. One out of every 22 of all known species in the Czech Republic has not been observed in recent years or decades. More than half of these (2.5% of all known species) are considered extinct; for example, certain species of orchids sensitive to pollution, various species of weed restricted to extensively used agricultural land, or species of rare habitats, such as fens or salt marshes.

Plants are mainly threatened by disturbance and destruction of habitats. The area covered by native types of vegetation is diminishing and becoming more fragmented every day. The quality of habitats is deteriorating, for example, through eutrophication, air and water pollution, intensification in agriculture, forest management, and fish culture. The status of numerous species, particularly of those dependent on sites formed and managed by man in the past, is getting worse. This is due to the lack of traditional management and abandonment of the previously utilised land. Direct removal of plants for medicinal purposes or other forms of destruction, such as plucking or digging, are rarer today but may still play a negative role in case of species with a highly limited occurrence.

When assessing specific, better known and documented species, such as the ones recorded in the European lists, the situation is similar to that for other groups. The assessment reports record more than 60% of species with an 'unfavourable – bad' conservation status. Unlike the whole group of plants, the individual species of this group generally show a similar assessment in most criteria. This means that a species, whether with an overall 'unfavourable – bad' or 'favourable' status, will probably have similar results in each category – its range, population, habitat, and future prospects. The major causes of their current status are similar to the other groups. Nevertheless, the importance of individual factors varies in groups according to the requirements of each species. It may be generally stated that, besides the direct elimination and loss of habitats, invertebrates are very sensitive to the effects of 'new' threats – invasive species and climate change.

Fishes and lampreys

Fishes and lampreys are number one among vertebrates as to the share of extinct and threatened species as assessed in the Red Lists. The assessment reports state that nearly half of these species (46%) have an 'unfavourable – bad' status. The reasons are more than obvious. They are linked to the destruction and substantial changes in the character of their habitats. Among the most affecting factors are low water quality (toxic substances, altered chemistry and content of oxygen, eutrophication) and each day more frequent unsuitable watercourse using. Transverse objects (dams, weirs) still lack functional fish passes and considerably fragment the streams. At the same time, they frequently alter their character. The running parts of rivers – mainly larger ones – become nearly still with a completely different regime of sedimentation. A number of species depending on the natural dynamics of watercourses lose their potential for survival and propagation in such altered conditions. The transverse dikes block migration of fish such as the Atlantic Salmon or the Eel between the river and sea environments, which is part of their life cycle. Presence of these species in the Czech waters is thus nowadays dependent on supportive conservation measures. . The

existence of fish in still waters (there are only a few natural reservoirs in the Czech Republic but a large number of artificial dams and ponds) is directly linked to stocking. Some species are even intentionally stocked in their non-native watersheds, which affects the overall structure of the fish population (e.g., the Brook Charr or the Rainbow Trout).

Amphibians and reptiles

Red Lists have been published at the European level for amphibians, reptiles, and mammals. By comparison, we may identify specific problems of these groups in the Czech Republic. According to the European Red List of amphibians and reptiles (EU 27), at least 23% of amphibians and 21% of all known species of reptiles are threatened by extinction (classed as critically endangered, endangered, or vulnerable).

The Red Lists of amphibians and reptiles of the Czech Republic even state that more than 50% of the species are under the threat of extinction. In the categories of threatened species of both groups, nearly all Czech species are protected (under Decree No. 395/1992 Coll.). The group of protected reptiles even encompasses all 11 species. The higher share of threatened species in the Czech Republic is probably given by the fact that many of them occur on our territory on the edge of their range.

The high percentage of species considered by the assessment reports as having an 'unfavourable –inadequate' status is primarily caused by poor conditions of the habitats and a negative development of their populations´ size. Most evident factors are land use changes, destruction and fragmentation of biotopes, the presence of non-native species, but also, as is the case for fishes, management practices applied in ponds and artificial reservoirs and unsuitable watercourse maintenance and changes in their character. Many species suffer from a direct and often mass destruction at all of their life stages, affecting the dynamics and stability of their populations, as well as of their disturbed habitats. For example, animals die in their immature stages in dried out small and seasonal reservoirs or while crossing roads during migration.

Birds

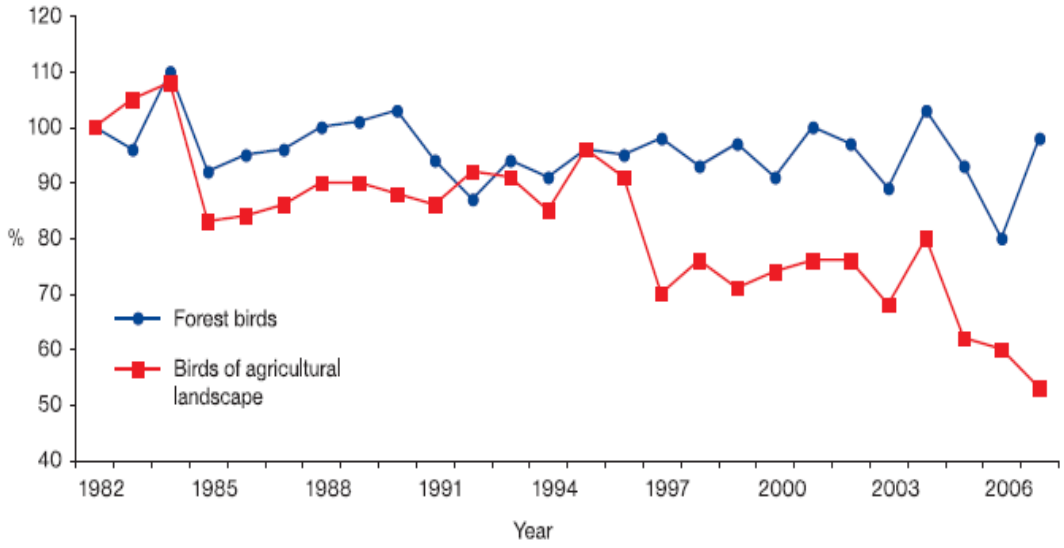
About 200 species of birds nest in the Czech Republic. Further, tens of species regularly migrate through the Czech territory or winter, including five globally threatened species. About 37% of bird species are threatened at the European level; according to the Red List of the Czech Republic 52% of bird species are somehow threatened.

Compared to the early 1980s, the numbers of about one third of all bird species in the Czech Republic have declined, the numbers of one third have increased, and the rest have remained the same. Effective long-term and focused protection of birds has 'brought to life' especially some of the legally protected species, which had almost become extinct. Today, we may observe how, little by little, they return to the wild nature of the Czech Republic (White-tailed Eagle, Peregrine Falcon). Also on the increase are species taking advantage of the changing condition of forests (Black Woodpecker) or species adapting to the presence of man

(Woodpigeon). New species appear which are subject to internationally coordinated protection (Imperial Eagle, Common Crane). On the other side, the most rapidly disappearing species are those typically living in the agricultural landscape and those depending on ponds and wetlands.

The so-called 'group indicator of birds occurrence' based on their status at the beginning of the 1980s (100%) shows that the numbers in the representative group of forest species have been stable or increasing for a long time, whereas the trend in birds of the agricultural landscape is just the contrary. Certain species, primarily field birds, have suffered from a dramatic decline in numbers. Some specialised species have vanished or almost disappeared from the Czech landscape (Great Bustard, Curlew, European Roller, and Woodchat Shrike). The main causes are similar to those in other groups of animals: on one side, there is intensive agriculture making the landscape homogenous, a loss of nesting opportunities, a decline in the quantity and variety of food, and direct destruction of nests by machinery; on the other side, abandoned land is being overgrown by vegetation largely reducing some populations (Skylark 43%), or increasing others (Red-backed Shrike). Birds dependent on the water environment are affected by intensive utilisation of ponds, which reduces the numbers of some water and wetland species. The removal of riparian vegetation brings along destruction of suitable nesting sites (e.g. Black-headed Gull); the increasing carrying capacity of ponds caused by fertilisation deteriorates the food supply and orientation of birds under water (ducks, grebes).

Figure 5 - While the populations of forest birds in the Czech Republic remained practically consistent between 1982 and 2007, the number of birds in the agricultural landscape in the same period dramatically declined by nearly a half (2010)



The serious problems in practically all sites primarily relate to development activities. Construction of transport and energy infrastructures, wind farms, or recreational areas poses a substantial threat.

Larger species are threatened by death from power lines or from collision with unsuitably located wind power plants. Significant risks are posed to birds by the intensive development of road network resulting in more fragmented landscape (for more details see the chapter on Landscape), glass walls, and other obstacles causing immediate death, or destruction of nests on buildings.

A more significant issue is the fact that some conflict species are persecuted or their populations are reduced under pressure of interest groups. Hunting is rarely based on scientific knowledge (for example, inadequate goose hunting seasons). Interventions in the wild populations represent another challenge (e.g., release of captive birds).

Poisoned baits or illegal breeding, connected, for example, with egg theft, pose a risk to large birds of prey.

Mammals

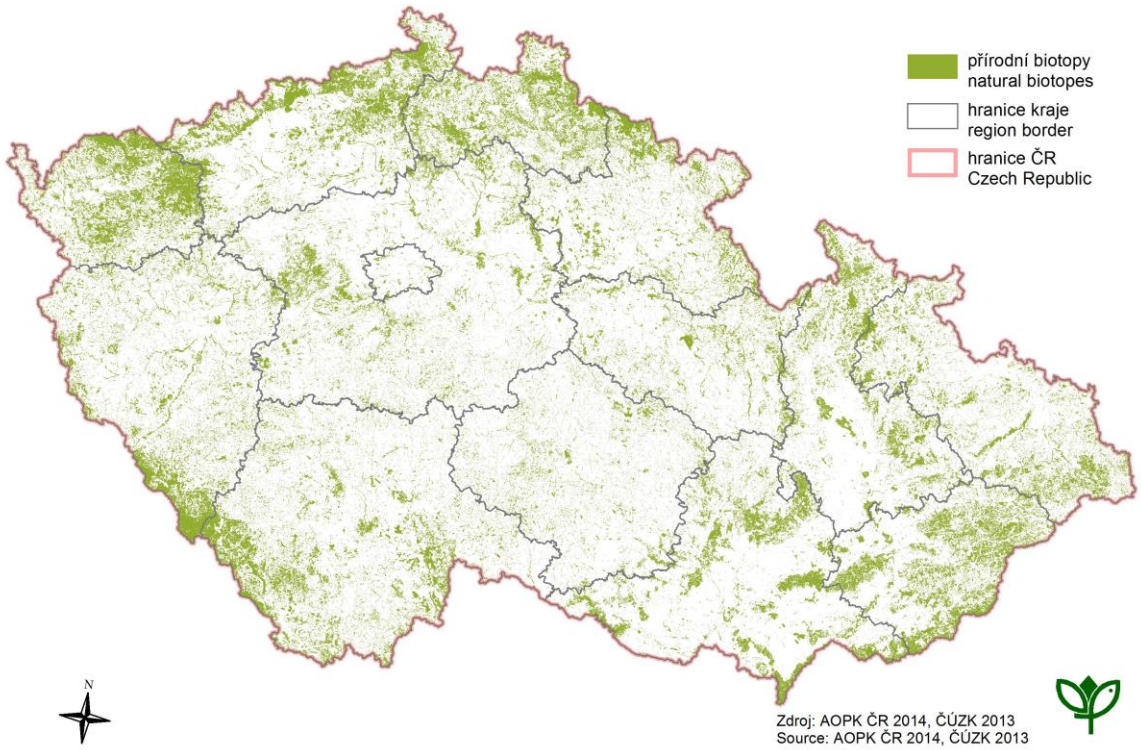
The European Red List of mammals (EU 25) states that a minimum 13% of all known European mammals as threatened, whereas the Czech Republic´s Red List of mammals lists nearly 20% in the same category. The principal reason for such a difference between the national and the European level is probably the same as for reptiles and amphibians, i.e. many of the species occur on the Czech territory at the edge of their range (various bats, European Ground Squirrel, Forest Dormouse, Steppe Polecat, Wolf, Brown Bear). Records mention maximum tens of animals and a single or a few populations. Bats and the European Ground Squirrel rank among the most threatened species, along with the Steppe Polecat and large carnivores (Lynx, Wolf, and Brown Bear).

A large number of mammals have an unknown status as a result of the complexities of monitoring. For example, the European Polecat occurs all over the area of the Czech Republic, but the size and status of its population, including the future prospects, cannot be clearly determined (among other factors, owing to notable competition from the invasive American Mink). Nonetheless, mammals are the best assessed group in the assessment reports (30% classed as having a ‘favourable’ status). This result is partly thanks to their great adaptability and ‘visibility’. This ‘visibility’ facilitates their monitoring and the recognition of potential negative changes, and, particularly in species providing direct benefits to man (e.g., hunting), it allows adoption of active measures to enhance their numbers. On the other hand, large carnivores are perceived as dangerous or as competitors (in the sense of damage caused to hunting game or fish). Therefore, they used to be intentionally persecuted and driven to local extinction already in past centuries. Only concentrated efforts and rigorous protection can create conditions for their gradual return to the Czech nature (see box Lost and Regained on page 81). This, however, still depends on the status of their populations in neighbouring countries, especially in the Carpathian massif in Slovakia and Poland. Mammals are also often subject to repatriation projects. Reintroduction of the Lynx in Šumava and the adjacent areas may be considered as a successful project in the Czech Republic, although its pursuit has not ceased and the promisingly growing population is repeatedly facing illegal hunting.

Habitats

The Red Book on Habitats of the Czech Republic is not very different from the red lists of plant and animal species, but the criteria for biotope assessment are modified to correspond to their distinct requirements and occurrence. The assessment outputs prove a high share of natural or near-natural biotopes, which are currently under threat in the conditions of the Czech Republic: an overwhelming majority (90%) show symptoms of unfavourable development related to changes in the utilisation of the landscape. The link between the size of a habitat in the country and its condition is also obvious. Merely seven biotopes out of total 157 are classified as of least concern (i.e. under minimum or no threat), but their area represents 46% of all natural habitats in the country. Thus, there is a long-term trend of a decline in particularly rare or small-size natural biotopes. The adaptable biotopes are spreading, whereas those requiring specific conditions retreat or disappear. This situation leads to homogenisation of the Czech landscape (i.e. uniformity from the point of view of the vegetation cover) as mentioned in the chapter on Landscape.

Figure 6 - Map of natural habitats in the Czech Republic. There is an obviously small share of valuable sites (marked green) in the entire country area with their main occurrence in marginal areas (2013)



The assessment reports under Article 17 of the Habitat Directive (92/43/EEC) are drawn up by Member States under an approved standard methodology and result from an obligation of

monitoring and reporting laid down by this Directive. The overall conservation status of each habitat is assessed based on four criteria (current size, potential range, structure and function, and future prospects), while the criterion with the worst assessment result is decisive. This means that in case any of the criteria is assessed as unfavourable, the overall conservation status is considered as unfavourable. The habitat status may be assessed as 'favourable', 'unfavourable – inadequate', or 'unfavourable – bad'. If no data are available, the status is defined as 'unknown'. The assessment reports are submitted every six years and the Czech Republic submitted its first report in 2007. For the needs of the Directive, the European legislation divides Europe into several biogeographical regions. The Czech Republic involves the Continental Region (95% of the country area) and Pannonian region (5% of the country area – in Southern Moravia). If the assessed habitat is located in more than one biogeographical region, reports are elaborated for each region individually. That is why the number of assessed habitats is seemingly higher in the Czech assessment reports than their total number in the country.

The overall conservation status of habitats of Community interest is relatively bad in the Czech Republic. Only 11 of them are assessed as 'favourable', 13 as 'unfavourable – inadequate', and 71 as 'unfavourable – bad'. The main reason resulting from the analysed individual criteria seems to be a high rate of degradation, i.e. mainly a disturbed structure and function (see pictures 2.10 and 2.11). More specifically, we should talk about an insufficient share of plant and animal species characteristic for a given habitat, which is caused, above all, by a growing pressure of the surrounding environment (decreasing participation of the natural component in the landscape), unsuitable management, invasive plant species, eutrophication, and, in case of aquatic habitats, artificial adjustment of water channels. The unfavourable status of habitats in the Czech Republic is a result of their limited resilience and incapacity to sufficiently eliminate or absorb the external effects, which cause their further degradation, gradual alteration, or even disappearance.

1.2 Assessment of the overall causes of threats to biological diversity in the Czech Republic

All the main drivers threatening biological diversity in the Czech Republic at all levels (genes/individuals, populations/species, ecosystems/landscape) are as follows (PLESNÍK 2004):

1.2.1 Natural habitat fragmentation, degradation and destruction resulting into its loss

Due to long-term impact of humans on nature and the landscape in what is now the Czech Republic, natural or semi-natural habitats have been preserved rather in marginal areas, accounting for only 17% of the country´s territory (MIKO & HOŠEK 2009). The most significant primary ecosystems are the remnants of the primeval Central European forests,

grasslands and wetlands, particularly of peat bogs (PLESNÍK 2004). Primary and particularly natural or semi habitats are threatened with changes in land use, which most frequently degrade and alter the habitats to the artificial, man-made environment. At present non-natural sites comprise almost 60% of the Czech Republic, whereas a quarter is covered with forests of low natural value. The largest changes in land use since 1970 have been causing the increase in meadows and urban greenery and recreation areas, but also industrial built-up areas or transport infrastructure (MIKO & HOŠEK *l.c.*, ZEDEK *et al.* 2010). In 2013 built-up areas and other land-use plots cover already 10.6 % of the Czech Republic´s territory (CENIA 2013a). However in total the changes in land use slowed down across the country during 2000 – 2006 compared to 1990 – 2000 (EEA 2010).

Landscape fragmentation in the Czech Republic due to artificial barriers, particularly transport infrastructure has been continuing. In 1980 – 2010 the proportion of non-fragmented areas in Czech Republic declined from 84 % to 63 %. The rate in decrease slowed rather down compared to the previous period (2000 - 2005, difference 5.4 %) in 2005 – 2010 (difference 2.4 %), yet the landscape fragmentation due to transport infrastructure has been continuing and according to some projections, in 2040 only 53% of the landscape in the Czech Republic will be non-fragmented. The highest landscape fragmentation is found in the Central Bohemian, South Moravian and Moravian-Silesian regions, which were also the regions with the greatest loss of non-fragmented areas in 2005 – 2010 (CENIA 2014a). At present there are 6,000 transverse barriers across the rivers of the Czech Republic, which may harmfully affect water ecosystems, *e.g.* aquatic animal migration or other movements (CENIA 2013a). Among the 28 evaluated European countries the Czech Republic is the fifth in landscape fragmentation proportion from the whole country´s territory (EEA 2011).

1.2.2 Invasive alien species

Geographic position, development of human settlements and progressing globalisation have significantly strengthen the spread of invasive alien species, *i.e.* species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity, namely other species, habitats or even whole ecosystems and their processes, in the Czech Republic. Although there is no official list of invasive alien species or non-native/alien species, which may become invasive, there have been published lists of non-native species of wild plants and animals (*i.e.*, blacklists) in the Czech Republic (ŠEFROVÁ & LAŠTŮVKA 2005, PYŠEK *et al.* 2012).

According to the latest data, non-native species account for 36.2% of vascular plant taxa in the Czech Republic and 90 of them are invasive. (ZEDEK *et al. l.c.*, DANIHELKA 2013). More than one third (34.6 %) of non-native vascular plant species in the Czech Republic originate from the Mediterranean and almost one fifth (19.4 %) from other parts of Europe (PYŠEK *et al.* 2008b, 2012). Concerning wild animals, the proportion of non-native vertebrates in the Czech Republic is 10.2 % (PLESNÍK & STAŇKOVÁ 2001). Out of 595 non-native species of wild animals, both vertebrates and invertebrates, 113 are considered as invasive species (ŠEFROVÁ & LAŠTŮVKA *l.c.).* For more details on the most important non-native species in the Czech Republic, see MLÍKOVSKÝ & STÝBLO (2004).

While the number of introduced invertebrate species in the Czech Republic has been increasing since the late 19th century, in mammals and plants a lot of the invasive alien species had been introduced intentionally or accidentally already prior to 1900 (ZEDEK *et al. l.c.*). Distribution maps show the evidence that non-native vascular plant species are most common and widespread in agricultural lowlands and in urban areas, at sites with sandy soil in lowlands and along rivers, whereas they are much less common in mountain areas. In medium altitudes the non-native wild plants occur more frequently in the agricultural landscape/farmland than in forest ecosystems (CHYTRÝ *et al.* 2005, 2009). As far as habitats are concerned, the the highest numbers of non-native species have been reported on arable land, in annual synanthropic vegetation, anthropogenic tall-forb stands and trampled sites, where the average proportion of archaeophytes is 18 – 56%, that of neophytes 4.2 – 9.5% respectively (PYŠEK *et al.* 2003b, CHYTRÝ *et al.* 2005).

A survey in 302 Specially Protected Areas of the Czech Republic shows that vascular plant alien number depends from altitude, protected vegetation type, relationship to the native species and intensity of the penetration of the propagating species defined by the population density in the region. Since natural vegetation is an effective barrier against the establishment of alien species including invasive ones, the early protected areas harbour less non-native plant species. Thus, on a historical time scale, the early establishment of nature reserves in a given country decreases the probability that the reserve will be invaded by alien plants. (PYŠEK *et al.* 2002, 2003a, *cf.* HULME *et al.* 2013, PYŠEK *et al.* 2013).

At present National Strategy on Invasive Alien Species in the Czech Republic has been under preparation. It will be based on the approaches having been applied in the Convention on Biological Diversity, the Council of Europe or the Bern Convention (GENOVESI & SHINE 2004, CBD 2014), and on the current EU legislation. The Czech Republic does not have any special legislation on invasive alien species: the issue is treated with a plenty of laws, decrees and other legal measures (*cf.* DOLEŽALOVÁ 2012). Since both intentional and accidental introduction proportion is similar in all basic taxa or ecological/functional groups, except invertebrates, and due the present rate of international trade and adopted phytosanitary and veterinary measures the current trend in the rate of invasive alien species introductions is supposed to continue in the near future (ZEDEK *et al. l.c.*, MARKOVÁ & HEJDA 2011, PLESNÍK 2011a). According to generally accepted and respected robust scenarios, the current and projected climate change shall also significantly contribute to the trend (PLESNÍK 2009, WALTHER *et al.* 2009, EEA 2012a, BELLARD *et al.* 2013, STDF 2013).

1.2.3 Excess inputs and depositions of nutrients, particularly nitrogen and phosphorus, in the environment (eutrophication)

Excess inputs of mineral nutrients, particularly nitrogen and phosphorus, have many effects on biodiversity and it may affect natural processes even on land: nutrient ratios in soil change, some soil organism (edaphon) taxa or ecological/functional groups decline, *e.g.* mycorrhizal fungi, whereas in aquatic/inland water ecosystems after the certain threshold of phosphorus concentration has been reached, algae and cyanophyta/cyanobacteria rapidly grow (ERISMAN *et al.* 2014). In the Czech Republic aquatic ecosystem eutrophication is exclusively caused by

excess phosphorus in water, especially its diluted forms, above all in the season suitable for growth of algae and cyanophyta/cyanobacterial blooming, also known as blue-green algal bloom.

Atmospheric deposition of nitrogen has remained high since the 1990s and nitrogen eutrophication threatens 41.6 % of the total area of the Czech Republic (MoA 2013a). The deposition affects most seriously mountain ecosystems (HRUŠKA & KOPÁČEK 2005, HOŠEK *et al.* 2007, ZEDEK *et al. l.c.*). In 2012 the total nitrogen deposition achieved the highest values in the Krkonoše/Giant Mountains, Jizera Mountains and the Krušné hory/Ore Mountains (CENIA 2014b). The consumption of mineral fertilisers has been increasing in the Czech Republic since 2000 (CENIA 2013a).

Since 1990 in inland water/aquatic ecosystems there has been a sharp decrease in NH_4^+ (by 84 %) and total phosphorus (58 %) levels in rivers due to the construction of new wastewater treatment plants or modernisation of the old ones. In the same period the concentrations of nitrogen, particularly nitrates, in running surface waters and underground waters decreased by a quarter (ZEDEK *et al. l.c.*). Phosphorus levels remain high in some water reservoirs, fishponds and down-streams or lower streches of the rivers, which results into algal and cyanophyta/cyanobacterial blooming in summer (MoA/MoE 2013). A recent survey has shown that out of the 74 evaluated water reservoirs only 27 display good or better ecological potential as far as eutrophication is concerned (36.5 % - KRÁSA *et al.* 2013).

1.2.4 Direct persecution by man and overexploitation of the target species and other taxa populations.

Illegal killing of Special Protected wild animals in the Czech Republic affects particularly avian and mammal predators. Poaching is the main threat to establishment of viable populations of all the three large carnivore species, namely the Eurasian lynx (*Lynx lynx*), grey wolf (*Canis lupus*) and brown bear (*Ursus arctos*) living in the Czech Republic (ČERVENÝ *et al.* 2005, KUNC & BARTOŠOVÁ 2005, UHLÍKOVÁ *et al.* 2008). Out of 258 European otters (*Lutra lutra*), whose cause of death in 1991 – 2010 is known in the Czech Republic, 7.4 % died a violent death (metal jaw traps, shooting, direct killing, poisoning, VĚTROVCOVÁ *et al.* 2011).

Extermination of predators with poisonous baits kills indiscriminately any species of scavenging avian predators, particularly birds of prey or other raptors. The effective substance is almost always carbofuran, an insecticide. From January 2004 to March 2014 there were found 155 birds poisoned demonstrably by carbofuran in the Czech Republic. However since poisonous baits are laid in secrecy and in most cases nobody knows about it, it is believed that there are many substantially more birds of prey poisonings with carbofuran in fact. Although poisoning of wild animals is a multiple criminal offence in the Czech Republic and it has been strictly banned for sixty years in the country, nobody has been caught yet (BIRDLIFE INTERNATIONAL 2011, ČIHÁK &VERMOUZEK 2011, ČSO 2014).

As far as wild plants are concerned, overexploitation threatens especially herbs in the Czech Republic. Mountainous herb, the roseroot (*Rhodolia rosea*), also known as the golden root or

the King´s crown living in the Krkonoše/Giant Mountains and Jeseníky Mountains has been almost eliminated from the Krkonoše/Giant Mts. sites due to herbalists collecting them. The wild plant population has been saved only by transferring to and replanting it at new sites (KOLÁŘ *et al.* 2012).

1.2.5 Climate change

According to the generally accepted scenarios we supposed that even in the Czech Republic the importance of impacts of the current and projected climate change on biodiversity at its all basic levels will be further increasing. Even although the Czech Republic is not located one of the planet´s parts, where the climate change impacts will be the most significant, it needs to be pointed out, that climate change will become a more significant driver of biodiversity loss than in the past (PLESNÍK 2009, EEA 2012b). For more details, *cf. 1.6.2.* Changes of biota and the occurring and expected climate change

1.2.6 Natural disasters (e.g., floods)

Significant natural disasters occurring in the Czech Republic are related to weather, or climate. In some years extremely high rainfall may account for more than 150% of the average annual volume and the lowest annual rainfall may be approx. 50% of the annual average only. Very high monthly volumes may exceed the long-term monthly average five times or more (ROŽNOVSKÝ 2014).

The greatest natural disasters in the Czech Republic are floods. In the healthy landscape regular, *e.g.* annual small-scale floods, e.g. floods connected with spring thawing of snow, are a standard disturbance (a temporary change in average environmental conditions that causes as an outside affect a pronounced change in a population, a community or in an ecosystem).

Reliable data about floods go back only to the first half of the 19th century in what is now the Czech Republic. Older data are indirect and are based *e,g,* on markings, where water levels reached during floods, or reports in chronicles. Since 1997 the Czech Republic has suffered from floods more frequently than in the past: during that time there were more floods than in the whole 20th century (MoA/MoE 2010). There were floods in Bohemia and Moravia in 1997, then 2002, when mostly Bohemia was affected. Then there were floods mostly in South Moravia 2006 and Bohemia 2013. Also 2010 showed high frequency in local floods. Even though the big floods 1997, 2002 and 2013 are not greater than known historic ones as far as their impact on nature and the affected area is concerned, yet they are considered to be extraordinary. Some experts believe that in long-term perspective there is no decrease or increase in floods in the Czech Republic. Others suppose that extreme events such as floods display a much more significant impact of climate change than growing or rising temperature (PRETEL 2009).

Water absorption, drainage or runnoff in the landscape depends not only on meteorological phenomena, but also on infiltration of water into soil and on water natural retention across the

landscape, which is related to the soil cover characters, the state of soils (damaging of some of its functions) and land-use type (MoA/MoE *l.c.*, VOPRAVIL *et al.* 2010). The ability of landscape to retain and keep water is negatively affected by the sprawl of built-up areas, high proportion of arable land, large-scale drainage in the landscape, semi-natural and natural forest alteration into plantations/monocultures, shortening of rivers by straightening of the watercourse (in the 20th century watercourses were heavily shortened by one third, river network density halved) and canalized, loss of humus in soils, advancing water erosion and soil compaction caused by heavy machinery. Enlargement of paved surfaces at the expense of greenery prevents rainwater from infiltration into soil and it also increases the temperature around the built-up parts of human settlements. Drainage keeps the landscape dry, badly ploughed furrows speed up water runoff. Compared to 1945 water runoff has sped up by half in the Czech Republic. Some watercourses have more than 50% of their watershed/basins drained and in agricultural land the drainage proportion reaches 25.1 % (MoA 2013a).

Healthy landscape cannot stop a large flood wave, but it can slow it down and decrease its height and to some extent it can buffer food impact on nature and human society. Permanent grassland can keep up to 90% of rainfall. A continuous healthy forest can keep twice or three times more water than a field. Comparing water balance of woody plants (field balks, hedgerows) and arable land, it is concluded that agriculture with sufficient field balks and hedgerows can keep much more water: from woody plant sites only 10 mm of water runs on the surface, whereas on arable land it is 140 mm (KEDZIORA & OLEJNIK 2002). A woody plant strip can lower the volume of rainwater running on surface by 77.5% (JOHNSON *et al.* 2007). Data from the Czech Republic confirm, that an mature natural forest can keep three or four times more rainfall than a spruce plantation (KANTOR 1992).

Floodplains near natural watercourses compared to floodplain along regulated watercourses can keep much more water, due to greater articulation of the surface of semi-natural meadows, *i.e.* more depressions and cut-off meanders or oxbow lakes, which are filled with water during a flood. It is estimated that 283.5 ha in the inundation area of the Lužnice River in a semi-natural floodplain meadow can keep 2.3 million m^3 water, but an artificially transformed floodplain with a regulated watercourse can keep only 0.83 million cubic meters of water: this accounts for a 74% drop in retention capacity, which in turn increase the flood threat to the settlements down the river (PITHART *et al.* 2010). If there has been preserved a floodplain forest near the river, whose greater surface coarseness slows down the water drainage and increases the water level in the flooded area, the quantity of retained water grows significantly. Average increase in retained water level in a restored floodplain forest (compared with a field/arable land) is 61 cm, which means a retention increase 6,100 m^3 per a hectare of the floodplain forest. Restoration of eight hectares of floodplain forest may slow down peak flood arrival by even 22 minutes (DEFRA 2008). In July 1997 the last greater floodplain complexes in Moravia (confluence of the Dyje/Thaya and Morava/Moravia Rivers, Poodří/Odra River Basin Region and Litovelské Pomoraví/Litovel Morava River Region) kept three times more water than all dams in the watershed of Morava and Odra Rivers combined. During the floods also the area of meanders, floodplain forests and meadows in the Poodří/Odra River Basin Protected Landscape Area caught total 89 million m^3 of water and

lowered the flood wave in Ostrava by 100 m^3/ (PETŘÍČEK 1997, 1999, PELC 1999). Similarly, during the August 2002 flood the 35 km long stretch of semi-natural meadow along the Lužnice River caught an amount of water comparable to a half of the controlled water-retaining volume of the Orlík water reservoir (PRACH 2006).

Due to its history, the Czech Republic is one of the European countries with the greatest proportion of human population living in inundation areas, particularly floodplains (PETŘÍČEK & CUDLÍN 2003). For the present disasters it is typical, that the extent of damage during a single event increases and also more people are affected by a disaster. During the last two decades the floods caused much more damage, both losses of lives or material losses, than similar disaster in the past (LANGHAMMER 2007).

Drought is the opposite extreme to floods related to weather and climate. It has been more frequent in the Czech Republic in recent years, but it is not only due to lack of rainfall, but also to the water retaining capacity in the landscape. Droughts affected large areas of the Czech Republic in 2000, 2003 and 2012. There were also droughts in smaller areas in South Moravia (2007 and 2011), but even in 2013, when the Czech Republic was affected by floods (ROŽNOVSKÝ *l.c.*).

1.2.7 Contamination with pollutants

In spite of many improvements since 1990s, the Czech Republic has been among the most polluted regions of Europe (HEMERKA & VYBÍRAL 2010).

Despite the ongoing decrease of air pollution, air quality in the Czech Republic has not improved since 2000: it is true particularly for areas, where the air pollution limits are repeatedly and relatively often exceeded such as the Moravian-Silesian region. There the air pollution limits for carcinogenic substances, *e.g.* for suspended particles (particulates or particulate matter as a part atmospheric aerosols) and benzo(a)pyrene and low-level ozone are exceeded frequently. Regarding acidificationit needs to be pointed out that emissions of acidifying substances (SO_2, NO_x and NH_3) in air have been constantly decreasing since 1990: during that period the total amount of acid rain emissions decreased by 83.1 %. As far as heavy metals are concerned, agricultural land in the Czech Republic poses mostly no risk for the food chain. Lead concentrations in the environment have been decreasing since 2000, which may be connected to the ban of leaded fuel in cars. DDT and other chlorinated pesticides used in 1950s and 1970s levels have been decreasing in the Czech Republic in the long term: yet they remain high in some areas. On the other hand, the pesticide consumption has been significantly increasing in the Czech Republic since 2000. Polychrorinated biphenyls (PCB) were decreasing in the mid-1990s, but the decrease has stopped. Polybrominated and polyfluoride substances are not monitored in the Czech Republic (CENIA 2013a, 2013b, 2014c).

With respect to negative effect on aquatic ecosystems and human health there still have been concerns about consistent high metal concentrations, some organochlorinated pesticides in old

burdens and polyaromatic hydrocarbons, particularly in watercourses in regions with high industrialisation and long-term anthropogenic loads – on rivers Bílina, Ohře, Lužická Nisa and Odra Rivers and in the Labe/Elbe River stretch close to German border (MoA/MoE *l.c.*).

Less attention is paid to micropollutants and possible impact of nanotechnologies both on biota and the abiotic environment.

1.2.8 Diseases

Most diseases threatening wild plant, wild animal and other organism populations are infectious diseases caused by introduced pathogens (PLESNÍK 2004, KOLÁŘ *et al. l.c.*). The North American Crayfish Plague (*Aphanomyces astaci*) destroys crayfish populations native to Europe (KOZUBÍKOVÁ & PETRUSEK 2009, KOZUBÍKOVÁ-BALCAROVÁ 2013). In 2008 the first recorded occurrence of the chytrid fungus *Batrachochytridium dendrobatidis* causing dangerous illness of amphibians was reported from the Czech Republic (CIVIŠ *et al.* 2010).

Due to the current and projected climate change more pathogenswill be introduced to the Czech Republic (cf. *1.6.2.* Changes of biota and the occurring and expected climate change). Among others, drought destabilises Norway spruces in gley soils or gleysols and water affected habitats and decrease of water levels caused drying of trees, which leads to infection with Annosum Root Rot (spruce wood mass damaging with the fungus *Heterobasidion annosum*) and to lower resistance of Norway spruce growths/stands to strong wind. Weakening of trees is then responded to by other economically significant organisms or pests (particularly bark beetles) and other organisms, particularly endophytic fungi, which may be manifested as vascular mycosis, mostly transmitted by bark beetles (JANKOVSKÝ 2002, PLESNÍK & PELC 2009).

The biodiversity loss drivers are listed above according to their significance for biodiversity decline at all levels and at the national level. The significance of the individual drivers may differ in various parts of the Czech Republic: *e.g.* in geographically isolated ecosystems covering small area such as relict habitats in the agriculturally used landscape/farmland or in municipal parks the significance of invasive aliens species is higher, eutrophication has greater negative impact on aquatic than terrestrial ecosystems. In some cases the drivers act at the same time (synergic effect): in the Czech Republic it is for instance the joint effects of current and projected climate change and natural habitat fragmentation, degradation and destruction in mountainecosystems (PLESNÍK 2009).

The experts, who prepared the various Red List of Threatened Species in the Czech Republic report, that a whole third of all species assessed faces to an increased extinction risk there (ZEDEK *et al. l.c., cf.* Tab. x). However the less species the evaluated taxon or ecological/ functional group includes, the more pronounced the degree of threat is as well as the number of extinct species. Vertebrate groups with few species show more than half of the endangered species of all the species they include. Among the species-rich groups, more than 40% of the assessed species are endangered also among vascular plants. At first sight there is better

situation in fungi or mosses, but in fact it may only reflect lack of up-to-dat, robust and reliable data about less studied species. The same applies to invertebrates. Seemingly low proportion of endangered insect species (22 %) will look quite differently, if we take a detail look at relatively well documented groups such as dragonflies (48 %), scarabaeid and stag beetles (*Lamellicornia*, 49 %), butterflies (46 %) or wasps (*Vespoidea*, 47 %). Negative external disturbances and other affects has had the worst impact on blister beetles (*Meloidae*): out of the 23 species occurring in the Czech Republic 10 have become extinct, other 11 are threatened and only two are in favourable conservation status, in the lowest risk of extinction (*cf.* ČÍŽEK *et al.* 2009).

Out of the taxa or ecological/functional groups, whose endangerment at the pan-European level has been assessed, the greatest proportion of pan-Europeanendangered species out of the total number of species occurring in the Czech Republic are butterflies (7 %), followed with mammals and saproxylic beetles (5 %, IUCN 2013a). In Czech Republic´s territory there are 46 species in total, who are listed in the 2013 IUCN Red List as globally threatened. Out of them 35 are animals and 11 plant species: the greatest numbers of globally endangered species are among invertebrates, without molluscs (18 species). Three species of wild animals occurring in the Czech Republic are evaluated as globally critically endangered (IUCN 2013b).

An analysis of of severely critically endangered species occurrence in Protected Landscape Areas (PLAs) and National Parks (NPs) and in the unprotected, non-reserved landscape concluded, that more than half of the critically endangered wild vascular plant species have their core populations occurring in PLAs and NPs. On the other hand almost three quarters of known wild animal species live mostly in the unprotected, non-reserved landscape. As far as the severely and critically endangered Specially Protected Species of fungi, the distribution of a third of them has not been sufficiently known in the Czech Republic, third of them are distributed in PLAs and NPs and a third of them inhabits mostly the unprotected, non-reserved landscape (CHOBOT *et al.* 2008).

Table 1 - The proportion of critically endangered, endangered and vulnerable species (in %) out of the total number of the species in the Czech Republic, Europe and world: as of March 10, 2014, only groups in which most species were assessed (PLESNÍK *et al.* 2003, BIRDLIFE INTERNATIONAL 2004, FARKAČ *et al.* 2005, HOLEC & BERAN 2006, TEMPLE &TERRY 2007, COX & TEMPLE 2009, TEMPLE & COX 2009, KALKMAN *et al.* 2010, LIŠKA & PLAICE 2010, VAN SWAAY *et al.* 2010, CUTTELOD *et al.* 2011, FREYHOF & BROOK 2011, GRULICH 2012, KUČERA *et al.* 2012, IUCN 2013b)

taxon/ecological group	CZ	Europe	World
mammals	18	15	25
birds	48	13	13
reptiles	61	19	19
amphibians	59	23	41

freshwater fish	45	37
freshwater molluscs		44
day butterflies	46	9
dragonflies	48	15
Scarabaideae	49	
vascular plants	69	
mosses	35	
lichens	37	
fungi (macromycets)	13	

1.3. Agro biodiversity

1.3.1 Main national policies and strategies, supporting financial measures and legislative framework related to agro-biodiversity

General rules on agriculture, its sustainable production, land-use and natural resources management are stated within Act No. 252/1997 Coll., on agriculture. Its objectives are to create conditions to (1) secure the ability of the Czech agriculture to ensure the production of basic nutrition needs, food security and non-food agricultural resources; (2) support the non-productive agricultural functions, which contribute to the protection of the environment, especially soil, water and air and to maintenance of inhabited and cultural landscape; (3) implement Common Agricultural Policy and Policy on Rural Development of the EU; and (4) development of various economic activities in order to enhance the living standards in rural areas.

Act No. 154/2000 Coll. on the improvement, breeding and registration of livestock and on the amendment of some related laws (the Breeding Act). The purpose of this Act is to lay down rules and conditions for the breeding and improvement of the livestock concerned, the protection, conservation and utilisation of animal genetic resources, identification of animals that are subject to identification, registration of registered animals, that are kept in the Czech Republic so that this activity is, with a support from state funds, an instrument to preserve the genetic diversity and performance of the livestock concerned. By the term livestock

concerned is meant cattle, buffaloes, horses, asses, pigs, sheep, goats, poultry, breeding fish and bees.

The conservation and utilisation of plant as well as microbial genetic resources important for food and agriculture are governed by Act No. 148/2003 Coll. This act sets conditions and procedures for collecting, conservation, evaluation, sustainable utilisation and provision of plant and microbial genetic resources important for food and agriculture to other users.

Considering the aquatic genetic resources, i.e. farming of aquatic organisms such as fish, crustaceans, molluscs and aquatic plants, the Czech Republic has a long tradition of fish farming in ponds. Other mentioned groups of aquatic organisms kept within the country have just minor economical importance. The rules on the improvement and breeding of breeding fish is governed by the above-mentioned Breeding Act, while the detailed rules on fishing, fish farming management and fish hunting are the subject of Act No. 99/2004 Coll. on fishing.

A growing and important sub-sector of agriculture in the Czech Republic is the sector of organic farming. Act No. 242/2000 Coll., on Organic Farming sets out the basic rules and conditions for farmers producing organic products, it also includes related information on necessary certification schemes and procedures, necessary identification and labelling of organic products and foods and other information.

The quality of soil is a key attribute of agriculture and it is currently also one of the biggest concerns. The soil protection is being dealt with Act No. 334/1992 Coll., on the protection of agriculture soil. In addition Act No. 254/2001 Coll., on waters and Act No. 114/1992 Coll., on the nature and landscape protection, apply in connection with the Act on soil in order to prevent soil erosion and its further degradation. The concrete measures against the soil erosion from agricultural land are stipulated with the so called Standards of Good Agricultural and Environmental Conditions (GAEC), which are stated under the governmental regulation No. 479/2009 Coll., on consequences of non-compliance to certain subsidy schemes.

The Ministry of Agriculture in cooperation with the Research Institute of Agricultural Economics and other institutions prepared the Rural Development Programme of the Czech Republic for 2007-2013 and related National Strategy Plan for Rural Development of the Czech Republic for 2007-2013. Both documents are tools to implement the European Community as well as national rural development policies.

The Government of the Czech Republic adopted on 14th December 2010 under No. 1227/10 the Action Plan for the Development of Organic Farming in the Czech Republic 2011-2015. Here is the link to access the document also in English: https://portal.mze.cz/ssl/web/en/mze/agriculture/organic-farming/action-plan-for-the-development-of.html.

The National Biodiversity Strategy of the Czech Republic 2005 – 2015 considers in general terms the genetic resources for food and agriculture as well as holders of this material. The strategy was approved by the resolution of the government of the Czech Republic No. 620 on 25. May 2005. It sets up several objectives, the implementation of which is currently under revision and study.
Supporting financial programmes administrated under the Cross Compliance scheme that are related to the objectives and conditions under the Common Agriculture Policy of the EU and Standards of Good Agricultural and Environmental Conditions (GAEC).

Since 2004, the Czech Republic has been applying within the agriculture sector the so called Single Area Payment Scheme (SAPS). This supporting scheme was negotiated before the Czech Republic joined the European Union in 2004. The advantage is that the given payment is independent on the particular crop that farmers decide to grow. Farmers are thus better prepared to react on current demands of the markets.

The Rural Development Programme of the Czech Republic is a supporting measure acquiring the financial resources from the EU based European Agricultural Fund for Rural Development (EAFRD). It has four basic areas of support: Axis 1 relates to the enhancement of competitiveness of agriculture, food production and forestry; Axis 2 is aimed at enhancing the status of biological diversity, protection of water and soil and adaptation to climatic changes; Axis 3 considers the improvement of life in rural areas and diversification of farming economies; and Axis 4 is aimed at creating local strategies and plans in order to support small-scale local projects.

The national programme on the conservation and use of animal, plant a microorganism genetic resources important for food and agriculture – it is a multiyear conservation and supporting programme launched by the Ministry of Agriculture for the period of 2012 – 2016. The programme is administered by the Ministry of Agriculture executed by the Institute of Animal Science in Prague – Uhrineves and the Crop Research Institute in Prague Ruzyne.

1.3.2 The current state of genetic diversity of plants and animals and the National programme on conservation and utilisation of animal, plant and microbial genetic resources for food and agriculture

The issue of genetic diversity within the agricultural sector can be divided into three areas, which include genetic resources of plants (crops), animals and microorganisms important for food and agriculture utilisation. The conservation measures of agro-biodiversity can also be sorted according to *in-situ* measures, which are aimed mainly at soil organisms and crop wild relatives and which should be ensured by farming procedures taking into account all agri-environmental aspects and programmes, necessary standards and policy requirements mentioned above; and *ex-situ* measures that are mainly being ensured by the National Programme on Conservation and Utilisation of Plant, Animal and Microbial Genetic Resources for Food and Agriculture. This multi-year conservation programme and supporting

scheme is aimed at conservation and sustainable utilisation of crop genetic resources, farm animals, fish, bees and microorganisms.

The Ministry of Agriculture launched the current National Programme for the period of 2012–2016. It consists of three national sub-programmes dealing accordingly with crops, livestock and other animal genetic resources and microorganisms important for food and agriculture. Genetic resources of forest tree species are not included in the above-mentioned scheme as they are dealt with separately.

Crops

The National Programme on Conservation and Utilization of Plant Genetic Resources and Agro-biodiversity is based on domestic traditions, national legislation, especifically Act. No. 148/2003 Coll., and FAO recommendations expressed in the Global Plan of Action. It also respects the international standards for genebanks set up by the FAO Commission on Genetic Resources for Food and Agriculture (CGRFA) and other international commitments stemming from the relevant agreements - the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), the Standard Material Transfer Agreement (SMTA), the Convention on Biological Diversity (CBD), European Cooperative Programme for Plant Genetic Resources (ECPGR) and A European Genebank Integrated system (AEGIS)

The NP outlines the basic conditions and requirements that are followed by the genebanks, i.e. the mutual cooperation in the areas of collecting, documentation, characterization, long-term conservation and sustainable utilisation of genetic resources. Apart from the safety preservation, a lot of attention is paid to the acquiring of data from regular working operations as well as experimental research. Further assortment of information is crucial, since the samples of genetic resources together with the relevant information are regularly provided to other users, especially other breeding, research and educational institutions. In accordance with the domestic needs and international priorities, the support of agro-biodiversity for sustainable development and its non-production purposes becomes a significant part of the National Programme.

In terms of structure, the Crop Research Institute in Prague-Ruzyne was entrusted by the Ministry of Agriculture to coordinate the activities of the National Programme and altogether16 workplaces belonging to 12 legal entities cooperate under its the framework.

More information can be found on the website of the Crop Research Institute: http://genbank.vurv.cz/genetic/resources or Ministry of Agriculture of the Czech Republic http://portal.mze.cz/public/web/mze/dotace/narodni-dotace/geneticke-zdroje/.

Figure 7 - Increase of collections in the period of 1951-2012

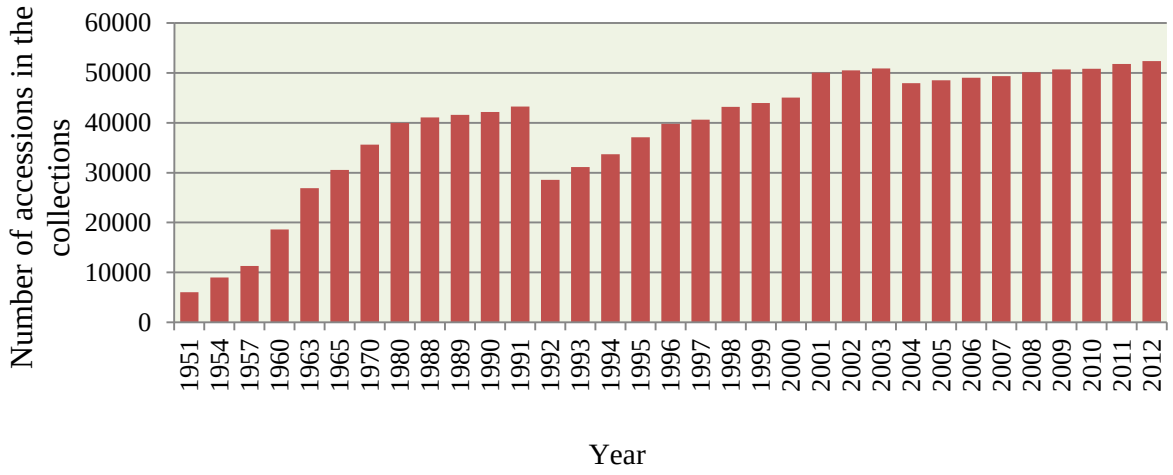


Figure 8 - Number of PGR samples provided to local and foreign users by all participants of the National Programme (1998 - 2012)

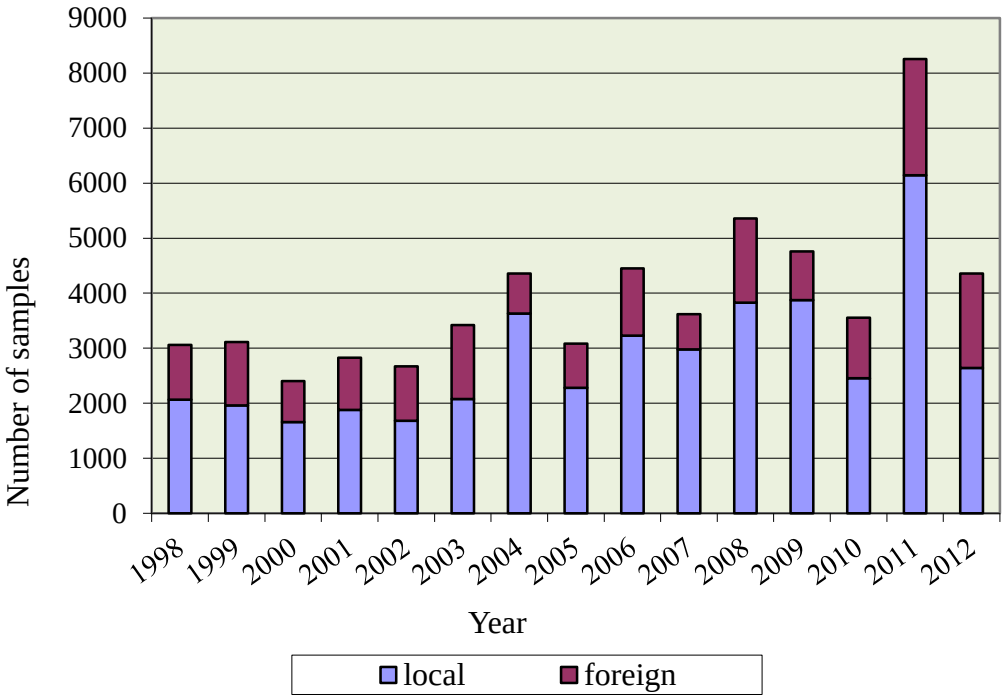
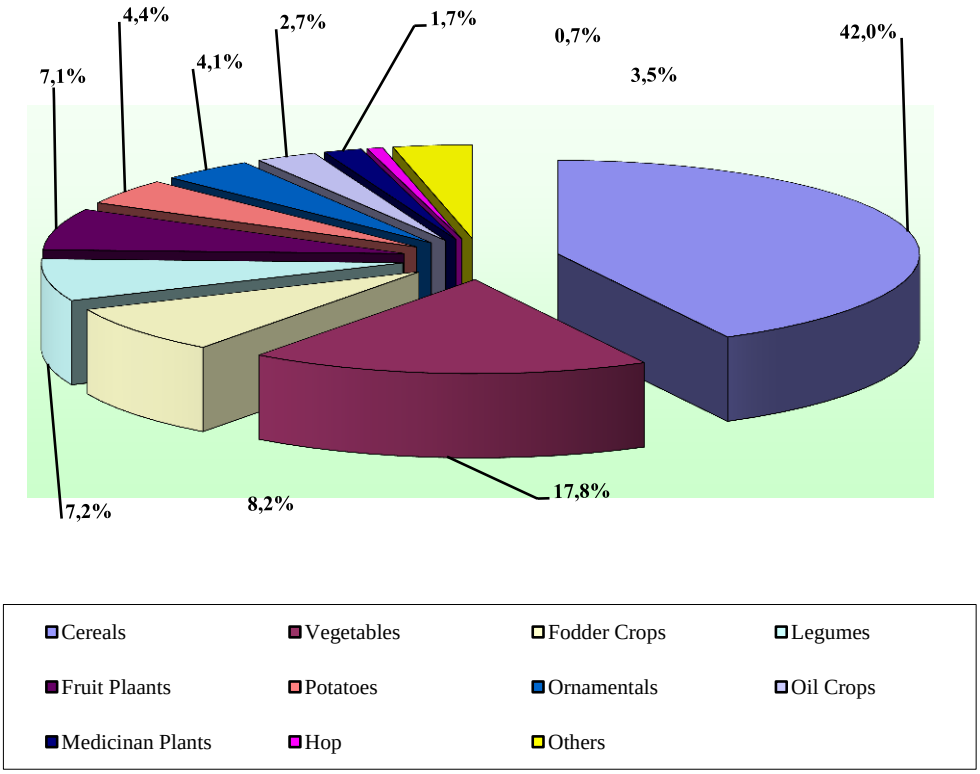


Figure 9 - Crop structure of the Czech PGR collections



Animals

The Institute of Animal Science (http://www.vuzv.cz) was entrusted by the Ministry of Agriculture to coordinate the National Programme on Conservation and Utilisation of Animal Genetic Resources Important for Food and Agriculture. The programme is based on national legislation, especially Act. No. 154/2000 Coll., on breeding, then FAO recommendations expressed in the Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration on Animal Genetic Resources. The Institute also serves as the National Reference Centre for storage and use of animal genetic resources. The Reference Centre is a member of the European Regional Centre for animal genetic resources and serves as the European Regional Focal Point (ERFP). Information of all activities of the ERFP is accessible on http://www.rfp-europe.org. The Institute of Animal Science provides data into the European information system European Farm Animal Biodiversity (EFABIS, http://efabis.tzv.fal.de), into the global system Domestic Animal Diversity Information System (FAO – DADIS, http://dad.fao.org), and into the information system under the CBD (Clearinghouse Mechanism).

The main objectives of the National Program are to (1) conservation of the current animal genetic diversity and its sustainable development, (2) development and support of nationally important underutilised or minor breeds occurring originally within the territory of the Czech Republic, and (3) international cooperation in all above-mentioned activities. One of the main

goals is to financially support the *in-situ* conservation of the nationally important breeds, i.e. animals kept directly on farms. Therefore, the National Programme is being executed in cooperation with a number of relevant breeders´ associations, e.g. Association of Horse Breeders´ Unions of the Czech Republic, Sheep and Goat Breeders Association in the Czech Republic, Union of Pig Breeders in Bohemia and Moravia, and others. Detailed information can be found on the website of the Institute of Animal Science:
http://www.genetickezdroje.cz/index.php?p=narodni_program_uvod&site=default,
or Ministry of Agriculture of the Czech Republic:
http://portal.mze.cz/public/web/mze/dotace/narodni-dotace/geneticke-zdroje/.

Microorganisms

The National program on conservation and utilisation of genetic resources of microorganisms and small animals of economic importance is governed by the national legislation, specifically Act No. 148/2003 Coll., on conservation and utilisation of plant as well as microbial genetic resources important for food and agriculture. The programme supports the conservation and utilisation of various microorganisms, invertebrates and other small animals that are economically important or relevant for agriculture practice. The collections include thousand of species and strains of viruses, viroids, bacteria, phytoplasma, algae, lower and higher fungi, yeasts, insects and other invertebrates, e.g. nematodes and acarids, and also small mice-like species of mammals. These organisms are kept within controlled conditions by 14 collection holders and are used for further research mainly in laboratories. Very important part of the programme are activities connected to evaluation, characterisation and documentation of individual samples and also identification of samples by standard methods, ELISA tests or DNA characterization in order to exclude duplicates and make their further utilization effective.

Microorganisms have a wide amplitude of use in agriculture and other related areas of human interest, e.g. for making a reference samples and kits, various detection methods and veterinary preparations, they are used in crop breeding processes and plant health systems. The Ministry of Agriculture is responsible for the administration of the programme and entrusted the Crop Research Institute to coordinate the related activities of the entities involved.

Most collections are included within the European Culture Collections Organization (ECCO) and World Federation for Culture Collection (WFCC). The transactions of these genetic resources are regulated by the relevant quarantine legislation and are monitored by the World Health Organization (WHO). The research, evidence and diagnostics use of harmful and quarantine organisms follow Roma Agreement (1951) and respect undertakings of Budapest Convention on recognizing of microorganisms depositions for the reason of patent processing.

Figure 10 - Changes in collections of microorganisms in years 2004-2013

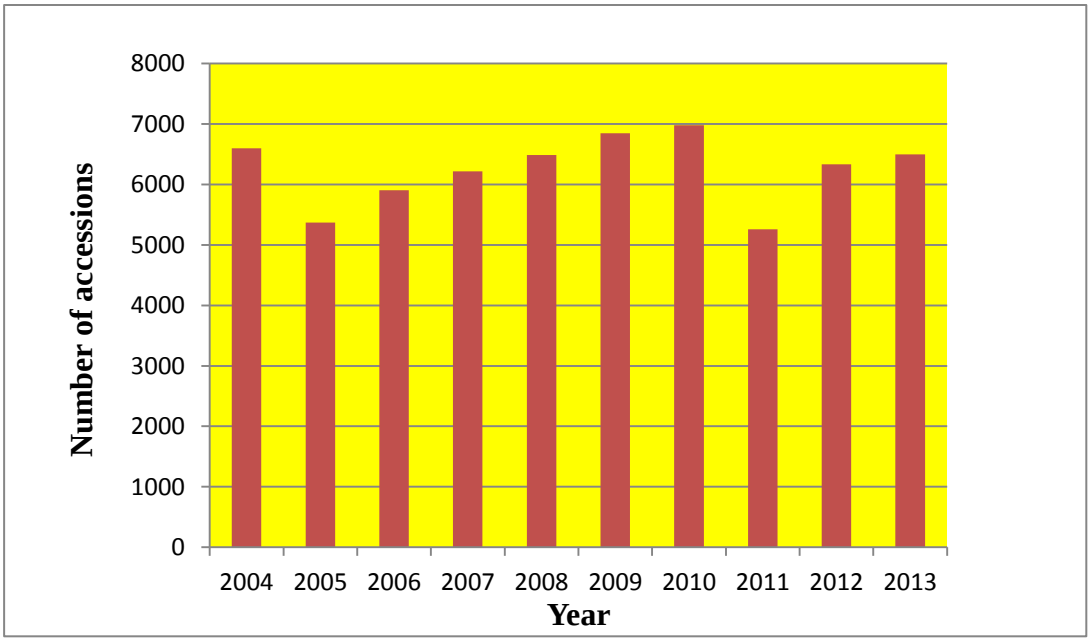


Figure 11 - Structure of organisms within the collections

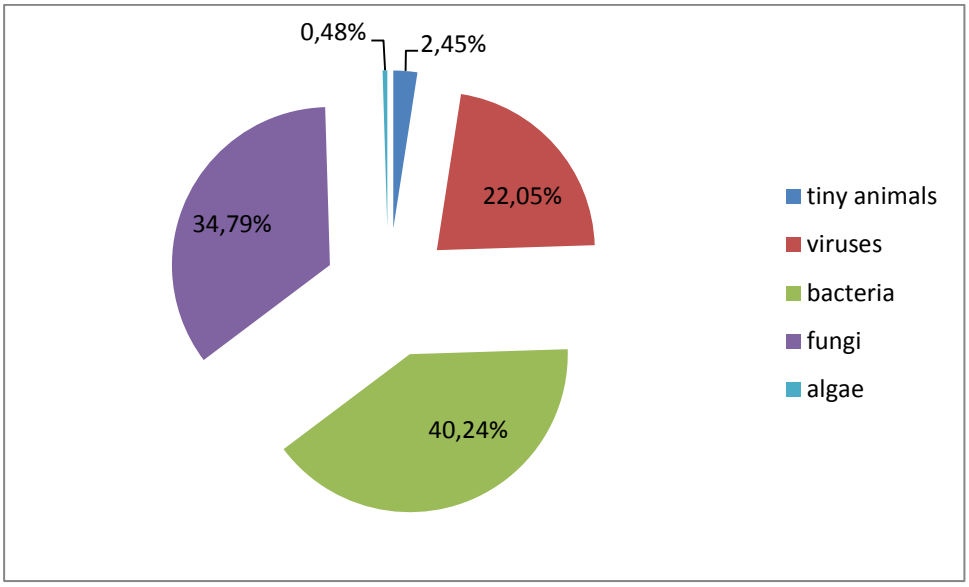
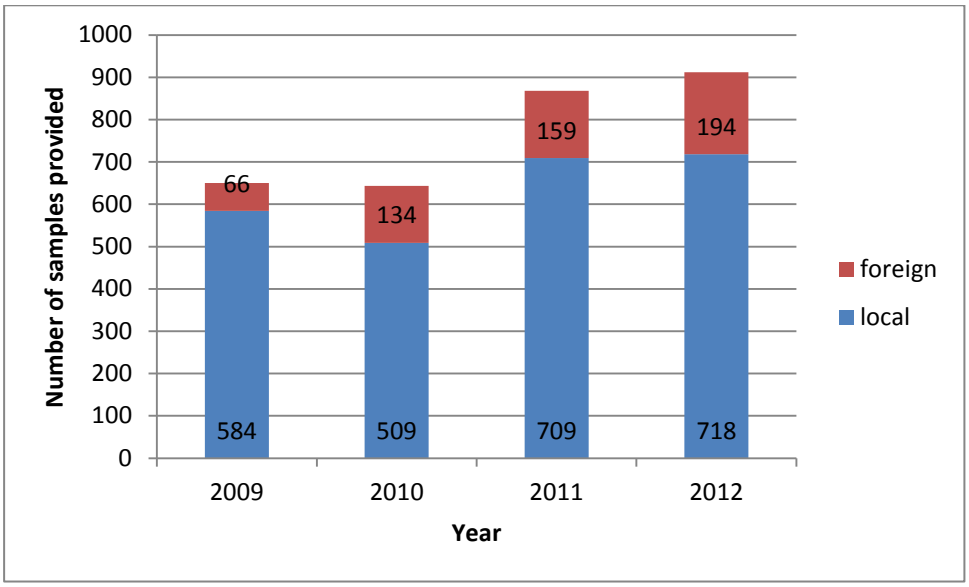


Figure 12 - Number of samples provided to local and foreign users by all participants of the National Programme of Microorganisms (2009 - 2012)



1.3.3 Main factors threatening biodiversity in agriculture, impact of biodiversity loss in agricultural areas

Agricultural land represents the most widespread type of land use: as of 1.12.2012 it represented 53.7 % of the Czech Republic (MoA 2013a). The main drivers endangering biodiversity in agriculturally used ecosystems correspond with the above main drivers of biodiversity loss on all its levels in the Czech Republic (*cf.1.2. Assessment of the overall causes of threats to biodiversity in the Czech Republic*):

- Breakdown, degradation and destruction of natural and near-natural environment leading to its disappearance

Due to collectivisation of agriculture in 1950s and its industrialisation in 1980s the Czech Republic has not only relatively high intensification of agricultural production but it also has one of the largest ploughing rates of arable land in Europe (70.9 %, MoA 2013a) and in spite of the restitutions and privatisation of agricultural land, it has quite a large area of average field. Almost 65% of farming companies with less than 10 ha of land represented only 2.2% of total agricultural land area. Companies with more than 500 ha land represented less than 4% of total number of agricultural companies, but they owned 69.9% of the total land area (MoA 2013a). The most valuable biotopes in the Czech Republic are sites, which are significantly altered by humans, but still representing an example of intensively farmed landscape, which has already disappeared in most of the Czech Republic, e.g. military training sites, quarries or mine dumps spontaneously overgrown with plants (JONGEPIEROVÁ *et al.* 2012, KOLÁŘ *et al. l.c.*). Biotopes (types of natural sites) protected by EU legislation and depending from farming procedures in the Czech Republic and EU are in worse condition of protection than biotopes, whose creation and existence are unrelated to agricultural production (MIKO & HOŠEK *L.C.*, HALADA *et al.* 2011, BUNCE *et al.* 2012). Most of the species extinct in

the Czech Republic were not tied to small areas, residual specific biotopes such as blown sand or dry heath land, but formerly intensively utilised landscapes (PLESNÍK 2004).

Water erosion endangers almost 50% of agricultural land in the Czech Republic. At present the maximum soil loss in the Czech Republic represents ca 21 million tons of topsoil a year, which corresponds to economic loss at least 4.3 billion CZK. Various degrees of wind erosion endangers potentially some 14% of agricultural land in the Czech Republic (the highest endangerment affects 2.5 %; strongly endangered is 1.5% of agricultural land).

The most serious problem for agricultural land remains urban sprawl, construction of buildings. 2001–2006 in the Czech Republic disappeared ca 20 thousand ha of agricultural land that is 11.2 ha/day. Reinforcement (solidification) of land endangers almost half of agriculturally land in the Czech Republic (MoA 2012, 2013b).

- Invasive alien species

Invasive alien species, which affect the living component of agro-ecosystems are also some economically (pests) and epidemiologically (pathogenic organisms) significant organisms (*cf.1.2. Assessment of the overall causes of threats to biodiversity in the Czech Republic*).

- Excess deposition of nutrients in the environment, especially nitrogen and phosphorus (eutrophication)

Excess deposition of nitrogen endangers 51.9% of agricultural land in the Czech Republic (MoA 2013a).

- Direct hunting by man and overexploitation of the population of target species and other taxa

- Climate change

The most often mentioned form of climate change in the next decades is global warming, which according to some models, may lead to average warming up to 5°C. It is difficult to exactly define the impacts because most agricultural plants have short vegetation period and because of the use of intensive technologies, change in the planted varieties, changing species composition etc. The present condition of agricultural land in the Czech Republic is not very good as far as the character and quality of the land is concerned. This is especially due to the loss of organic mass in the soil due to low application of farm fertilisers, soil erosion and other factors. Organic mass in soil is important to maintain humidity as it slows the speed of warming-up and then also the speed of drying of water during summer, while in winter it shortens the depth of soil freezing because of its lower thermal conductivity (MoA 2011).

Also faster arrival of the individual phenologic phases and extended vegetation period plays a significant role. Among the positive impacts of the expected climate change there are improved harvests in most middle latitudes. However this depends from sufficient water and protection from diseases and pathogens, which will be very problematic. Average harvest of agricultural crops will be affected not only by changes in temperatures and rainfall, but also by increasing CO_2 concentration in air. The change of overall evaporation

(evapotranspiration) will be affected especially change in the air temperature, but also change in the leaf area index (LAI) of the greenery.

In grassland ecosystems it can be expected that rainfall defines the competitive relationship among grasses, beans and other species: higher rainfall supports the growth of grass. Grassland in dry sites will be more resistant to smaller rainfall. Meadows with more biodiversity will be able to handle drought better than grasses, which have lower diversity of species. The circulation of nitrogen will be affected only by differences in the plant biomass production in different altitudes, but also by different efficiency of nitrogen use in plants at different water availability situations.

Managed artificial ecosystems will be endangered especially in lowlands of the Czech Republic, where already now the limiting factor is water availability and where we can expect the arrival of newly migrating pathogens. Due to longer vegetation period and due to higher temperatures the composition of plant and animal communities will change, vulnerable species of wild plants and wild animals will disappear as well as other organisms living in agricultural ecosystems or certain biotopes may vanish.

Methods of management have key importance for water retention in landscape. It is clear that extensive fields sowed with wide-row crops (maize *Zea mays*, sunflower *Helianthus annuus* etc.) in a single watershed represent the main cause of increased surface rainwater runoff and washout of soil and they remain one of the key drivers of flood situations. From areas covered with winter crops and perennial crops and permanent grassland much less water leave during heavy rainfall and water does not wash away a lot of sediments, unlike the same sized areas with wide-row crops. These effects are likely to keep increasing as the climate change progresses.

The worst impact of climate change in the Czech Republic will be and already is occurring in dry regions, where even mild increase of rainfall cannot compensate increased air temperature (Rakovník and Žatec region in the Czech Republic). Especially in dry regions the negative impacts will affect the intensively agriculturally used landscape. Heavily farmed ecosystems will suffer long-term lack of water in summer, so the need for irrigation will increase. On the other hand, during storm rainfalls the water will runoff quickly. Compared to present situation, soil erosion may intensify (VAŠKŮ 2007, PELC 2009, PLESNÍK & PELC *L.C.*, PRETEL 2011, ROŽNOVSKÝ *l.c.*)

- Contamination with pollutants

Acidification highly endangers 43% of land in the Czech Republic. Soils have a great tendency to acidification especially in the Vysočina region, then also in the South Bohemia and Carlsbad region. The development of soil reactions in the Czech Republic suggests an increasing acidification trend, especially in potato regions, whose hunger soils have lower buffer capacity (MoA 2012).

In 2000 – 2012 acceptable levels of soil pollution (public notice No. 13/1994 Coll.) were mostly exceeded in DDT and DDE content. In 2012 the requirements of this public notice for the content of organic chlorinated pesticides failed in 18 monitoring areas of agricultural land and 2 monitoring areas of permanent grassland, i.e. 50% of samples. Use of DDT based preparations has been banned in the Czech Republic since 1974, but high percentage of over-limit samples indicates strong persistence and long-term burden to the soil (MoA 2013a).

1.4. Forest biodiversity

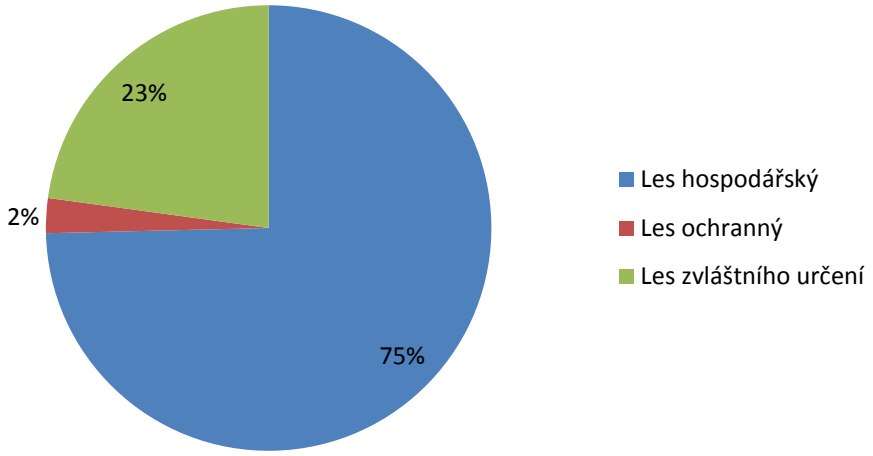
1.4.1 National policies and strategies

Pursuant to Act No. 289/1995 Gazette on Forest (the Forest Act), as amended later**,** the forest consists of trees and their environment and land allocated for displaying the forest functions. Forest has production and non-production functions.

The above act defines three main forest categories:

- Protective forests (forests at extremely unfavourable sites, in high mountains and forests in the dwarf-pine vegetation zone).
- Special purpose forests (forests in areas of the 1st degrees of water source hygienic protection, in protection zones of sources of natural medicinal and table mineral waters, forests in national parks and natural reserves. Special purpose forests can also be forests, where there is a public interest in the improvement or protection of environment or other qualified interest to give non-production functions higher priority than forest production functions).
- Productive forests are those classified as neither protective nor special purpose forests.

Figure 13 - Representation of forest categories in the Czech Republic in 2012; productive forest (blue colour), special purpose forests (green colour), protective forests (red colour); Source: Forest Management Institute (FMI, Czech ÚHÚL)



Basic environmental aspects of forest regeneration are covered by national legislation. The minimum proportion of soil improving and stabilizing woody plants is based on the above Forest Act and it is a binding requirement of forestry management plans. Decree No- 83/1996 Gazette sets the minimal proportion according to the individual forest category and the economic unit (forestry management unit based on forestry typology). Due to the above legally binding regulation and to reforestation/afforestation subvention programmes/subsidiary schems and other incentive measures focused on increasing proportion of soil improving and stabilising woody plants there is a continuous increase in the broad-leaved deciduous tree species proportion. Therefore, they increased from 12% in 1950 to 26% in 2012.

Table 2 - Development of species composition of forests in the Czech Republic 1950-2012; Source: FMI

Species	Rok/Year							
	1950	1970	1980	1990	2000	2010	2011	2012
	Area of forest land ha / %							
Norway spruce	1353203	1427735	1437499	1413893	1 397 012	1 347 239	1 341 421	1 334 417
	60	55,6	55,7	54,7	54,1	51,9	51,7	51,4
fir	64682	53325	44786	27708	23 138	25 869	26 448	26 859
	2,9	2,1	1,7	1,1	0,9	1	1	1
pine	477627	491501	469403	460481	453 159	436 308	434 202	432 915
	21,2	19,2	18,3	17,8	17,6	16,8	16,7	16,7
larch	33529	57410	68266	81762	97 170	100 761	100 817	100 956
	1,5	2,2	2,7	3,2	3,8	3,9	3,9	3,9
other conifers	4719	14885	19275	21446	4 586	6 352	6 581	6 941
	0,2	0,6	0,8	0,8	0,2	0,2	0,3	0,3
	1933770	2044856	2039229	2005290	1 975	1 916	1 909	1 902

					065	529	468	088
total conifers	85,8	79,7	79,2	77,6	76,5	73,9	73,6	73,2
	81016	139761	145817	155269	163 761	178 466	180 597	182 327
oak	3,6	5,5	5,7	6	6,3	6,9	7	7
	102243	139761	145817	155269	154 791	189 998	194 257	198 652
beech	4,5	5,5	5,7	6	6	7,3	7,5	7,7
	-	66926	65027	74167	74 560	72 264	71 169	71 026
birch		2,6	2,5	2,9	2,9	2,8	2,7	2,7
	99778	167980	166209	167959	183 696	209 559	211 325	213 145
other broadleaves	4,4	6,5	6,5	6,5	7,1	8,1	8,1	8,2
	283037	503825	513041	536928	576 808	650 287	657 348	665 151
Total broadleaves	12,4	19,6	20	20,8	22,3	25,1	25,3	25,6
	2216807	2548681	2552270	2542218	2 551 873	2 566 816	2 566 816	2 567 239
Total without unstocked areas	98,3	99,3	99,2	98,4	98,8	98,9	98,9	98,9

The National Forest Programme II approved by the Czech Government in 2008 serves as a key policy document for sustainable forest management in the country. The Coordination Council for implementing the National Forest Programme II developed a number of documents with the help of a huge range of experts working in various groups. The outputs are recommendations summed up in 17 key actions.
Action 7 is called Sustaining and Improving Forerst Biodiversity. The key action includes 12 recommendations elaborated into the detailed measures:

1. Assessing and in reasonable cases reviewing the target forest tree species composition as an overlap between the forest economic, ecological and social pillars.

2. Management aing at promotion natural tree species composition in forests, where environmental importance prevails.

3. Supporting diversity of forestry management measures as one of the prerequisites for sustaining forest biodiversity.

4. Keep increase in the proportion of forests left to spontaneous succession aiming atstep-by.step establishing a representative system, which shall be systematically monitored. The system shall be established particularly in National Parks and Nature Reserves.

5. Supporting the species native to the sites and which are the main representatives of biodiversity in the forests.

6. When using geographically non-native trees, respecting the limitations given by the present knowledge of their ecological behaviour as well as the precautionary principle.

7. Maintaining a mosaic of forest stands with high biological value in the landscape, e.g. overmaturate stands/growths, linear/strip growths, wetlands, water springs, peat bogs, and implementing the appropriate management there.

8. In forests owned by the Government, promoting measures towards natural forest tree species composition while at the same time maintaing the competitiveness. Restoring and growing the forests owned by the Government so as to maintain an increased proportion of soil improving and stabilising woody species and woody plants of natural species composition. In forests owned by private subjects, achieve the same objectives by suitable incentives, communication, education and public awareness.

9. Promote an increase in the ratio of decaying wood, timber logging remains and trees left to grow naturally in the forest so as to maintain biological diversity and set up mechanisms how to achieve that.

10. Differentiate the quantity and quality of the wood left in the stands/growths and respect the requirement to increase the biomass supply for further use while respecting the conditions of the stands/growths.

11. Limiting or fully abandoning planting of geographically non-native tree species in special purpose forests, if these forests are needed to maintain biological diversity. (With the exception of gene sources approved for geographically non-native tree species).

12. Proposing and implementing measures against spreading of alien invasive plant species in forests and in Specially Protected Areas also against other non-intentionally introduced species.

Activities connected with afforestation and deforestation are set by some legal regulations, whose primary focus is not biodiversity conservation and sustainable use, but they provide measures reflecting the environmental impact of such activities. Act No. 114/1992 Gazette on Nature Conservation and landscape Protection, as amended later, requires a binding decision of the respective State Nature Conservancy authority to approve forest management plans and forest management guidelines, deforestation and afforestation of land above 0.5 ha and construction of forest roads and forest amelioration systems. The above act also provides basic binding requirements for logging.

Act No. 289/1995 Gazette on Forests states that for afforestation of land declared as land allocated for providing forest functions, seeds or seedlings of tree species from the same or comparable natural forest areas and from the appropriate altitude shall be used. It also states, that legal and natural persons performing the timber harvesting must proceed so as to minimise negative affects on the forest ecosystem. Logging is limited by a binding maximum limit of overall logging set in the respective forest management plan or forest management guidelines. If the owner does not manage the forest according to the approved forest management plan or forest management guidelines, logging is possible only with the approval of an expert forest manager and if the logging exceeds average 3 m^3 per hectare of the forest, the State Forest Management Authority must be informed in writing in advance.

One of the most efficient market tools to support sustainable forest management is certification of sustainable forestry. The area of certified forests in the Czech Republic is

1,827,326 hectares, *i.e.* 68.6% the whole forest size by PEFC and 50,184 hectares (18.9 % of all the forests) by FSC.

Table 3 - Overview of certified forests in the Czech Republic; Source: Forest Management Institute (FMI, Czech ÚHÚL)

Type of ownership	PEFC	FSC
	Area of certified forests (hectares)	
Government	1 500 326	35 649
Natural persons	90 057	4
Legal persons	52 082	10 492
Municipal authorities	184 861	4 039
Total	1 827 326	**50 184**

1.4.2 Trends

In the Czech Republic, the forest cover has been gradually increasing, in the last decade by 0.08% annually and in 2012 it accounts for 26,661 km^2, which is 33.9% of the whole Czech Republic´s territory. The proportion of broad-leaved deciduous trees has been keeping growing. In 2012 coniferous species account for 73.2%, deciduous broad-leave trees for 25.6% and clearings for 1% of the forest land.

In the last decade the annual area of regenerated forest stands/growths has remained stable with a temporary increase in the second half of the decade due to large incidental /salvage feelings.

The proportion of broad-leaved deciduous trees during artificial forest regeneration reached 38.3% in 2012 in compliance with the objectives mentioned in the previous chapter.

In 2012 the proportion of natural regeneration reached 21.8% in comparison with 13.5% in 2000.

Table 4 – Forest restoration (source: Czech Statistical Office, 2013)

Restoration method	2000	2002	2004	2010	2011	2012
Man-made restoration	21 867	18 120	19 042	21 859	21 755	19 903
mm-restoration: repeated	4 371	3 212	2 766	3 087	3 712	3 751
Natural	3 422	3 940	4 802	5 127	5 075	5 561
Total	25 309	22 060	23 844	26 986	26 830	25 464

1.4.3 Main factors threatening biodiversity in forests

Year 2007 was the worst for forest conservation during the last decade. Due to great damage caused by the Kirill unusually violent European windstorm, forming an extratropical cyclone with hurricane-strength winds, the logging reached the historic maximum of 18.5 million m^3, from which almost 15 million m^3 were incidental/salvage loggings. As seen in the following table, also in 2008 there was significant proportion of incidental/salvage loggings related to the natural disaster. Abiotic drivers are the major cause of incidental/salvage loggings.

Table 5 - Random logging (source: Czech Statistical Office, 2013)

Year	Logging				
	elemental mil. m^3	exhalation mil. m^3	insect mil. m^3	other mil. m^3	total mil. m^3
2000	2,39	0,08	0,32	0,5	3,29
2001	1,49	0,06	0,23	0,6	2,38
2002	3,38	0,03	0,29	0,51	4,21
2003	6,12	0,06	1,26	0,76	8,2
2004	2,76	0,04	1,27	1,3	5,37
2005	2,3	0,04	0,98	1,21	4,54
2006	5,97	0,03	1,14	0,89	8,03
2007	12,65	0,04	1,56	0,64	14,89
2008	7,6	0,04	2,31	0,8	10,75
2009	3,25	0,03	2,62	0,73	6,63
2010	4,07	0,03	1,79	0,57	6,46
2011	2,17	0,02	1,05	0,58	3,82
2012	1,7	0,02	0,79	0,73	3,24

Health condition of forests has been monitored in the Czech Republic since 1986 within the international cooperative programme of the United Nations Economic Commission for Europe (UNECE) known as the ICP Forests, which is one of the most important European schemes for forest ecosystem monitoring and checking.

Health condition of trees is characterised particularly by the degrees of defoliation, which is defined as a relative loss of assimilation tissues in the tree crown/canopy compared with a healthy tree growing under the same stand and site conditions, or deprivation of leaves. It is a loss caused mostly due to adverse environmental changes in forest ecosystems as an output of long-term and excessive air pollution (SO_2, NO_x, F, Cl, O_3, heavy metals, dust particles, *etc.*).

Overall broad-leaved deciduous tree species defoliation of older trees (more than 60 years old) has slightly improved so defoliation in class 1 and 2 has decreased and defoliation in class 0 has increased. The change has been mostly due to the European or Common Beech (*Fagus sylvatica*), where defoliation in class 0 increased from 23.9 % in 2011 to 29.9 % in 2012 whereas classes 1 and 2 decreased. In case of oaks (*Quercus* spp.) only a small improvement came. Younger broad-leaved deciduous trees (59 years old or younger)

displayed a small decrease in overall defoliation similarly to older trees, with lower defoliation of class 2 and more class 1 and 0. Even there it was the beech, which had the highest dominancy there. Its defoliation class 0 increased significantly from 54.9 % in 2011 to 81.6 % in 2012 whereas proportion in classes 1 and 2 decreased. Oak has improved only slightly, similarly to the older category.

Along with terrestrial monitoring of the forest condition in the Czech Republic there is also long-term use of remote sensing data provided by satellites. The advantage is that it can gather information from large areas in short time and it provides unified systemic assessment unbiased with any subjective factors, which may be present during ground visual assessment. Since the mid-1980s the Czech Republic has been using satellite Landsat-TM snapshots to monitor health condition of forests, since they appear to be the most suitable for this purpose.

One of the other factors with negative affects on forest ecosystems are game animals. According to the National Forest Inventory (2001-2004) 11.4% of trees are damaged due to browsing by game animals;. 29.6% of regenerated trees are damaged by gane browsing.

Populations of hoofed game animals have significantly increased in numbers since the World War II.

Table 6 - Annual bags of main game species in the Czech Republic (number of individuals)

Game species	2006	2007	2008	2009	2010	2011	2012
Red-deer	16 871	20 217	21 415	21 527	21 820	20 961	23 120
Fallow-deer	9 972	11 395	13 394	13 309	14 209	13 305	14 642
Mouflon	6 893	8 320	9 304	9 118	9 368	8 398	9 378
Roe-deer	99 074	108 992	127 213	131 875	120 206	113 915	108 616
Wild boar	59 904	121 192	138 854	121 821	144 305	109 563	185 381
Mallard	247 322	328 225	315 773	286 024	272 422	277 390	268 485
Pheasant	588 555	664 251	598 176	530 444	528 878	524 674	518 208
Hare	67 544	115 065	105 745	84 111	62 848	47 739	56 310

1.5 Biodiversity in inland waters

1.5.1 National Policies and strategies

There are following instruments, national policies and strategies concerning the biodiversity in fresh water issues in the Czech Republic:

- Water Act No. 254/2001 Coll., together with several implementing decrees and government orders. They set up basic rules for the fresh water management, e.g. for usage of surface and ground water, building water management constructions, discharging wastewaters, planning in water management, protection of the water regime and water resources, protection of water quality, protection against floods, and other issues.

- The Water Framework Directive 2000/60/EC (WFD). The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. It includes River Basin Management planning.

- Act No. 99/2004 Coll., on Fisheries, together with several implementing decrees and government orders. They set up basic rules for fish farming, fishing and fish protection as well as the farming of other aquatic organisms and protection of their life and environment and other issues to ensure sustainable fishing.

- Convention on Wetlands of International Importance especially as Waterfowl Habitats (the Ramsar Convention).

In concordance with the text of the Convention the Czech Republic has designated 14 wetlands (RS) into the List of Wetlands of International Importance. They constitute an overall area of 58 537 ha, from which 22 709 ha are peat bogs, 11 753 ha are ponds, and 24 078 ha are floodplains.42

The two last RS were designated in 2012. The first Ramsar site is “Springs and Mires of the Slavkovský les (Pramenné vývěry a rašeliniště Slavkovského lesa)”. The wetland is located in Western Bohemia in the region Karlovy Vary and it is a part of Protected Landscape Area Slavkovský les.

The site is a source of important mineral springs with unique mineral composition. Moreover, we can find there other types of wetlands like raised bogs and forest peat bogs, transition mires and wet meadows.

The second Ramsar site is “Jizera Headwaters (Horní Jizera)”. The wetland is located in northern part of the Czech Republic at the Czech-Polish borders. The RS includes one of the largest characteristic raised bogs complexes in the Czech Republic and in the temperate Europe as well as transition mires within the floodplains of the Jizera River Valley in the central part of the Jizera Mountains. A natural character of the Jizera River is preserved in the upper part of the valley that is characterized by many meanders and naturally formed shallows and large gravel beds. The wetland is a part of Protected Landscape Area Jizerské Mountains.

All designated wetland sites are protected and are situated within the national parks or protected landscape areas. In some cases, the sites have the status of the strictest protection according to national legislation and are designated as national nature reserve or nature reserve. Currently, there are four wetlands of international importance listed in the *Montreux Record* due to change of their ecological status. Three of them are in danger due to potential construction of water canal Donau-Odra-Elbe.
The Czech Ramsar Committee plays the role of advisory body for the Ministry of the Environment in the field of implementation of the Ramsar Convention and wetland conservation, research and sustainable use.
One of the main activities of the Czech Ramsar Committee during the last two years has been the implementation of resolution concerning interaction wetlands and agriculture. Two seminars on national level to exchange information and share experience in this field and to meet conservationists and agriculturists were organised in 2012 and 2013.

The Strategic plan of implementation of the Ramsar Convention in the Czech Republic for the period 2009-2015 according to the SP of the Ramsar Convention for the same period (Resolution X.1).The plan covers 23 measures focused on water and wetland ecosystems. The plan is a part of The Updated State Nature Conservation and Protection Programme of the Czech Republic (see below). The measures are fulfilled continuously.

The Updated State Nature Conservation and Landscape Protection Programme of the Czech Republic (SNCLPP) (2009). The Programme covers period of ten years (2010-2020) and includes the national wetland policy and relevant measures for the implementation of the Ramsar Convention in the Czech Republic.

1.5.2 Monitoring and trends

The territory of the Czech Republic creates the European watershed of three river systems of the Elbe, the Danube and the Odra River. Their water content is highly dependent on precipitation. Spring areas, dead and unused arms and alluvial flood areas are an integral part of river systems. Five glacial lakes are located in the Šumava Mountains. Several minor peat bog lakes are located in other mountain areas. Also given the presence of karst areas and territories with lack of water in the Czech Republic, specific aquatic habitats can be found, such as underground karst rivers, periodical surface rivers and other temporary aquatic habitats. There are only a negligible number of natural aquatic ecosystems with still water, which functions are partially replaced by a number of fishponds currently exceeding 21 000.

Artificial or highly modified ecosystems also include flooded quarries, sand pits and gravel pits, abandoned peat deposits, channels, millraces and amelioration ditches. Dam lakes are elements of discontinuity in river systems and constitute a special transitional body between still and flowing water. The ecological state of water and wetland ecosystems is substantially determined by the character and condition of terrestrial ecosystems in their river basin.

After 1989, the volumes of industrial and agricultural pollution substantially decreased and a number of wastewater treatment plants were built resulting in fast and radical improvement of water quality. However, point and diffuse pollution sources have not been fully eliminated yet and the effects of the eutrophication processes still remain, mostly as inflow of nutrients from agricultural lands. In spite of substantial reduction of emissions, the impact of acidification on biodiversity is still clear, particularly in oligotrophic mountain ecosystems.

Monitoring of biodiversity in inland water is realised in the Czech Republic on a regular basis. It includes:

- Monitoring of waterbirds (since 1973). Since 1973 bird numbers have been monitored using regular censuses in one-month intervals. The study summarising the results of a long-term monitoring of waterbirds at the most important fishpond system in the Czech Republic was completed in 2008.
- International Waterbirds Census (since 1967).
- Winter Birds Census in the Central Bohemia (since 2003).
- United Programme of the Birds Census in the Czech Republic (since 1983) – census of all birds breeding in the Czech Republic.
- Monitoring of species according to EU Directives (Bird Directive and Habitat Directive).
- Monitoring of the ecological state of the Ramsar Sites (planned)

Certain species of aquatic fauna, such as the autochthonous crayfish species (*Austropotamobius*

torrentium and *Astacus astacus*), or great bivalves (e.g. freshwater pearl mussel *Margaritifera margaritifera*) have already disappeared from a majority of original localities. Several species could profit from the recovery programmes or active management of sites. Several species of freshwater birds show positive trends (see below).

Figure 14 - The trend of waterbird species Podiceps cristatus in the Czech Republic [% change]: (Source: http://jpsp.birds.cz/vysledky.php?taxon=267)

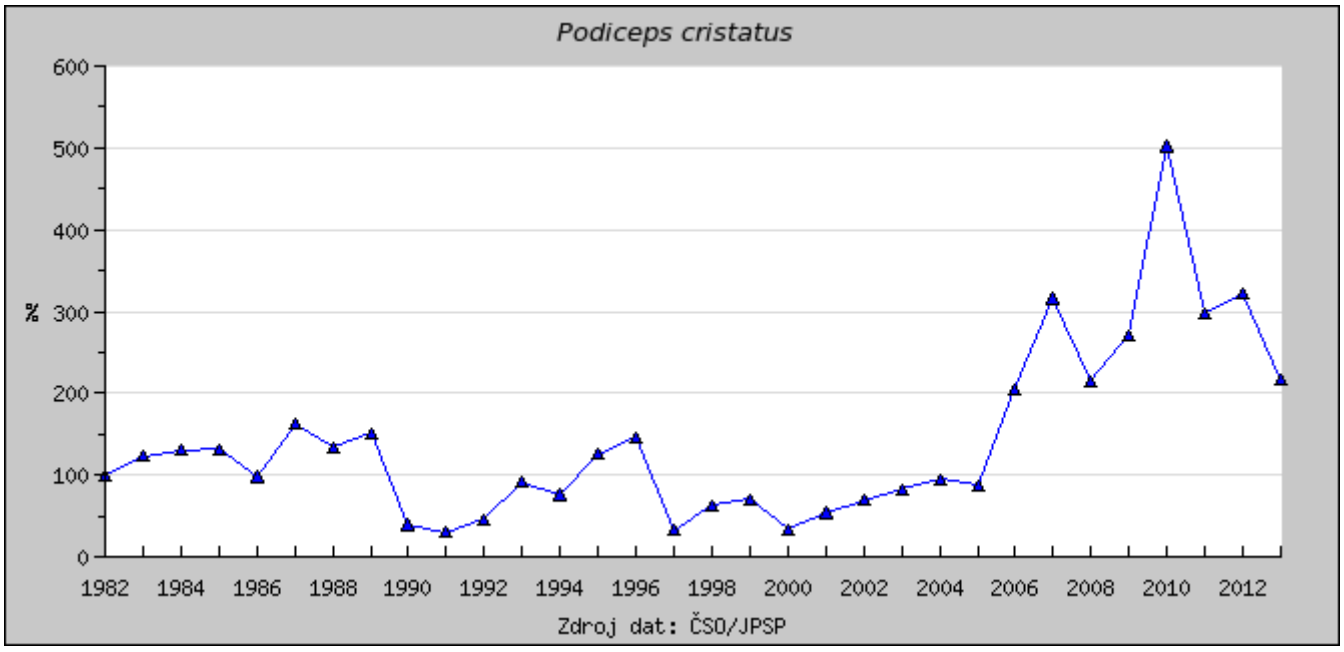
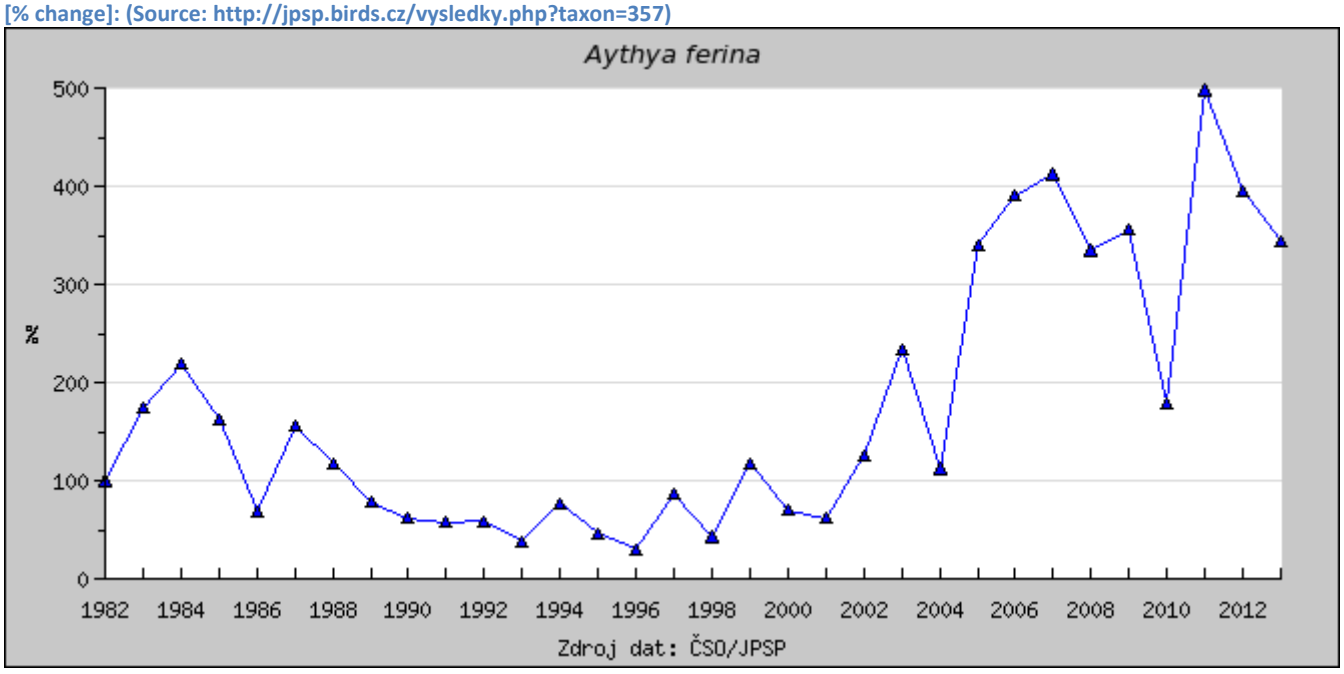


Figure 15 - Figure XX indicates the trend of waterbird species *Aythya ferina* in the Czech Republic [% change]: (Source: http://jpsp.birds.cz/vysledky.php?taxon=357)



1.5.3 Main drivers endangering biodiversity of inland water, causes of biodiversity loss

The main drivers threatening biodiversity in inland water ecosystems are the same as the above main drivers of biodiversity loss generally at all its levels in the Czech Republic (*cf.1.2. Assessment of the overall causes of threats to biological diversity in the Czech Republic*):

- Natural habitat fragmentation, degradation and destruction resulting in their loss

- Excess inputs and depositions of nutrients, particularly nitrogen and phosphorus, in the environment (eutrophication.) In the Czech Republic eutrophication is more significant in water than in terrestrial environments (details in *1.2 Assessment of the overall causes of threats to biological diversity in the Czech Republic*).

- Invasive alien species

- Direct persecution by man and overexploitation of the target species and other taxa populations

- Climate change

Impact of climate change on landscape water balance will be displayed particularly by more frequent extreme hydrological events such as floods and droughts and changes in the surface and underground water regime, stock volumes in water reservoirs and also in surface water quality.

Since the spring direct runoff from thawing and all-year basic runoff are decreasing, the summer and autumn water supply in soil will decrease, intensity and frequency in periods of lack of soil moisture (agricultural drought) will increase, water supply will decrease due to higher demand (hydrological drought) and also overall runoff from a watershed/basin will decrease all year round. An exception is the winter period, when there is less snow due to higher temperature. Lower overall runoff and drastic decrease in minimal flow cause the minimal ecological water volume in rivers will not be maintained. The present maximum spring runoff will shift from spring to winter period, when there will be higher likelihood of floods.

Change in the flow volume in watercourses will affect water quality, water transport system and irrigation in agricultural production. If air temperature and rainfall increase, water quality may not be affected, but otherwise water ecosystems may witness decreasing oxygen and greater nitrogen mineralising. With rising water temperature also biological activity in cyanophyta/cyanobacteria increases, leading to the well-known cyanophyta/cyanobacteria blooming, also known as blue-green algal bloom. Increasing air temperature will thus lead to higher eutrophication in water reservoirs (*cf. 1.2 Assessment of the overall causes of threats to biological diversity in the Czech Republic*) and to lower self-cleaning ability of rivers.

In floodplains the water level decrease will be accompanied with increasing in underground water levels, soil will receive less moisture through rising, water and spring capacity will decrease. In some areas of the Czech Republic there will be lack of high-quality drinking water and the landscape will get continuously dry and also vulnerable wetlands will disappear, particularly those of limited size.

Climate change will have smaller impact on runoff in relatively resilient mountainous ecosystems with large rainfalls and in watersheds/basins with greater accumulation capacity (hydrological structures with great water accumulation, *e.g.* Natural Water Accumulation Protection Zones, NWAPZ).

Due to significant decrease in minimal flow volumes in summer and autumn months we can expect significant problems with water quality in watercourses under wastewater treatment plants. Expected decrease in wastewater dilution will affect oxygen regime, either through the above increased eutrophication and also contamination of water with micro-organisms. Greater impact on water quality can be expected in small watercourses, where wastewater is released into, particularly if the wastewater is not cleaned perfectly (VAŠKŮ *l.c.*, MINISTRY OF THE ENVIRONMENT OF THE CZECH REPUBLIC 2009, PELC 2009, PLESNÍK & PELC *l.c.*, PRETEL 2011, OECD 2013).

- Contamination with pollutants

Due to flue gas desulphurisation in brown coal power plants, watercourses have been acidified only in the highest parts of the Krkonoše/Giant Mountains, Jizera Mountains and Orlice/Eagle Mountains and in the west part of the Krušné hory/Ore Mountains (MIKO & HOŠEK *l.c.*).

1.5. Mountain biodiversity

1.5.1 Status and trends

The Czech Republic is surrounded, except the southern border, by a chain of mountain ranges exceeding the altitude of 1000 meters. To mention just some of them from the southwest to the southeast – Sumava/Bohemian Forest (max. altitude 1456 m), Krusne/Ore Mts (1244), Jizerske Mts (1126), Krkonose/Giant Mts (1602), Orlicke Mts (1115), Hruby Jesenik (1491), Moravskoslezske Beskydy (1324) or Bile Karpaty/White Carpathians (970). However, only the Krkonose/Giant Mts with the highest top of the country (1602 m asl) reach well above the alpine timberline (at 1250–1350 m asl) and have well-established subalpine and alpine vegetation belts with unique habitats of arctic-alpine tundra. This mountain range along the Czech-Polish border may be really considered the hotspot of mountain biodiversity in the Czech Republic (for more details see the 4th Natl Rep CBD, Czech Rep 2009: pp. 38–40).

Majority of mountain ranges in the Czech Republic can be characterized by their own unique biodiversity, incl. endemic species and plant communities. They are protected mainly as National Parks or Protected Landscape Areas (2 NPs and 12 PLAs may be considered mountainous in the whole country; altogether 8168 km^2, i.e. ~10 % of the area of the CR) or included in the EU Natura 2000 network (see Chapter 7 for more details).

There are no deep changes in status and trends of mountain biodiversity since the last report (2009). However, some trends in mountain ecosystems could be well illustrated by long-term

population dynamics of birds in the Krkonose/Giant Mts – e.g. an increase of a forest species (the coal tit *Periparus ater*) as a reaction to improved quality of mountain spruce forests in the region (heavily damaged by the air pollution in the last century), or a sharp decrease of an alpine species (the water pipit *Anthus spinoletta*) reflecting probably an impact of the climate change (Figure 16). The most important factors influencing mountain biodiversity are mentioned in the following chapter.

Figures 16 and 17 show different trends of two bird species in the Krkonose/Giant Mts in the last 30 years – the increase of the "forest" coal tit *Periparus ater* and the decline of the "alpine" water pipit *Anthus spinoletta* (index in % on the y-axis; 100 % = 1983 or 1984 respectively). Source: Flousek J. (unpublished data)

Figure 16 – Trend of coal tit (*Periparus ater*) in the Giant Mts.

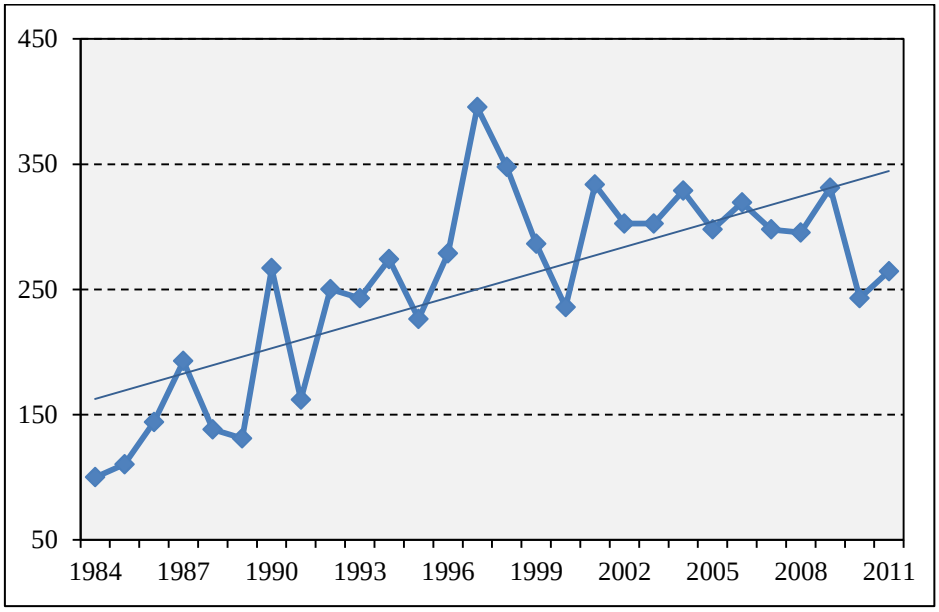
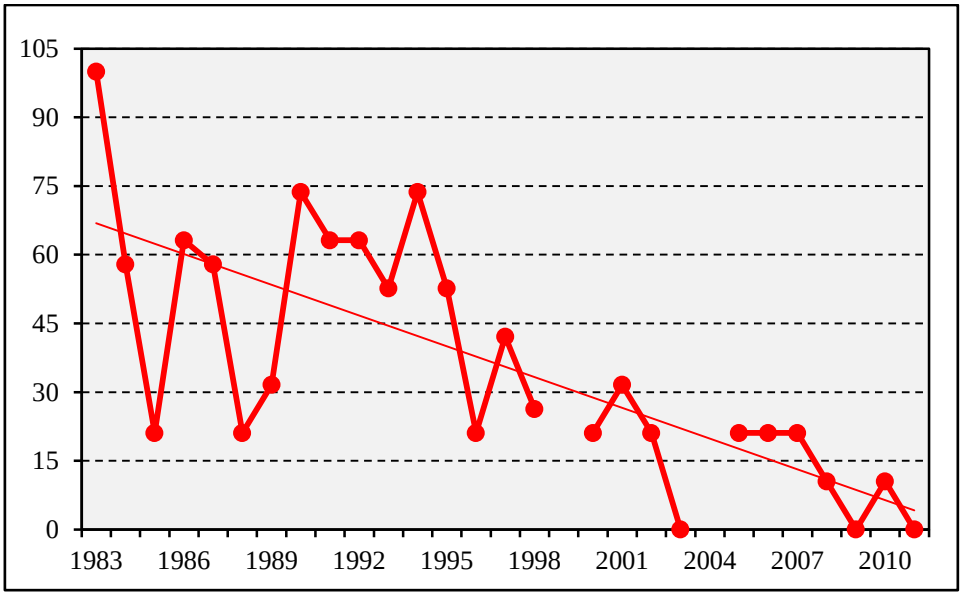


Figure 17 – Trend of water pipit *(Anthus spinoletta)* in the Giant Mts.



1.5.2 Main drivers of mountains biodiversity changes and their consequences

Majority of factors are described using the Krkonose/Giant Mts as an example but they influence the other mountain ranges in different rates as well.

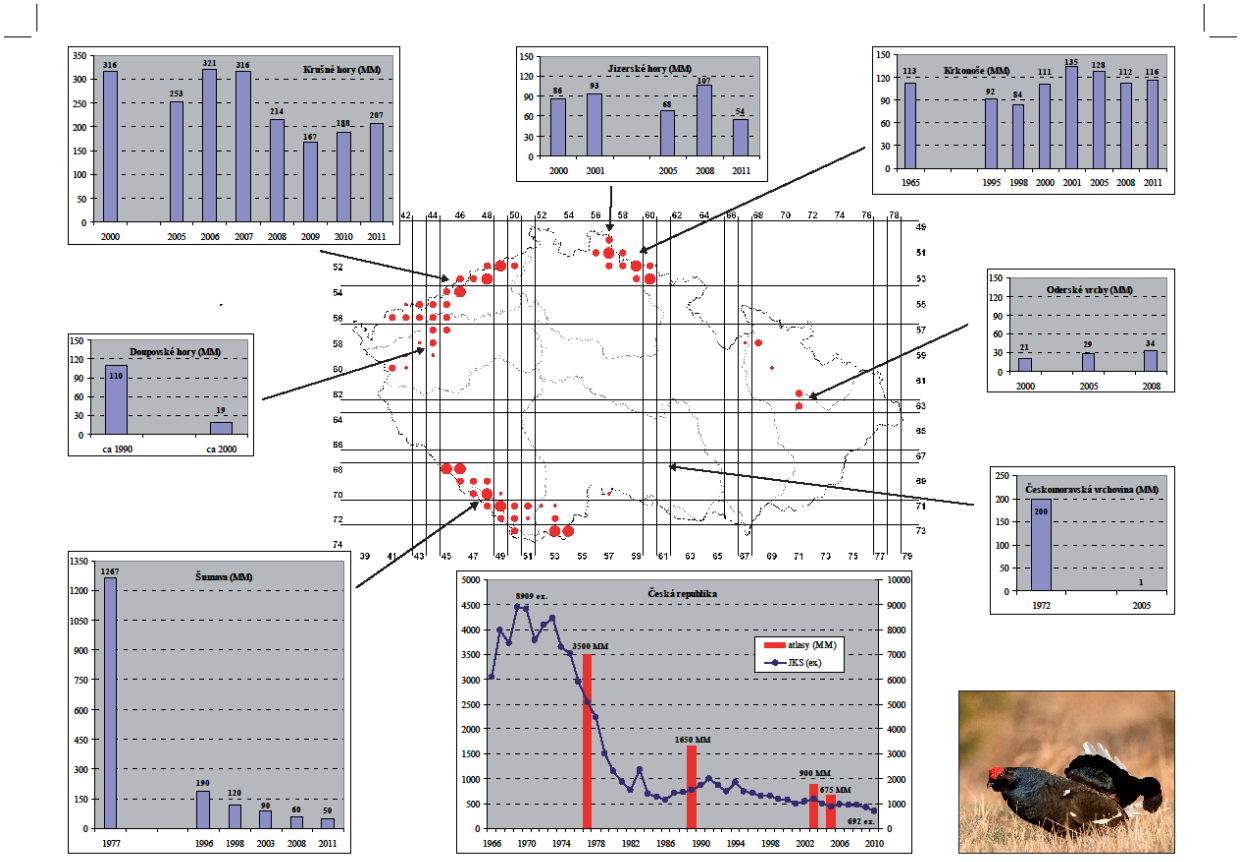
The most important negative factor in the past – ***air pollution*** – has impacted mountain ranges and their biodiversity (e.g. resulting in large-scale novel forest decline) mainly in northern part of the country roughly till the end of the last century. It may be considered solved recently (reduced emissions in N Bohemia, SE Germany and SW Poland) and quality of forest ecosystems is gradually improving, incl. slow changes in soil chemistry or recovery of forest plant and animal communities (e.g. lichens, birds, etc.).

Since the air pollution has been reduced, ***tourism and recreation*** have become the most important problem for biodiversity in Czech mountain ranges. Majority of them and the protected ones especially are very attractive for tourism and recreation. The most famous ski resorts are concentrated in both the NPs (Krkonose/Giant Mts, Sumava/Bohemian Forest) and several ski centers may be found in majority of PLAs. For example, the annual number of visitors is estimated at 5–6 million in the Krkonose/Giant Mts NP. They run very wide variety of summer and winter sport and recreation activities both in resorts and open nature (sometimes even illegally in core zones of the NP). There is a high pressure to build new chairlifts or increase capacities of the old ones (both bringing more people to mountain ridges), to build new ski pistes (usually at the expense of forests), to produce artificial snow for ski pistes (followed by changes in soil chemistry, composition of plant and animal communities, etc. and with increased noise and light pollution), to use open nature for free-riding activities (mountain biking, skialpinism, snowboarding, snowkiting, etc.). All the activities together heavily impact mountain biodiversity, esp. very sensitive tundra habitats

above the timberline (wide variety of disturbances, incl. trampling, spreading of invasive species, etc.), forest plant and animal communities, endangered/rare plant and animal species, etc. The black grouse (*Tetrao tetrix*) may serve as a good example (Figure 18). Its population in the country dropped by 90 % since the 1970s due to habitat changes especially, the species completely disappeared from lower elevations and isolated populations survive in mountains only. However, two subpopulations only (in the Krusne/Ore Mts and the Krkonose/Giant Mts) seem to be in favorable status with a potential for long-term survival. And both of them are in areas heavily affected by winter sports that are considered the most important negative factors for the black grouse recently.

Figure 18 shows the decline of the black grouse *Tetrao tetrix* in the Czech Republic and its population changes in single mountain areas.

Figure 18 – The decline trend of the black grouse (Tetrao tetrix) in the Czech Republic



Forest management in national parks is under responsibility of respective NP authorities. It is a valuable tool to support reconstruction of damaged forests (esp. in the Krkonose/Giant Mts NP), to make for natural species composition and age structure of forest stands, and subsequently to recover mountain forest biodiversity. However, there was hard discussion on forest management in the Sumava/Bohemian Forest NP during the last years. Activities of the local NP Administration that aims to reduce a large-scale outbreak of bark beetles (esp. *Ips typographus*), were not reasonable in some cases, e.g. use of insecticides or felling of infected

trees even in key areas of the NP that are important to protect some habitats and species (e.g. large mountain spruce forests unique in the European scale, or the last viable population of the capercaillie *Tetrao urogallus* in the country)[5], however the current situation became more stable and present NP Administration has decided to ban the use of insecticides in the most valuable areas.

Sustainable ***meadow management*** is a key tool to protect secondary montane meadows, habitats of European concern under the EU Habitats Directive. They were formed by mowing and grazing over several centuries and are very rich in biodiversity, incl. endemics. Bile Karpaty/White Carpathians and the Krkonose/Giant Mts are the most representative regions for these habitat types. Many management techniques are developed and practiced to protect flower-rich meadows in the former region[6], long-term meadow management is also a priority of the NP Administration in the latter one (incl. LIFE Corcontica, the ongoing LIFE11 NAT/CZ/000490 Project for 2012–18).

Mountains are considered the most vulnerable as regards *climate change*, which applies even for the Czech Republic (see Chapter 6 for more details). High attention is given to monitor mountain biodiversity under the impact of climate change, e.g. changes in species composition and phenology of plant communities in tundra habitats (the Krkonose/Giant Mts are included in networks of international GLORIA and ITEX projects), or altitudinal shifts of animals (e.g. ticks *Ixodes ricinus* or birds[7].

1.6. Biodiversity and climate change

1.6.1 Strategies and policies to manage biodiversity and climate change, financial mechanisms for adaptation and mitigation measures

Climate protection strategy of the Czech Republic is represented by the National Programme to Abate the Climate Change Impacts in the Czech Republic (hereinafter as "National Programme"), which was prepared according to the requirements set by the EU Council decision 99/296/EC and approved by the decision of the Government of the Czech Republic No. 187 dated 3 March 2004.

[5] Kindlmann P., Matejka K. & Dolezal P. 2012: The forests of the Sumava Mountains, bark beetle and nature conservation. Karolinum Praha: 381 pp.

[6] Jongepierova I. (ed.) 2008: Grasslands of the White Carpathian Mountains. ZO CSOP Bile Karpaty: 461 pp.

[7] Materna J., Daniel M., Metelka L. & Harcarik J. 2008. The vertical distribution, density and the development of the tick *Ixodes ricinus* in mountain areas influenced by climate changes (The Krkonose Mts., Czech Republic). Int. J. Medical Microbiol. 298 (S1): 25–37.
Reif J. & Flousek J. 2012: The role of species' ecological traits in climatically driven altitudinal range shifts of central European birds. Oikos 121: 1053–1060.

Based on the Government decision No. 395 dated on 6. 4. 2005, the National Programme was evaluated in 2007 with respect to the environmental potential and economic impacts of the adopted measures, i.e. comparing the initial situation and decrease of greenhouse gas emissions since the adoption of the National Programme. On 16. 4. 2008 the review was approved by the Government of the Czech Republic.

Currently a new document "Climate Protection Policy" is being prepared, which should replace the National Programme. The document is to be presented in 2014 / 2015. It will also include an updated strategy of climate protection and proposal of measures to efficiently decrease the greenhouse gas emissions.

Based on the Government decision No.1452 dated on 30. 11. 2009, also a Climate Change Adaptation Strategy of the Czech Republic is being prepared. This document is based on the White Paper of the European Commission "**Adapting to Climate Change: Towards a European Framework for Action"** (2009) and follows the Communication of the European Commission –EU Strategy on adaptation to climate change (2013). The Adaptation Strategy of the Czech Republic has been adjusted to specific conditions prevalent in the Czech Republic and its objective is to reduce anticipated climate change impacts, adapt to these impacts, maintain good living conditions and develop economic potential for the future generations. The support of measures for adaptation to negative impacts of climate change is also one of the priorities of the State Environmental Policy 2012-2020.

Creation and implementation of strategic documents (mitigation and adaptation) is an integral part of obligations adopted within the UN Framework Convention on Climate Change (UNFCCC).

Supporting financial mechanisms

Biodiversity protection measures, which have so far been supported from national and European programmes, focus on maintenance and increase in the number of various species, ecosystem protection and creation of suitable conditions for their further existence, protection and support of biodiversity *in situ*, optimisation of water regime, reducing climate change effects on ecosystems, increased adaptive ability of ecosystems and species especially with regard to increasing fragmentation of landscape and care for handicapped animals.

A large part of these measures is already funded from national subsidy programmes (such as Programme of renewal of the natural functions of the landscape, Landscape Programme, "Administration of Vested State Property in Special Protected Areas").

These measures are also supported by the Operational Programme Environment, during its programming period 2007 – 2013 and within the Priority Axis 6 - Improving the State of Nature and the Landscape.

The future programming period of the Operational Programme Environment will emphasize measures aiming to strengthen eco-stabilization functions of the landscape, especially restoration of natural water regime, increase of close-to-nature landscape features and defragmentation of landscape.

1.6.2 Changes of biota and the occurring and expected climate change

Climate is the most dynamic part of natural environment and in the Czech Republic, there is relatively high weather and climate variability over time. In addition, surprisingly high habitat heterogeneity and a quite wide range of scenarios of the projected climate change make it difficult to precisely estimate the climate change impacts on biodiversity in the Czech Republic. Yet the currently used scenarios suppose certain warming, longer vegetation period, change in rainfall over the year, lack of moisture due to higher evapotranspiration (the sum of evaporation and respiration in a certain area) and increased frequency in extreme climatic phenomena such as droughts, storm rainfall and subsequent floods with high culmination flow volumes or even tornadoes (VAŠKŮ *l.c.*, PRETEL 2009, 2011). It is supposed that due to the expected increase of air temperature droughts and higher moisture deficiency may become more frequent, which would make the climate in the Czech Republic drier (ROŽNOVSKÝ *l.c.*).

In the Czech Republic, the main impacts of the projected climate change may be summed up as follows:

- Natural and semi-natural ecosystems will be affected by extinction of some species and spreading by other species including pathogenic and invasive alien species, also depending on latitude and altitude;
- Due to the mosaic character of landscape and small habitat patches and quite small size of the Czech Republic itself, there can be supposed significant changes or even disappearance in some natural and semi-natural ecosystems regardless their location within the Czech Republic;
- Climate change will affect wild animal movement across the landscape (dispersal foraging for food, shelter and space for establishing new home ranges, migration);
- Managed artificial ecosystems will be threatened particularly at low elevations in the Czech Republic, where even now water availability is a limiting factor and increased occurrence of the existing pathogens and newly arriving pathogens is projected (MoE 2005).

Among the ecosystems most vulnerable to climate change in the Czech Republic, mountainous ecosystems and ecosystems formed by residual primary grasslands should be mentioned. It is supposed that climate change will affect particularly ecosystems above the tree line in all the three mountains ranges of the Czech Republic, where alpine habitats occur (the Krkonoše(/Giant Mts., Kralický Sněžník Mts., Hrubý Jeseník Mts.). They are also vulnerable due to their relatively small size (PLESNÍK 2009). Particularly in forest ecosystems there will be visible changes in altitudinal vegetation zonation (BUČEK & VLČKOVÁ 2009, 2011, HLÁSNY *et al.* 2011).

The Czech Republic will be probably influenced by the main shift in wild plant and animal which is projected to will occur across Europe, *i.e.* from Southwest to Northeast Europe. By

the late 21st century, the mean potential range shift relative to the late 20th century is by a distance of several hundred kilometres in a north-eastward direction, although some individual species' potential ranges are displaced in quite disparate directions and by distances in excess of 2,000 km. The mean rate of potential range shift is between a few times and more than an order of magnitude faster than past rates of range shift estimated from the Quaternary record or from historical data. Therefore, alpine wildlife species and subspecies will most likely become extinct as well taxa and functional/ecological groups (guilds) preferring microclimatically specific habitats (glacial cirques, raised peat-bogs, airborne sands). Mountain plant species and subspecies with the limited distribution ranges (mountain endemics, *e.g.* the hawkweed *Hieracium nivimontis*, the Sudeten Mountains Carthusian Pink (*Dianthus carthusianorum sudeticus*) or the Sudeten Mountains Bohemian Bellflower (*Campanula gelida*) will be most negatively affected by climate change (PLESNÍK 2009). Of 431 plant species, occurring in the Czech Republic, Slovakia and Hungary and studied within the European vegetation model EUROMOVE, 40 are projected to disappear by 2100. On the other hand, 84 plant species will newly colonised the above three Central European countries (BAKKENES *et al.* 2006).

Concerning climate change impacts on biota, birds are one of the best studied taxa or ecological/functional group in the Czech Republic. Comparison of changes in bird community structure in 10 European countries including the Czech Republic based on arious climate change scenarios does not show a significant change. According to the authors of the Climatic Atlas of European Breeding Birds by the end of the 21st century the Czech Republic will no longer be a nesting territory for particularly the species, whose current distribution range centre is located in Northern Europe, such as the Tengmalm´s Owl (*Aegolius funereus*) or the Pied Flycatcher (*Ficedula hypoleuca*). On the other hand, *e.g.* the European Bee-eater (*Merops apiaster*) will colonize most of the Czech Republic during the same time frame (HUNTLEY *et al.* 2007, 2008). The Climate Impact Indicator (CII), measuring climate change impacts on common bird species populations, shows a growing impact of climate change on bird populations in the Czech Republic. After a period of sharp increase in the indicator due to significant climate change, on the turn of the millennium the situation has stabilised however there has been a great difference in the relative numbers of southerly and northerly species (ZEDEK *et al.l.c.*). The results of an analysis based on large-scale monitoring data (103 bird species, monitored from 1982 to 2006) showed that bird species with more northern latitudinal distributions had more negative population trends in the Czech Republic, particularly compared to southern species. The effect of climate change remained significant when habitat requirements (habitat selection) and the migratory strategy of each species were controlled and is even stronger than species phylogenetic relationships (REIF *et al.* 2008, 2009).

The distribution range shift analysis in 119 butterfly species on the territory what is now the Czech Republic in 1950 - 2001 revealed that altitude shifts in the distribution of Czech butterflies are already detectable on the coarse scales of standard distribution maps (grids 11.1 x 12 km, KONVIČKA *et al.* 2003). Even though distribution range in most butterfly species has been declining in the Czech Republic, recently also arrival of new species has been observed,

mostly spreading from the South and partly from the West, which is usually explained as a result of climate change. Not only common species, but also some formerly rare species are arriving, *e.g.* the Scarce Swallowtail (*Iphiclides podalirius*) or the Great Banded Grayling (*Brintesia circe*). Thus, some butterfly species are coming back, whose habitats were destroyed by man in the past, but which are able to find a new suitable place under the present warmer climate (MIKO & HOŠEK *l.c.*).

In some more southerly, namely Pannoninan species (*e.g.*. the European Praying Mantis *Mantis religiosa*, European Bee-eater *Merops apiaster*, Golden Jackal *Canis aureus*), it has been questionable whether their apparent distribution shifts towards the north in the Czech Republic can be attributed to climate change or to which extent has been caused by time-to-time repeated natural fluctuations or pulsations in their distribution range.

Changes in distribution range and occurrence seasonality caused by climate change occur also in economically and epidemiologically significant species. The Czech Republic and Sweden have recorded shifts in the Common Tick (*Ixodes ricinus*) distribution northwards or to higher altitudes. Yet the recently reported higher incidence of tick-borne diseases in Europe cannot be explained only by climate change, because *e.g.* the rate of increase in tick-born encephalitis differs significantly in different parts of our continent (DANIEL *et al.* 2006). It is expected that *e.g.* the Colorado Potato Beetle (*Leptinotarsa decemlineata*) and European Corn Borer (*Ostrinia nubialis*, KOCMÁNKOVÁ *et al.* 2010) will shift their distribution to new areas. Extraordinary phenomena related to weather may affect the population dynamics of small mammals, which damage forest vegetation including seedlings (HOMOLKA *et al.* 2013).

An analysis of 254 records from nine European countries, including the Czech Republic, showed that most of the changes in timing of events during the year (phenological phenomena) was significantly related to average monthly temperature of the preceding two months. The earlier in spring the event is (*e.g.*, blooming or leafing or maturing in wild plants), the stronger the temperature effect was (MENZEL *et al.* 2006).

Climate change will also foster spreading of alien invasive species. While native species may dramatically decline both in numbers and distribution ranges or become extinct due to climate change and other biodiversity loss drivers, some of them will be replaced with a limited number of highly adaptive invasive alien species, which will lead to loss of biodiversity or to homogenisation of biota (PLESNÍK 2009). On the other hand, the above species dispersal models indicate, that also some up to now highly successful invasive alien species may decline or disappear: an example is the Japanese Knotweed (*Reynoutria japonica*), inhabiting, *inter alia*, the Czech Republic (BEERLING *et al.* 1995).

Biodiversity can be applied in adaptation of natural environment and human society to climate change. A list below presents of possible adaptation measures to promote biodiversity protection and its adaptation to the current and projected climate change, has been set up the Czech Republic, too (PELC 2009, 2010, PLESNÍK 2011b, PLESNÍK & PELC *l.c.*, PRETEL 2011):

1) Protection of primary or semi-natural forests including old-growth ones and increasing of species, age, spatial and genetic diversity of forest ecosystems;

2) Peat-bog conservation and restoration;
3) Conservation of various habitat/ecosystem types in the wider, non-reserve landscape to complement the habitats/ecosystems in Specially Protected Areas and also raise awareness and support of owners and land managers for implementation of climate change adaptation measures in the wider landscape;
4) Promoting restoration of landscape features such as field balks and margins, hedgerows. groves, alleys, small water reservoirs, fishpond systems, springs, wetlands and to their appropriate management;
5) Promoting near-natural method of watercourse restoration, grassing over potential areas of concentrated surface runoff and reforestation/afforestation of the selected areas
6) Improving landscape connectivity – establishing fully functioning national multi-level ecological network called the Territorial System of Ecological Stability of the Landscape (TSES), removal of barriers to dispersal of organisms through landscape, setting up small-size Specially Protected Areas next to each other;
7) Promoting erosion prevention and soil protecting measures on lands by slowing and reducing extensive surface run-off and reducing the flow-rate of waste and support to soil species richness and diversity with the help of suitable agrotechnological measures and principles of the best agricultural practice;
8) Optimisation and enlargement of the current Specially Protected Area network, respecting the scenarios and models of projected distribution of wild plants, animals and other organisms;
9) Reducing the impacts of other biodiversity loss drivers (natural habitat fragmentation, degradation and destruction resulting in their loss, direct persecution by man and overexploitation of the target species and other taxa populations, contamination of the environment by pollution, eutrophication or biological invasions);
10) Limiting large-scale production of liquid biofuels (the 1st generation biofuels, also known as agrofuels);
11) Promoting establishment of new green spaces including insulation greenery in urban environment and management of them, wider use of semi-vegetation shaped bricks and other building features with vegetation such as green roofs or walls, *etc.*;
12) Research of organism responses to climate change and on efficiency of implemented measures.

1.7. Protected areas, species and NATURA 2000 Network

1.7.1 General territorial protection

General protection of nature and the landscape provides legal protection for the entire territory of the Czech Republic, using a number of instruments – territorial systems of ecological stability, important landscape features, character of landscape, natural parks, and

provisionally protected areas. ***Any changes in the basic system of territorial protection of nature have been done since the 4th NR in 2009.***

According to Act No. 114/1992 Sb., on the Protection of Nature and the Landscape all species of fauna and flora are protected against destruction, harm, collection or capture - that means activities, which might endanger their existence or cause their degeneration, disrupt the reproductive ability, and bring about the species' population extinction or the ecosystem destruction. The most important instruments for general species legal protection include the protection of wild birds and species of trees growing outside forests.

The most important instruments for nature and landscape protection include territorial protection, ensured by established Specially Protected Areas. These are declared in accordance with Act No. 114/1992 Sb., on the Protection of Nature and the Landscape. In most cases, these include localities with unique or representative biodiversity, i.e. at the species, populations and communities' levels, areas with unique geological structure, areas representing the characteristic features of the character of the cultural landscape and areas significant for scientific research. The Act on the Protection of Nature and the Landscape specifies six categories of Specially Protected Areas - National Parks (NP), Protected Landscape Areas (PLA), National Nature Reserves (NNR), Nature Reserves (NR), National Nature Monuments (NNM) and Nature Monuments (NM).

Figure 19 – Large-scale specially protected areas in the Czech Republic

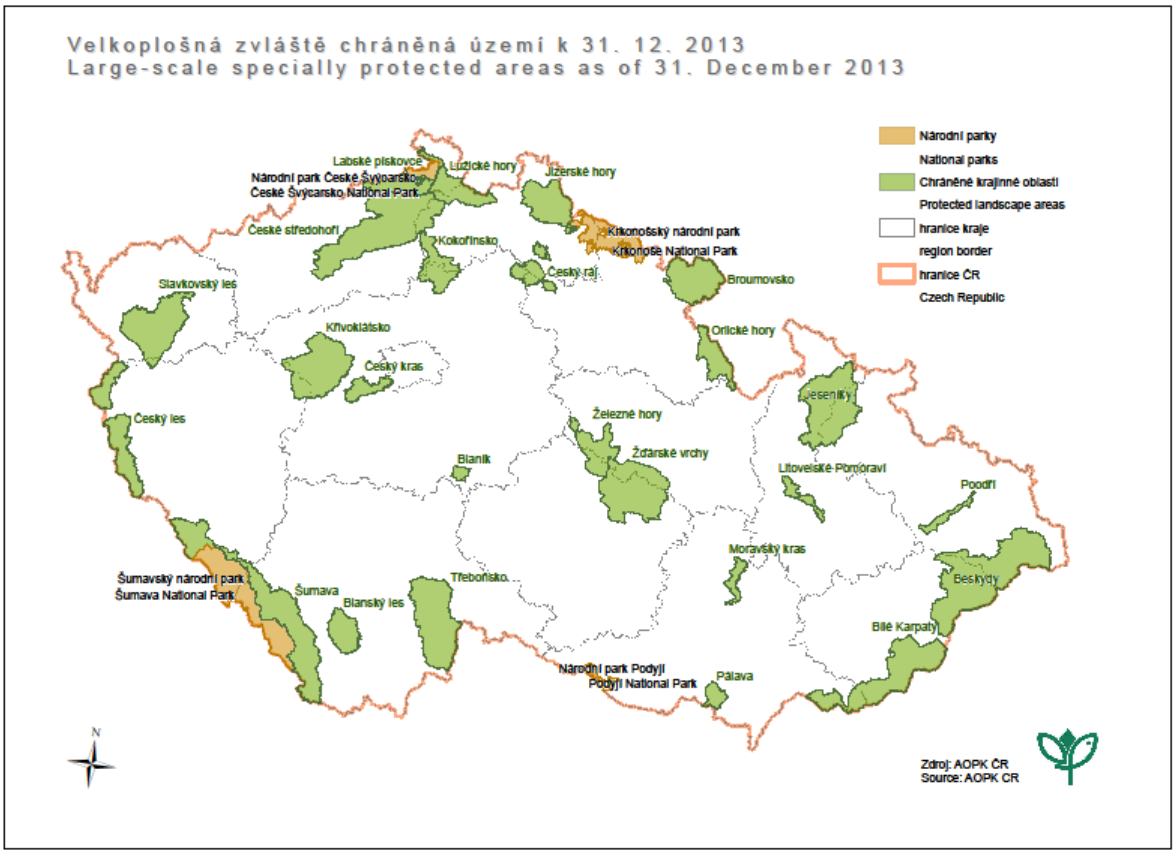
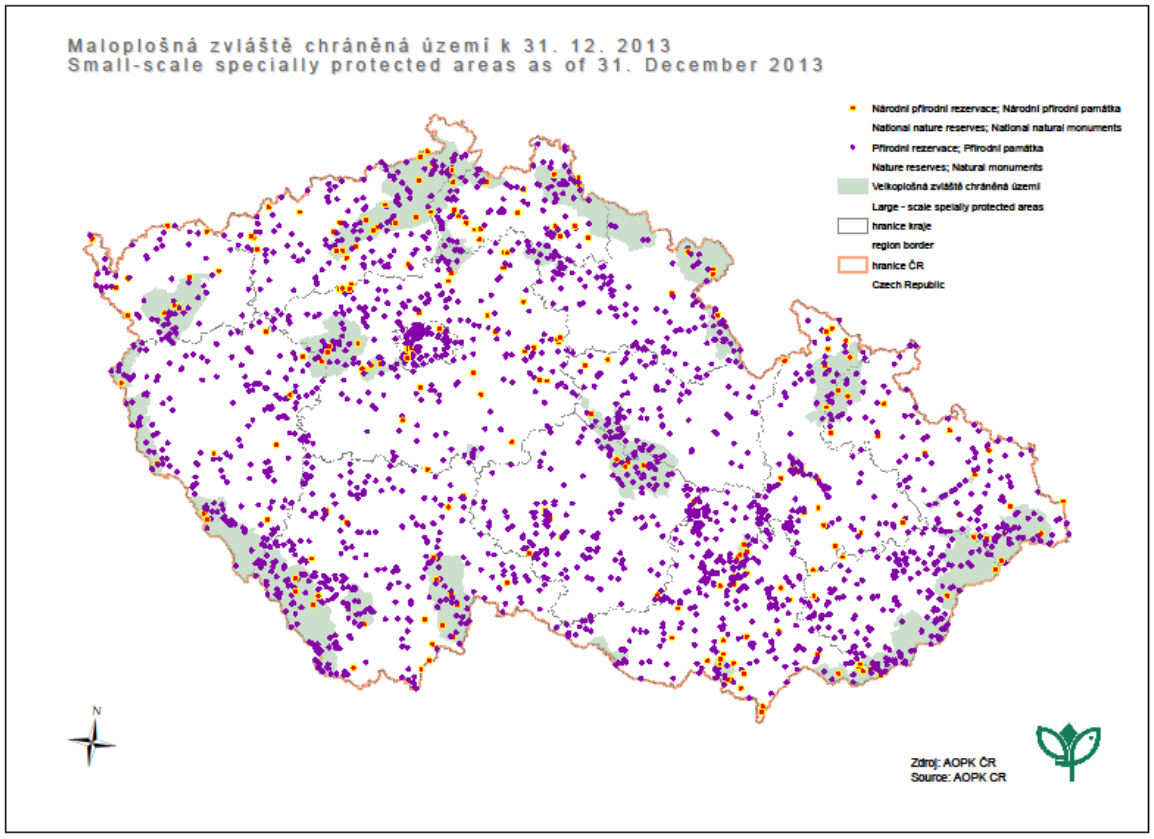


Figure 20 – Small-scale specially protected areas in the Czech Republic



1.7.2 Natura 2000 Network

According to the Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora sites of community importance shall be proposed for natural habitat types in Annex I and species in Annex II of the Directive. The SCIs include 61 natural habitat types, 40 species of wild flora and 80 species of wild fauna. The **Sites of Community Importance** in the Czech Republic were summed in the so-called National List, which was approved by the Government as a whole and published as Government Regulation no. 318/2013 Coll. (amending former Regulation no.132/2005 Coll., as amended). The **National List** is divided into two parts according to the biogeographic zones present in the Czech Republic: **Pannonian** (covering most of South Moravian Region and a part of Zlín Region- 4 % of the Czech Republic's territory), and **Continental** (96 % of the Czech Republic's territory).

The Czech National List of the SCIs is considered as almost complete. There several sites which are discussed to be added in the National list. The total number of SCIs in the Czech National List is 1075. The SCIs are protected as a specially protected area according to the Act on Nature and Landscape Protection in one of the six categories (national park, protected landscape area, national nature reserves, nature reserves, national natural monuments, and natural monuments) or by contractual protection or under basic protection pursuant to the provision of section 45c of Act no. 114/1992 Coll., on Nature and Landscape Protection.

In order to maintain or improve the preserved status of the subject of protection in the SCIs the set of recommended measures for each site is elaborated. A regular monitoring of conservation status of natural habitat types and species is set up and its main results are concluded in the six year report under the Art. 17 of the Habitat Directive. Last report has been compiled for the reporting period 2007-2013.

Figure 21 – Natura 2000 Sites in the Czech Republic

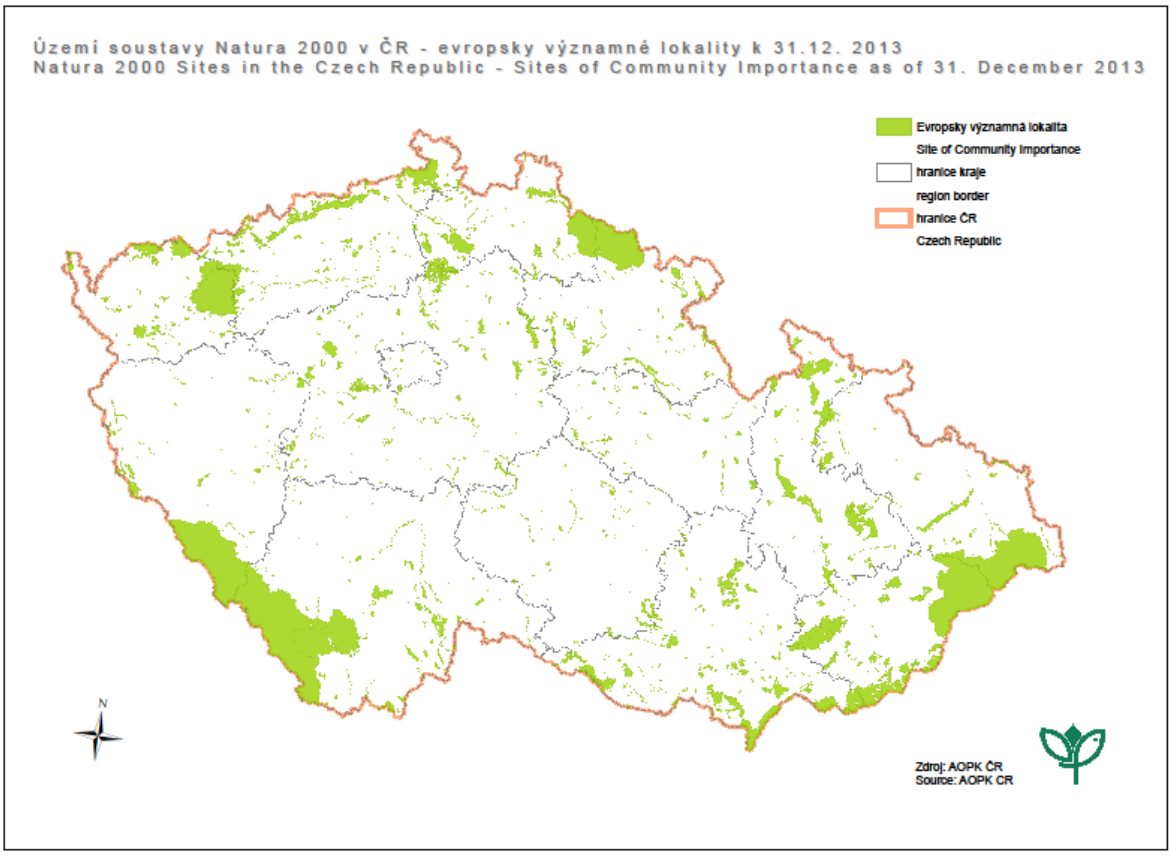


Table 7 - Protected areas of the Czech Republic in 2014

Category	Number	Area (ha)	Land cover (%)
National parks	4	119 489,00	1,51
Protected landscape areas	25	1 086 737,30	13,77
Large-scale specially protected areas	*29*	*1 206 226,30*	*15,28*
National natural monuments	113	4 520,89	0,05
National nature reserves	110	28 138,51	0,35
Natural monuments	1358	27 285,13	0,34
Nature reserves	808	41 010,87	0,51
Small-scale specially protected areas	*2389*	*100 955,40*	*1,25*
Specially protected areas	2418	1 255	15,88

		222,41	
Special Protection Areas	41	703 430,12	8,91
Sites of Community Importance	1087	785 576,14	9,96

1.7.3 Species protection and preservation programmes

Species preservation programmes for specially protected species of flora and fauna attempt to establish conditions permitting management of their populations leading towards reducing the risk of their endangerment. In 2014 was approved a new complex Conception of preservation programmes on endangered species, which contents and specifies priorities and general approach for action and management plans as well as actualised list of endangered species for preparation of other preservation and rescue programmes.

Below presented preservation programmes (action plans and management plans) have been implemented since the 4th National Report was submitted:

In 2009 was approved management plan for protection of **Eurasian Otter** (*Lutra lutra*);
In 2011 was adopted preservation programme for **Bohemian Early Gentian** (*Gentianella praecox* **subsp.** *Bohemica);*
In 2012 was finished preservation programme for **Spring Gentian** *(Gentiana verna),* when the mountains population are protected by appropriate management plans, one populations in lowland is without genetic variability and its conditions are unsustainable);
In 2013 was adopted preservation programme for **European Beaver** (*Castor fiber*) and in the same year was updated preservation programme for **Freshwater Pearlmussel** *(Margaritifera margaritifera).*

In the years 2014-16 the implementation of preservation programmes will be supported through EEA funds (support of implementation of measures of one existing and nine new preservation programmes). A programme of care (large carnivores) and update of 2 oldest programmes (Angelica and pondweed) shall be realised in two next years.

CHAPTER 2

NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN (NBSAP), THEIR IMPLEMENTATION AND REFLECTING BIODIVERSITY PROTECTION IN OTHER SECTORS

The 2005 – 2015 National Biodiversity Strategy (NBSAP) was adopted in 2005 (government decision No. 620/2005). All the information about the process of its creation and adoption is available in the 4th National Report of the Czech Republic to the CBD prepared in 2009[8]. Since it was prepared in 2005, the 2005-2015 strategy does not fully reflect the current international objectives in biodiversity conservation such as the CBD Strategic Plan 2011 - 2020 and its Aichi Targets.

All the current global objectives such as the Aichi Targets shall be included into the updated NBSAP covering the period of 2015 – 2025.

The 2005 - 2015 strategy is divided into on two major parts. The first one deals with strategic issues essential for biodiversity conservation in the Czech Republic, such as special protected areas (biodiversity conservation *in situ*), genetic resources and ABS, research and monitoring, economic aspects or biodiversity related public awareness and education. The second part deals with aspects of biodiversity in relation to different sectors and areas and related strategic documents, e.g. biodiversity conservation in agriculture, forestry, urban zoning plans, energetic policy and transportation. At the same time it covers specific objectives for the biodiversity components such as water and marsh ecosystem, mountain areas and grassland ecosystems. It also reflects cross-cutting themes such as the relationship of climate change and biodiversity or international cooperation in biodiversity conservation.

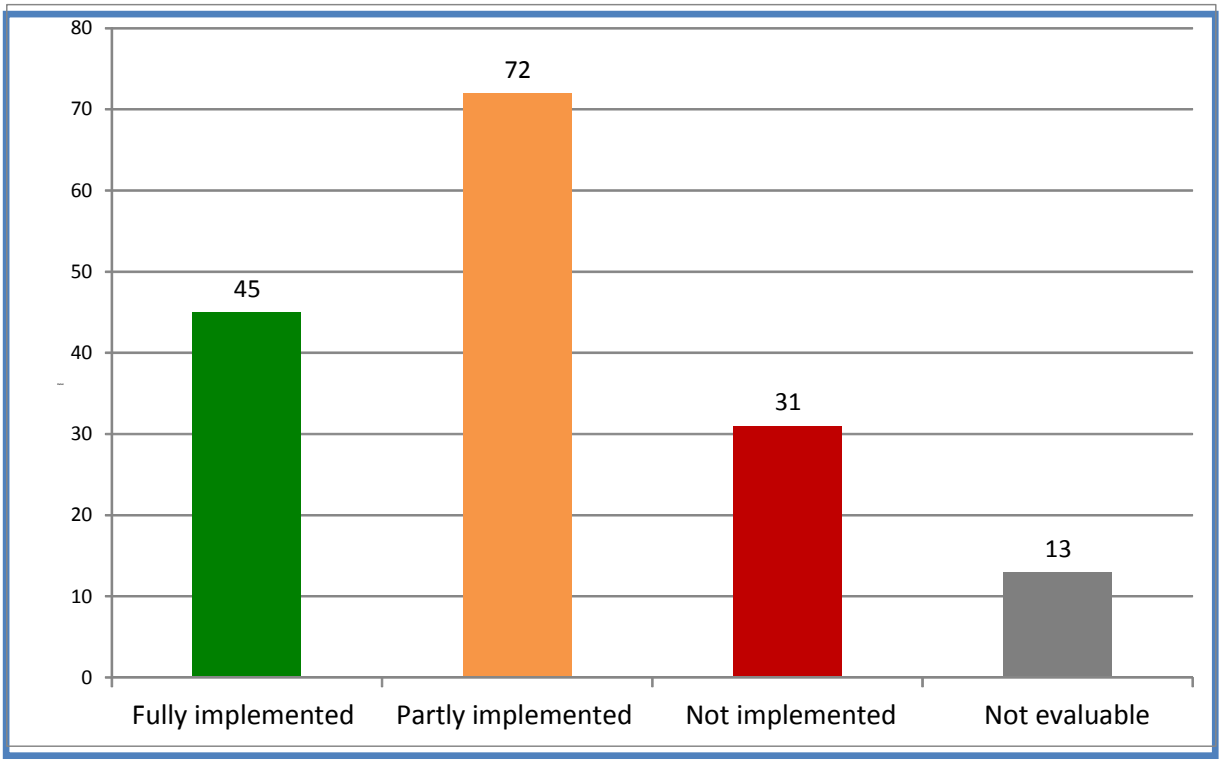
The strategy covers most of the thematic and cross-cutting programmes of the Convention, except those, which are not relevant for the Czech Republic.

In 2013 a detailed analysis of the performance of the objectives set in the strategy was conducted. The main conclusions of the analysis are:

The 2005 – 2015 Biodiversity Strategy contains 161 strategic objectives. Based on the assessment of the strategy we can consider 28% of the objectives as fulfilled, 45% objectives partially met and 19% of objectives not met, 8% of objectives cannot be evaluated (Fig. 22).

[8]The 4th National Report to the Convention on Biological Diversity, 2009, p. 64-65

Figure 22 - Overall assessment of the NBSAP strategic objectives.



Compared to the current situation the strategy contains relatively progressive objectives, continuously reflecting the developments in the conservation and sustainable use of biodiversity. Yet, in the light of international developments, a lot of the objectives are unsatisfactory and the strategy requires a major update, especially due to the strategic plans of the Biodiversity Convention for 2011 – 2020 and the Aichi Targets.

Tstrategy lacks some key concepts and visions (ecosystem services, biodiversity banking, ecosystem-based adaptations). The strategy also does not include framework strategic themes, which govern the overall direction of biodiversity conservation in the Czech Republic.

The Action Plan to fulfil the State Nature Conservation and Landscape Protection Programme of the Czech Republic (SNCLPP), partially overlaps and provides more details for individual objectives of the strategy. However SNCLPP was not prepared primarily as an Action Plan for the Strategy in the sense of article 6 of the Convention, but it was just another tool for landscape and nature conservation.

CHAPTER 3 provides more information on the inclusion and interconnection of the individual Aichi Targets with the current NBSAP in.

CHAPTER 3

PROGRESS IN ACHIEVING AICHI 2020 TARGETS

This chapter provides information on the present status of the implementation of the Strategic Plan 2011-2020 and the individual Aichi Targets. As stated in the previous chapter, the present NBSAP of the Czech Republic was prepared for the period of 2005-2015 so the Aichi Targets are not directly covered by it. In 2012 the Ministry of the Environment commissioned a detailed analysis of the individual Aichi Targets and how they are fulfilled or covered by national strategic documents. Based on this analysis and other findings (assessment of the present strategy, as provided in chapter 2) a detailed update of the strategy for 2015-2025 is being prepared. . The update shall reflect all the latest global biodiversity objectives relevant for the Czech Republic and set new priorities and a new framework for a new action plan.

The following part describes the current status of fulfilment of the individual Aichi objectives, their coverage by the existing documents on national level and recommendations for the method of its incorporation into the updated strategy.

From the perspective of the Czech Republic the strategic objectives 6, 10 and 13 are not relevant. Thus these objectives are not part of the below overview.

Strategic Goal A: „Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society“

Aichi Target 1: „By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably“

To meet this target, education and awareness raising at all levels is paramount. Though also family upbringing and pre-school and outside-school education have their importance, the core of the education system is created by elementary schools. The structure of elementary education is defined by the National Framework Education Programme. The biodiversity theme falls into several cross-cutting areas, especially Environmental Education. Biodiversity is there directly mentioned under the topic Ecosystems and Basic Conditions for Life. A relevant area is also the theme Man and Nature where biodiversity as such is not mentioned, although it is directly connected with the evolution and sustaining of habitable conditions on Earth. The term “ecosystem services” is not covered by the programmes at all, although several themes are directly related to it (“non-production importance of forests”, “ecosystem

functions"). State programmes and strategic documents[9] do not address the biodiversity value directly.

Apart from schools, people meet the biodiversity themes at different occasions, during awareness raising events, recreation or sports. Non-governmental organisations, museums, Protected Landscape Areas (PLA) play the main role in development of these activities. An example of successful models are periodic events such as "European (International) Bat Night" organised by ČESON (Czech Bat Conservation Society) or International Film Festival about Environment, Natural and Cultural Heritage called "Ecofilm" under the auspices of the Ministry of Environment. Activities and campaigns runby the Ministry of Environment and some NGOs are not the only ones which may contribute to raise public awareness about biodiversity and its importance.

Another potential lies in the involvement of public in the research and monitoring of biodiversity such as "citizen science", i.e. volunteers who take part in research projects. Since 1969 there has been a large programme of "Bat Counting at their Winter Sites in the Czech Republic" providing a unique overview of long-term trends in bat populations. There is also traditional monitoring in ornithology ("birdwatching"), withmany volunteers contributing with their observations to the Unified Bird Counting Programme (Czech: JPSP) and Waterfowl Species Monitoring since 1982. A lot of experts contribute to the "Mapping of Butterflies in the Czech Republic" organised by the Institute of Entomology in the Czech Academy of Sciences. Classical example of "citizen science" is volunteer meteorologists etc. Just like in many areas of interest, the awareness raising needs incentives and there is a strong need to offer active volunteers some options how to contribute.

At the EU level the information and education activities focus on the preparation of communication campaign about the Natura 2000 network. State Environmental Policy (SEP)[10] considers education as one of tools of the environmental policy implementation, however it does not set specific measurable objectives how to increase biodiversity value awareness. The objectives in NBSAP are formulated in a similar way, stipulated more specific recommendations, who to inform and address the public, but there is no detailed unified strategy yet.

Since the awareness about biodiversity conservation and about its sustainable use is closely related to the of availability of biodiversity related information , all measures should be focused on clear presentation of biodiversity related information , especially biodiversity in the Czech Republic, but also about global aspects of biodiversity conservation. A unified system making available the biodiversity related information to the wider public would help to involve citizens in active biodiversity conservation.

In order to meet the strategic objective 1, in 2013, the Czech Republic's Clearing-House Mechanism of the Convention on Biological Diversity (CHM) was updated and now it

[9]State Programme for Environmental Education in the Czech Republic

[10] State Environmental Policy (SEP) 2012 - 2020

provides more complex information in a more user-friendly form. Further update of the information system is planned for 2015.

Aichi Target 2: ***„By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems“***

One of the key problems of biodiversity conservation and ecosystem services is the fact, that the biodiversity conservation objectives have not been included into the strategies and concepts of the individual government departments. Thanks to the systematic work of the Ministry of the Environment, the Czech Republic managed to cover the biodiversity objectives or nature conservation objectives in most of the national strategies, concepts and programmes. In some of these strategic documents (e.g. National Strategic Plan of Rural Development) biodiversity plays a major role. Of course not all the strategies and processes contain quantitative objectives of biodiversity conservation. In this respect, there is a strong need to reflect current biodiversity targets while updating the sectorial strategies. However in general the Aichi Target 2 is being fulfilled.

Table 8 - Incorporation of biodiversity into strategic documents

Strategy/concept	Incorporation of biodiversity
Regional Development Strategy of the Czech Republic 2007-2013	It includes several measures in part P.5.1., especially "Strengthening of biodiversity and ecological stability in the Czech Republic".
National Strategy Plan for Rural Development of the Czech Republic 2007-2013	It includes an explicit part "Biodiversity" (1.3). Priority II.1 is biodiversity, sustaining and development of agricultural and forest systems with high natural value and of traditional farming landscape.
Transport Policy of the Czech Republic for 2014-2020 with an outlook to 2050	It deals especially with the impacts of transport infrastructure on fragmentation of ecosystems with the objective to "Minimise negative impact of transportation on… stability of ecosystems in landscape and their structure and functions, improving ecological connectivity allowing migration of wild animals ".
State Energy Concept of the Czech Republic	One of its priorities is "Ensuring friendly approach to environment and minimum impacts of energy production on nature and landscape", but most of its objectives are about lowering of emissions and efficiency of resource use.
National Forestry Programme to 2013	Key action 7: Sustaining and improving biodiversity in forests.
Strategy for Sustainable Development of the Czech Republic (2010)	Includes a priority axis No. 4 "Landscape, ecosystems and biodiversity", which includes several objectives focusing on the protection of landscape and various types of ecosystems, which are viewed here as the basic prerequisite for biodiversity conservation.
National Programme of Conservation and Use of Genetic Sources of Plants, Animals and Organisms Important for Food and Agriculture 2012-2016	Deals with biodiversity protection, especially agro-biodiversity. Objective 4 is to "create conditions for efficient and continuous use and spreading of agro-biodiversity and genetic sources ". Objective 7 undertakes to take part in international efforts to protect genetic sources and agro-biodiversity.
National Programme to Abate Climate Change in the Czech	Biodiversity protection is indirectly mentioned in chapter 2, which speaks about "active help to

Republic (2004)	endangered species" (endangered with climate change) and ecosystems.
Draft of the Climate Protection Policy in the Czech Republic (2009)	Biodiversity has more space here than in the 2004 document. Chapter 1.3.2. "Climate change impacts in the Czech Republic" has a sub-section "Biodiversity" which lists the most significant climate change impacts on biodiversity in the Czech Republic: mountain ecosystem vulnerability, alien invasive species arrival and even negative impact of some adaptation measures. It also mentions measures to abate vulnerability of biodiversity in agriculture and forestry.
Concept of the State Policy of tourism of the Czech Republic for 2007–2013	Biodiversity is listed here as one of key pre-requisites for the development of tourism. Sustainable forms of tourism should further strengthen biodiversity. (1.2). A SWOT analysis highlights the risk of underestimating the care for natural heritage and landscape character
State Programme of Environmental Education and Awareness in the Czech Republic (2000)	Biodiversity is indirectly covered by a number of measures, aiming at awareness raising on sustainable use of natural resources
Concept of Foreign Development Cooperation of the Czech Republic in 2010 - 2017	Foreign development aid also mentioned biodiversity conservation as far as environmental protection is concerned.

A specific topic is also dealing with biodiversity conservation at local level. While on national and regional level biodiversity related issues are quite well covered by different strategic documents, working with the biodiversity conservation and ecosystem services concept on local level still provides for a lot of opportunities but also risks. Implementation of the CBD on local level could still be improved compared to the national level, so there are lots of opportunities for change. On the level of regional administrative units strategic documents for nature and landscape conservation have been developed. An example is the Concept for Nature and Landscape Protection in Central Bohemia[11].

[11] http://www.kr-stredocesky.cz/portal/odbory/zivotni-prostredi-a-zemedelstvi/koncepce-v-oblasti-zp/Koncepce+ochrany+přírody+a+krajiny+Středočeského+kraje/koncepce-ochrany-prirody-a-krajiny-stredoceskeho-kraje.htm

EU Biodiversity Strategy uses the ecosystem services concept, i.e. how does human society benefit out of nature. By 2014 the ecosystem services should be mapped and economically assessed. State Environment Policy (SEP) uses indicators as tools for assessment of the policy implementation, though it does not set specific objectives for biodiversity or ecosystem services. NBSAP consistently sets objectives for development of biodiversity indicators. While updating the NBSAP it is necessary to reflect new strategic objectives and also link it to the EU Strategy. Also the ecosystem services accounting shall be developed. State Nature Conservation and Landscape Protection Programme of the Czech Republic (SNCLPP) is tied to NBSAP especially in monitoring and assessment of biodiversity components.

Aichi Target 3 ***„By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions"***

The structure of subsidies in different economic sectors (especially agriculture, forestry and fishing) often contributes to overexploitation of biodiversity and unnecessary pressure on ecosystems. Mentioned can be per area payments in agriculture e.g. compensation of damage caused by special protected species up to payments in the Landscape Protection Programme (PPK) and agro-environmental programmes. The NBSAP covered this theme quite consistently in the part related to Biodiversity and Economy. The main barrier is the lack of consistent approach while implementing some of the strategic objectives of NBSAP. Financial tools for biodiversity conservation are used inconsistently and not on a on a long term basis. As per the NBSAP recommendations a sound proposal for biodiversity financing supported by a qualitative and quantitative analysis is yet to be developed.

The EU Biodiversity Strategy 2020 intends to strengthen Payments for Ecosystem Services (PES). In the past there were attempts to at least partially assess the impact of environmentally harmful subsidies. The review of the EU Common Agricultural Policy (CAP) has shown that a lot of subsidies harmful to biodiversity subsidies occur especially in agriculture. This is why the standards of Good Agricultural and Environmental Conditions (GAEC) are introduced, setting fixed conditions for disbursement of direct payments. However there is no complex analysis of harmful subsidies identifying potential conflicts, or overlap of subsidies programmes negatively affecting biodiversity. No assessment of the existing programmes from the perspective of negative impacts on biodiversity has been conducted.

In 2013, the Ministry of the Environment commissioned a study aiming at a methodology to identify and tackle environmentally harmful subsidies.

Study Summary

In line with the Strategic Plan of the Convention on Biological Diversity, the Czech Republic should by 2020 eliminate or reform any environmentally harmful incentives or subsidies having a negative impact on biodiversity. The purpose of the study is to provide guidance on how to identify and reform any subsidies harmful to biodiversity. The study identifies the main problems related to negative impacts on biodiversity in agriculture and forestry, energy production and fossil fuels, water, fishing and transportation. The study uses the methodology employed by the Ministry of the Environment, Food and Rural Affairs (DEFRA) of the UK and it is based on the "system of signal lights". The whole method is based on preliminary screening (phase 0) and fours steps, in which the given subsidy is analysed gradually and the most suitable solution is recommended:

Phase 0 (screening of sectors): Significant threats to biodiversity are identified, especially in relation to key economic activities and sectors.

Phase 1 (analysis of subsidies): The main purpose of this phase is identification of the subsidies or incentives with increased likelihood of having significant impact on biodiversity and possibilities of their elimination or adjustments.

Phase 2 (deciding if elimination or adjustment is needed): The second phase helps to better understand, if the given subsidy needs adjustment (or removal) and if this step is justified.

Phase 3 (analysis of subsidy´s adjustment scenarios): The third phase proposes options for implementation of adjustments including their impact on biodiversity, economy and society

Phase 4 (call for action): The last phase of the analysis presents the whole adjustment in the context of current political situation. Based on this analysis a decision can be made i.e.: what is the best timing for the adjustment, is there a realistic chance for success, especially due to political and public support.

The whole procedure is explained on a case study on subsidies for electricity and heat production from landfill gas and sewage gas from wastewater treatment plants). The analysis uses 15 steps to explain the individual phases of the methodology how to identify and adjust or eliminate harmful subsidies. Since a lot of subsidies do not have a direct impact on biodiversity, the methodology and the signal light system allow identification and evaluation of subsidies´ harmfulness levels. Identification and assessment of harmfulness of a subsidy requires a standardised procedure, because only after taking all the steps required by the harmful subsidy assessment methodology we can decide the extent of harmfulness of the subsidy and start to adjust it systematically.

Systematic remedy of harmful subsidies requires not only their identification, but also their adjustment. In the view of this objective, the updated NBSAP 2015-2025 shall provide a basic overview of all identified harmful subsidies and shall provide details about the individual steps to eliminate them.

***Aichi Target 4** „By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits"*

This strategic target is directly related to a market mechanism supporting biodiversity conservation. Weakening of the drivers of biodiversity change requires strong feedback to the responsibility of companies and consumers for the products and limiting the impact of the production on biodiversity. The measures to decrease the negative impact on biodiversity may be an opportunity to introduce new market tools.

One of the few available documents aimed at consistent mapping of the relationship between business and biodiversity is the report of the Czech bio-platform[12]. An analysis of the relationship of the private and business sector and biodiversity conservation has shown big gaps. The starting point may be for example in the activities of WBCSD in the area of corporate assessment of ecosystems[13]. The objective of these activities is to make the businesses reflect potential ecosystem services degradation in their activities and also to assess the ecosystem services benefits. The European campaign "Business and Biodiversity"[14] is one of the examples. The program gathers information on good practices in business sector involvement t in biodiversity conservation and provides a platform communicating and spreading biodiversity conservation to business sector.

Strategic documents deal with Sustainable production and consumption only some extent but the impact of resource use on biodiversity and ecosystem services is not yet covered as it should.

The implementation of Aichi Target 4 thus appears to be one of the biggest gaps in the present biodiversity conservation at the national level as it is not sufficiently covered by national strategic documents. The 2014 review of the NBSAP provides for an excellent opportunity to improve the implementation of this target and to initiate systematic efforts to involve the business and private sector into the biodiversity and ecosystem services conservation. Sound analysis of the current situation, i.e.: how does the private sector reflect biodiversity and ecosystem conservation in their activities and what procedures and tools do they use.

One of the indicators recommended by the CBD Secretariat are trends in the ecological footprint. This indicator reflects total demand of the population on bio-capacity of the Earth. This indicator can be disaggregated to individual economic activities or sectors.

Another recommended indicator is trend of species endangered with extinction, which are economically exploited or which are traded internationally.

[12]Petřík, P. (Ed.), Smutný, M., Nondek, L., Vačkář, D**.,** Boháč, J., Zbořil, J., Hájek, M., Nebeský, M. (2008) Review on industry, business and biodiversity assessment in the Czech Republic. Czech Bioplatform, Institute of Botany, Academy of Sciences of the Czech Republic, Průhonice.

[13]WBCSD (2011) Guide to Corporate Ecosystem Valuation. World Business Council on Sustainable Development, Geneva.

[14]Business and Biodiversity Campaign, http://www.business-biodiversity.eu.

It is also recommended to monitor the extent to which biodiversity and ecosystem services are incorporated into accounting systems and reporting of companies and organisations.

These recommended indicators shall be part of the updated NBSAP.

Strategic Goal B "Reduce the direct pressures on biodiversity and promote sustainable use"

***Aichi Target 5** „By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced"*

It is expected, that if current trends continue, many habitats will be lost and there will be high extinction rate with drastic consequences for the society, if limit values are exceeded. Unless we take rapid steps to change current trends, a large number of ecosystem services derived from biodiversity will be lost.

Loss of natural habitats affects also the Czech Republic. For example the loss of near-natural grassland ecosystems is still relatively high. The area of natural meadows, marshes and moors decreased in 1990 – 2006 by 31 – 33 %. Most of these changes were caused by urban development and overgrowth by trees (see more in Chapter 1).

The EU Biodiversity Strategy deals with protection of species and habitats through Natura 2000 network. It is designed to avoid loss of natural habitats and to mitigate their degradation. The strategy requires the system to be completed by 2012 including management plans setting measures for active protection and restoration of protected areas. It also requires the habitats and species protection including necessary management measures to be incorporated into the key policies. These shall define the use of the land and water sources both within the Natura 2000 sites and also outside of them. Cross-border cooperation in the management of the system within the bio-geographic areas is also required.

The State Environmental Policy (SEP) emphasizes the need to tackle the landscape and watercourses fragmentation. According to SEP, landscape fragmentation leads to weakening of species´ populations species , disappearance of native species, degradation of ecosystems and their gradual unification for the benefit of invasive species, decrease in biological diversity, it also weakens the natural regenerative capacity of landscape and its potential to resist to increasing climate change driven extreme weather events.

As a solution, SEP proposes sustaining the necessary ecological functions of landscape, both by maintaining the existing ecologically stable areas as well as by supporting the increase and functional interconnection of such areas.

The main basis for conservation and even increase of biodiversity rate is to save biotopes and ecosystems and to create suitable conditions for their continuous existence. NBSAP thus has among others an objective to increase transparency of the existing protected areas and restore

the management planning according to the latest trends, which are based on standardised management plans and assessment of their results by an eco-system attitude to biodiversity protection *in situ.*

NBSAP also has an objective to create a mandatory monitoring system of species and habitats according to the habitat directive (92/43/EEC). Create a nation-wide biodiversity monitoring network with a central coordinating office, which would ensure long-term flow and assessment of data on biodiversity in the Czech Republic, especially in the form of long-term monitoring of ecosystems, which represent natural conditions and biological biodiversity in the Czech Republic from the view of Ecosystem Services. It is also considered necessary to incorporate biodiversity protection *in situ* into sector policies in the sense of sustainable development and cross-border cooperation in case of bilaterally protected areas should be supported just like in the EU Biodiversity Strategy.

NBSAP makes an independent assessment of forests including creation of a database of natural forests and a database of occupancy and types of biotopes of lower and higher plants and it intends to conserve or increase the present area of forests as a minimum basis to cover the needs of forest biodiversity conservation while safeguarding all the other forest functions.

NBSAP supports the features, which define landscape character and it defines it as a powerful tool for landscape affected by man. It intends to realise the remaining composition parts of TSES and to limit landscape fragmentation caused by migration barriers.

The updated State Nature Conservation and Landscape Protection Programme of the Czech Republic (SNCLPP) provides more tools to ensure efficient implementation landscape planning in the sense of the European Landscape Convention. It aims at updating the documentation and delimitation of the above-regional Territorial System of Ecological Stability of the Landscape (TSES). In biocenters of the TSES in state owned production forests which are not included into special protected areas, near-natural forms of management should be maintained or introduced. Define the public interest including nature protection functions and other non-production functions of forests in relation to special protected areas and to composition features of TSES by means of separate laws.

SNCLPP also demands implementation of measures for gradual elimination of watercourse fragmentation in line with the concept of making the river system of the Czech Republic navigable and intends to find the most important areas with large and diverse complexes of wet meadows, which will need to remain interconnected.

All these national objectives, directly related to Aichi Target 5, shall be revised during the update of NBSAP. The definition of objectives shall include a set of recommended measures and it shall also set a timetable for the implementation.

The revised national objectives concerning Aichi target 5 shall include new indicators, allowing more efficient monitoring of trend changes and achieving of objectives. It also will allow comparison of larger territorial units.

Among the newly set indicators there shall be for example:

- Trends in the share of damaged/endangered habitats
- Trends in the extent of selected ecosystems, biomes and natural habitats
- Trends in the status and vulnerability of ecosystems
- Population trends of species dependent from specific habitats
- Trends in the quantity and distribution of selected species
- Trends in the interconnection/fragmentation of ecosystems

It is also necessary to develop and use shared indicators for monitoring and assessment of the degradation of forests, forest biomass, forest health and forest products. Based on the NBSAP update, in relation with national objectives domestic legal framework and zoning plans or zoning maps would be reviewed and updated. New tools for zoning shall be used in order to protect natural habitats.

NBSAP shall also focus on monitoring of trends of density and distribution of selected species of animals and plants and on monitoring their genetic diversity.

In order to monitor landscape fragmentation such indicators shall be set which show the extent of fragmentation/connectivity of natural and semi-natural ecosystems, rate of forest fragmentation and which can evaluate the rate of fragmentation and regulation of watercourse systems as well.

Aichi Target 7 ***„By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity“***

Aichi Target 7 is reflected in the relevant national objectives of NBSAP, especially in the section which determines practical principles and a detailed manual of sustainable use of biodiversity components, as well as in the section which applies principles of ecosystem approach in the basic ecosystems and habitats in the Czech Republic into strategic materials of the Ministry of the Environment (MoE) and Ministry of Agriculture (MoA). NBSAP also requested monitoring and assessment of the impact of economic interference, conservation programmes and management plans on biodiversity, with a focus on forests, agriculture and aquatic ecosystems.

For the area of forest biodiversity exploitation, NBSAP defines, how the ecosystem approach principle should be applied, whereas also other, e.g. socio-economic aspects shall be considered. The defined objective was to prepare a strategy for further procedure, when alleviating the negative impacts o on forest biodiversity. Using the outcomes of the already commissioned study, methodology of status description and monitoring of forest ecosystem biodiversity shall be completed

SNCLPP emphasizes the need to establish and restore alluvial forests.

SEP emphasizes the need to minimize the threat to agricultural and forest soils caused by erosion and to limit and regulate contamination and other degradation of soils caused by human activities.

Agriculture is to a certain extent covered in all strategic documents dealing with this issue.

Almost all related strategic documents (EU Strategy, SOB, SNCLPP, SEP) set the environmental objectives for aquaticr ecosystems according to the Directive 2000/60/EC, setting a framework for activities inpolicy and creating national, integrated and complex monitoring system.

The assessment of Aichi Target 7 implementation is clearly limited by setting suitable indicators allowing verification of its fulfilment and of the adopted measures efficiency. NBSAP does not have indicators, which would allow an overall assessment of this target. In this respect the updated NBSAP shall clearly define the objectives and indicators, which should be achieved at the national level.

Appropriate selection and definition of indicators at the national level is crucial and shall reply i.e. on the following questions: what is considered as sustainable management, how does this management ensure biodiversity conservation. The updated NBSAP shall thus contain the following indicators:

Agricultural ecosystems

For areas related to agriculture there are clear indicators, which should be used to monitor how the Aichi Target 7 is being fulfilled. These are indicators tied to farming methods, e.g. nitrogen balance in agrarian systems, soil quality, genetic diversity of domestic animals, population changes in commercially exploited species and also changes in the volume of harvested materials and their production. An interesting indicator could also be monitoring of diversity of produced food. Ecological farming is also an indicator used to show trends in nature-friendly farming.

Aquatic ecosystems

A valuable indicator of changes in aquatic ecosystems is also the classical biological-chemical analysis of water quality in relation to water quality class assessment in the Czech Republic. Water management should also focus on changes in the quality of water in relation with fishpond areas. It is also necessary to monitor changes in the Czech freshwater fish production.

Forest ecosystems

The key component for the forest ecosystem assessment is continuing monitoring of changes in forest types and their composition. It is also necessary to certify the forest areas managed in a sustainable way. Other important indicators are level of forest degradation and changes in the forest production (in meaning of production of wood).

There are also other important indicators connected in general to all the three above areas: land use changes, share of products from sources managed in sustainable way, wellbeing and/or perception of existential security/poverty by the communities directly dependent on ecosystem services, rate of involvement of public and private sector into nature conservation measures etc. Most of these indicators shall be incorporated into the updated NBSAP.

***Aichi Target 8** „By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity"*

In general, the Aichi Target 8 is implemented quite well in national strategies, especially in the updated version of SEP (a number of proposed measures and selected objectives). This progress is closely linked to the fact, that the Czech Republic as one of the EU member states has transposed a number of directives and regulations into its own national legislation. The main focus of these measures is on air and water pollution. Heat and light pollution remain yet to be sufficiently addressed.

In compliance with the obligations arising from the membership of the Czech Republic in the European Union and as part of realisation of the individual directives a continuous assessment of the realised measures shall be conducted (e.g. minimization of selected emissions by 2020 according to the directive about national emission ceilings for some air pollutants or achieving at least good condition of surface and underground water by 2015 according to the water directive).

It would also be advisable to evaluate fulfilment of this strategic objective by a set of selected indicators. State Environmental Policy (SEP) defined several indicators in connection with the air and water pollution, which seem to be suitable. These are the following indicators: condition of surface and underground water resources (share of the water resources reaching or not reaching overall good condition), minimizing water pollution from surface sources (total area of the territory, implementation of measures minimizing pollution from surface sources), pollution of municipal wastewater (number of municipalities above 2 000 people according to the status of achievement of the requirements to drain sewage and clean wastewater), application of sludge from wastewater treatment plants on agricultural land (rate of samples with above-limit content of risky substances in sludge from wastewater treatment plants), number of contaminated areas, emissions of SO_2, NO_x, NH_3, VOC and $PM_{2.5}$ (comparison of emission changes since 2000 in kt/year, index: year 2000 = 100), share of land with exceeded pollution and target pollution limits, emissions of heavy metals and persistent organic substances (development of heavy metals and persistent organic substances since 2000 in kt/year, index: year 2000 = 100).

Aichi Target 9 ***„By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment“***

Inclusion of Aichi Target 9 into national strategic documents of the Czech Republic seems sufficient to some extent (even though they do not explicitly mention year 2020 as a deadline for extermination or suppression of the priority invasive alien species), but on the other hand, a number of measures are defined quite generally and not very specifically. The problem of invasive alien species is reflected in some legislative documents of the Czech Republic, for example the act. No. 114/1992 Coll. about protection of nature and landscape, act No. 326/2004 Coll., about herbal medicine, act No. 289/1995 Coll., about forests, act No. 449/2001 Coll., about hunting, act No. 254/2001 Coll. about water, act No. 99/2004 Coll. about fishing, public notice No. 215/2008 Coll. about measures against introduction and spreading of harmful organisms, plants and plant products. The baseline is the fact that the question of invasive alien species is not covered by a specialised act in Czech legislation yet.

EU Biodiversity Strategy considers the fight against invasive alien species as one of its priorities; due to missing mechanisms to align the approaches of the individual EU member countries a focused legislative tool is now being prepared as a regulation of the EU Council and European Parliament, which should come into force in 2014. It is expected that implementation of this regulation will significantly contribute to meet the Strategic Objective 9 on national and EU level.

IASs are covered by the existing national documents:

State Environment Policy of the Czech Republic (SEP) considers invasive alien species of plants and animals as one of the most serious and urgent problems. This document imposes an obligation to prepare a whole set of measures in order to limit the negative impact of invasive alien species. It is especially prevention, monitoring, early response, long-term regulation and also limiting the risk of spreading of alien species through trade and transportation, limiting their use and regulation within the rules of Good Agricultural and Environmental Conditions (GAEC) and realisation of programmes to suppress selected invasive alien species. By 2015, the legislative framework shall enter into force at the EU level, inconsistency among different legislative measures shall be eliminated and the environmental procedures should be interconnected with veterinary and phyto-sanitary regulations. The document proposes to create a unified information system on IAS, unify information on environmental conservation and phyto-sanitary and veterinary issues and connect the system to international databases by 2015. As part of its cooperation within EU and international structures, the document highlights the importance of regular monitoring and reporting, exchange and regular assessment of the reports.

Biodiversity Strategy of the Czech Republic (2005) can be considered as the most complex and detailed document at the national level dealing with the IAS issues. There is a special chapter A II. - Invasion species. It contains a list of international treaties and related Czech legislation. Its main purpose is “full and effective implementation of the CBD´s Article 8 (h)

and preparation and subsequent implementation of national binding rules in relation to invasive alien species on the basis of risk assessment, effects and trends in non-native species that threaten ecosystems, habitats and species are of the top priority. Procedures in management and handling of these organisms should be unified"; this objective is detailed in individual objectives from various aspects (e.g. conservation of biological diversity ex situ, ecosystem approach, individual ecosystem types, transportation). The strategy also names the main problematic issues concerning invasions to the Czech Republic (absence of a complex terminology, legislation, organisation and financial measures, absence of a generally accepted methodology of monitoring and liquidation, gaps in research financing, monitoring and mitigation, non-existence of penalties for introduction of invasion species , lack of public awareness on alien invasive species and related risks). It highlights the precautionary principle as the most important principle for efficient implementation of the Convention on Biological Diversity.

The updated SNCLPP sets several measures to limit further spread of already present alien species and their regulation and elimination. These measures are basically identical with the measures and objectives set in NBSAP and SEP of the Czech Republic.

The basic indicator of Aichi Target 9 is the number of documented invasive alien species on the territory of the Czech Republic. This indicator is also defined in the State Environment Policy (indicator: invasive species), where it reflects the total amount of invasive alien species and also the share of dangerous invasive species including the share of the species, against which measures are taken.

The CBD proposes 2 basic indicators for assessment of the objective: the number of invasive alien species in the territory and the cost (finances) spent on containing of the species.

According to other relevant sources[15] also investment into IAS related research can be an important step to achieve the Aichi Target 9 and can be thus considered as another indicator of fulfilment of the target.

Strategic goal C „To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity"

***Aichi Target 11** „By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes"*

[15]McGeoch, M. et al. (2010) Global indicators of biological invasion: species numbers, biodiversity impact, and policy responses. Divers.Distrib. 16, 95-108.

Protection of areas valuable for biodiversity and ecosystem services is reflected in European and national legislation. EU Biodiversity Strategy provides protection especially through the system of Natura 2000. In national strategies this issue is considered from the view of Territorial Systems of Ecological Stability of Landscape (TSES). This system focuses on zonal planning meanwhile the system of Natura 2000 consists from sites of Community importance, so called "Bird sites" and "Habitat Sites".

In 2011 Special Protected Areas (SPA) covered 16.49% of the Czech Republic. Natura 2000 sites covered 18% of the Czech Republic and they largely overlap the SPA. The SPA share of the Czech Republic territory is very close to the global CBD target (17%). Yet it would be advisable to conduct a more complex assessment of the efficiency, representation and quality of the subject of the protection in these protected areas – see the current status in chapter 1.7 (see Table 7).

The Aichi Target 11 is also closely connected with Action 1 of the EU Biodiversity Strategy. It deals with the completion of the Natura 2000 system and aims at ensuring its proper management. Member states must ensure timely preparation and realisation of maintenance plans for Natura 2000 sites and with the help of the European Commission they must implement procedures to share experience and promote cross-border cooperation in the Natura 2000 system management. The Action 2 of the EU Biodiversity Strategy deals with ensuring adequate financing for the Natura 2000 and the Action 6 is connected with setting priorities for restoration of ecosystems on local, national and European level and support to green infrastructure.

State Environment Policy of the Czech Republic (SEP) states that it is crucial to ensure preservation of the necessary ecological functions of landscape. This can be done through the protection of the existing ecologically stable areas, through extending and functional interconnection of such areas in the landscape or through improving conditions for the Territorial System of Ecological Stability (TSES) implementation. Creation of a legislative framework regulating zonal planning and land use changes is one of the objectives for optimisation of legislative tools for nature and landscape protection.

NBSAP mentions TSES as an important tool to ensure proper conditions for conservation and improvement of biodiversity. TSES is managed on three interconnected levels – above-regional, regional and local. One of the identified problems of TSES is insufficient mechanism for protection and restoration of composition features (biocenters, bio-corridors, interaction elements) of TSES on all its levels, as well as inconsistent preparation of zoning plans documentations (general plans) of local TSES.

NBSAP also recommends assessment of the existing system of protected areas. This system was developed over the past decades and might needs optimisation. Its efficiency is related to the standardisation of approaches to management plan preparations, ensuring quality management of protected areas and assessment of its outcomes, while using the principles of ecosystem approach to *in situ* biodiversity conservation. Improved management plans and the optimisation of the system of Special Protected Areas (SPA) from the perspective of

representative share and quality of reasons and objectives for protection are one of the objectives of the State Nature Conservation and Landscape Protection Programme of the Czech Republic (SNCLPP).

Case study: Role of TSES in nature and landscape protection

Territorial System of Ecological Stability (TSES) is a specific system of protection of landscape and nature in the Czech Republic, which was created in late 1970s as a response to landscape fragmentation and loss of natural habitats.

According to the act No. 114/1992 Coll. § 3 letter a), about landscape and nature protection, TSES is defined as an interconnected set of natural and also modified but near-natural ecosystems maintaining natural balance in the landscape. There are distinguished local, regional and above-regional systems of ecological stability.

The main objective of TSES is strengthening of ecological stability of landscape by conserving or restoring of stable ecosystems and their interconnections. TSES has three components: bio-centers, bio-corridors and interaction features.

Creating TSES is in public interest, to which land owners, municipalities and government contribute jointly. The Nature and Landscape Protection Act also calls protection and creation of TSES as one of the main tools of landscape and nature protection.

TSES is part of all newly created zoning plan documentations, not only zoning plans but also principles of zoning and it is implemented in the zoning plan process.

TSES is a territorial network of relatively ecologically stable areas, which integrates nature conservation into wider landscape units and relevant sectors and actually forms a green infrastructure. In most of the Czech Republic TSES are defined as a proposal. Selected parts of TSES are part of EECONET, but the concept of European Ecologic Network is currently not being further developed.

In order to implement Objective 11 the protected areas, or TSES, should include special important areas, important for biodiversity or ecosystem services, create ecological networks, be ecologically representative, efficiently managed and especially connected to landscape bodies and form a green infrastructure.

The updated NBSAP (2015 - 2025) shall include an assessment of how efficient and representative the system of protected areas is. It will also introduce standardised procedures to prepare management plans, realisation of management plans in protected areas, and how to assess management outcomes, while using ecosystem approach principles.

Aichi Target 12 "By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained"

Aichi Target 12 is covered by European and national legislation quite sufficiently. In order to meet this objective, EU Strategy defines and quantifies targets for improvement of the condition of species and habitats. National strategic documents provide rather qualitative assessment in this respect.

According to the act No. 114/1992 about protection of nature and landscape, all species in the Czech Republic are protected. Supplement II and III of the public notice No. 395/1992 as amended by the public notice No. 175/2006 Coll., includes a list of special protected species of plants and animals in the Czech Republic. Specially protected species are divided according to the level of endangerment to critically endangered, strongly endangered and endangered.

Protected species are also listed in Council Directive 92/43/EEC on the conservation of natural habitats and wild fauna and flora sites of community importance. (see Chapter 1.7)

State Environment Policy (SEP) states, that roughly one third of species in the Czech Republic is evaluated as endangered with extinction.

NBSAP focuses on protection of species especially from the perspective of monitoring, assessment of trends in the species and ecosystem behaviour, collection of knowledge in national ecosystem and species databases, which shall be used in methodical manuals for maintenance of protected areas, endangered species rescue programs and ecosystems. Conservation of biotopes and ecosystems and creation of suitable conditions for their continued existence is the main basis for sustaining and increasing of the number of species.

One of the main objectives of SNCLPP is sustaining sufficient number of wild plants and animals in natural populations of high genetic quality.

Aichi Target 13 "By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity"

At the national level, Aichi Target 13 is fulfilled by two basic legislative norms – the act No. 148/2003 Coll. about conservation and use of genetic resources of plants and micro-organisms important for food and agriculture and about change in the act No. 368/1992 Coll., about administrative fees, as amended (Plant and Microorganism Genetic Sources Act) and act No. 154/2000 Coll., about cultivation, breeding and registry of farm animals and about change of some related acts (e.g. Breeding Act). The conditions in all these acts and their

implementing regulations are carried out within the National Programme on Conservation and Utilisation of Plant, Animal and Microbial Genetic Resources for Food and Agriculture.

The act No. 148/2003 Coll., about genetic resources of plants and microorganisms defines the conditions and procedures for protection, conservation and exploitation of genetic sources of plants and microorganisms in the Czech Republic and are important for food and agriculture, to maintain biological and genetic diversity of world natural heritage and to allow their use for the needs of present and future generations. These conditions and procedures are defined in the National Programme on Conservation and Utilisation of Plant, Animal and Microbial Genetic Resources for Food and Agriculture for 2012 – 2016.

Strategic Goal D "Enhance the benefits to all from biodiversity and ecosystem services"

Aichi Target 14 "By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable"

Ecosystem approach has been successfully used in many assessment studies and political documents at the national, European and global levels. One of the very useful studies of this kind is the global Millennium Ecosystem Assessment (MA)[16]. The outputs of MA confirm the essential importance of biodiversity, without which the MA objectives cannot be achieved.

However the objective arises especially from the concept of ecosystem services. This concept is not integrated into Czech studies and strategic documents or only to a very limited extent. From this perspective this strategic objective is not implemented sufficiently yet.

Aichi Target 14 is relatively well incorporated into national strategic and planning documents. This is because the protection of ecosystems, their interconnection and their sustainable use is an obligation of the Czech Republic arising also from other international conventions and EU legislation. Fulfilling these obligations is also in line with priorities of the Czech Republic itself in the field of nature and landscape protection. Aichi Target 14 is reflected especially in national documents such as State Environment Policy (2012), NBSAP (2005) and updated SNCLPP (2009). However it should be noted, the objectives in national documents tend to have the character of general recommendations without specification, how to achieve them.

The updated version of NBSAP (2015 – 2025) shall include the methodology of national assessment of ecosystems and their services and also a clear set of objectives in this matter. It shall define how the selected indicators monitoring changes in ecosystem services provision shall be used.

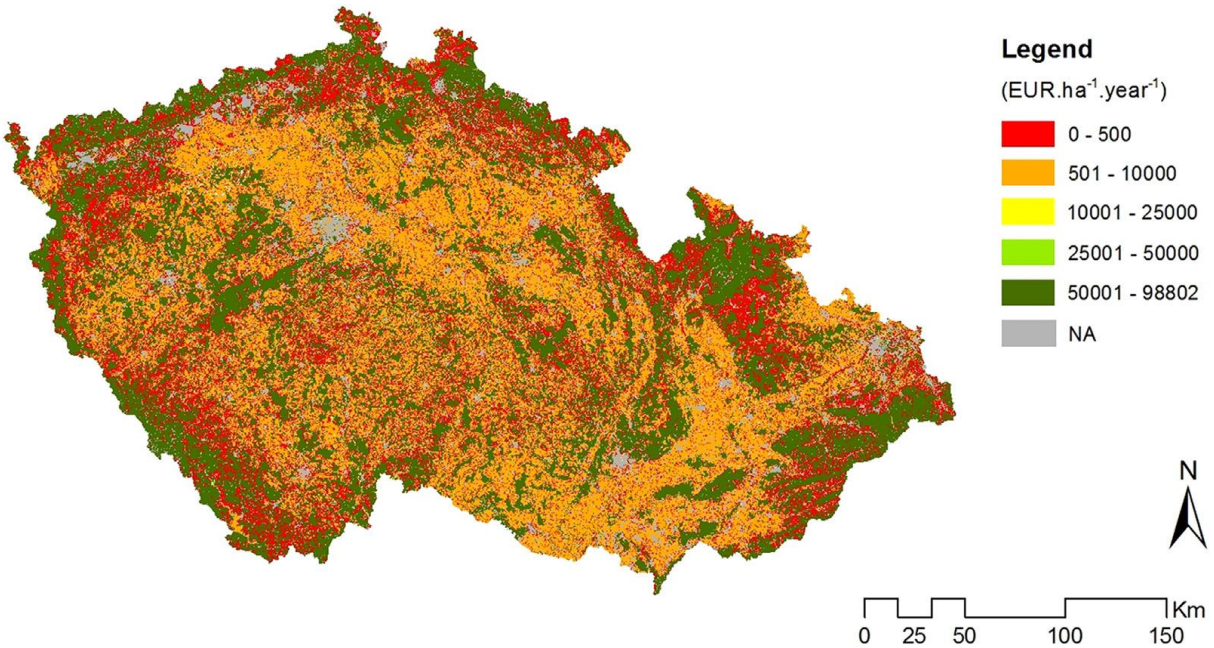
Case study: Integrated assessment of ecosystem services in the Czech Republic

[16]Millennium Ecosystem Assessment (2005) Ecosystems and human well-being: synthesis. Island Press, Washington DC.

Mainstreaming the concept of ecosystem services has been receiving increasing attention in recent years. Initially, most studies on ecosystem services assessments addressed global, sub-global or local levels. More recently, development of ecosystem services assessments at national level has been emphasized. Following this trend, integrated assessment of ecosystem services has been performed in the Czech Republic[17].

Study is aimed to identify and value ecosystem services delivered in the Czech Republic. To estimate the total value of Czech ecosystems was developed a geographically-specific database of ecosystem service values. The structure of the assessment is given by six ecosystem types (agricultural ecosystems, grasslands, forests, aquatic ecosystems, wetlands and urban areas) and 17 ecosystem services delivered from these ecosystems. Ecosystem types are further classified into 41 ecosystem categories based on a habitat approach. Specific literature review strategy was conducted to fill the database with biophysical and economic values of ecosystem services. Developed database consists of more than 190 values of ecosystem services, approximately half of them has been used for a benefit transfer to calculate total ecosystem values in the Czech Republic. The resulting average value of ecosystem services in the Czech Republic represents 1.5 the current national GNP (gross national product).

Figure 23 - Valuation map of ecosystems in the Czech Republic (source: Frélichová, J., et al., Integrated assessment of ecosystem services in the Czech Republic. Ecosystem Services (2014))



[17] Frélichová, J., et al., Integrated assessment of ecosystem services in the Czech Republic. Ecosystem Services (2014), http://dx.doi.org/10.1016/j.ecoser.2014.03.001i

Aichi Target 15 "By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification"

Ecosystems in the Czech Republic are protected especially through the system of protected areas (according to the act No. 114/1992 Coll. about protection of nature and landscape, and its implementing public notices 395/1992 Coll. and 64/2011 Coll.). The system covers almost 16 % of the Czech Republic (Miko et Hošek, 2009)[18] (see Chapter 1). There are distinguished two levels of Special Protected Areas (SPA, Czech: ZCHÚ): Special Protected Areas of Large Scale (Czech: VZCHÚ) and Special Protected Areas of Small Scale (Czech: MZCHÚ). Classification of SPAs defines the level (strictness) of protection and the regime of management. The management is carried out according to a valid Management Plan of the given SPA. As one of the EU member states, the Czech Republic has to define a system of Natura 2000 protected areas. Their management (bird areas and areas of European importance) shall follow the lists of recommended measures. Ecosystems located outside of the network of SPA and Natura 2000 are protected by the regime of "general protection" (according to the same act No. 114/1992 Coll). Apart from ecosystem protection in the sense of current conservation status there is also revitalisation (restoration) of altered or degraded ecosystems. Thanks to the government funding, EU subsidies and the involvement of non-profit sector these revitalisations are more and more frequent. A general example is revitalisation of aquatic and wetland ecosystem, restoration of wet meadows, mining areas and forest ecosystems damaged by immissions.

Aichi Target 15 is almost identically reflected in the EU Biodiversity Strategy. Through the requirement to introduce green infrastructure and restore at least 15% of damaged ecosystems the focus comes also to sustaining and reinforcing of ecosystems and their services. However the EU Strategy does not directly define the connection between climate change mitigation and fight the desertification.

In case of SEP (2012), the objective 15 is realised through the thematic of "Climate Change and Air Quality Improvement" and "Nature and Landscape Protection". Another document dealing with this topic is the National Programme to Mitigate the Climate Change Impacts in the Czech Republic, which is a partial analogy to the White Book of the EU from 2009. Its objective is to define the required adaptation measures, which can mitigate the expected impacts of climate change in the scale and conditions of the Czech Republic. The strategy uses sector-based approach, which allows easy identification of measures for individual types of ecosystems. It always evaluates climate change impact on the given ecosystem/sector, then adaptation measures are defined and their specific form is selected. Due to the general character of proposals and recommendations, the strong side of the proposed strategy is especially indication of climate change in the specific conditions of the Czech Republic.

[18]Miko, L. et Hošek, M. (eds.): Příroda a krajina České republiky. Zpráva o stavu 2009. 1st edition Prague. AOPK – Nature Conservancy Agency of the Czech Republic. 102 p.

The present NBSAP covers all the requirements set up by the Aichi Target 15. It mentions the need to increase ecosystem adaptive capacity, the need to protect, establish and restore ecologically important landscape segments and to take climate change into account. Other more detailed objectives are set in SNCLPP.

The updated NBSAP (2015) shall take into consideration the following recommendations:

- At the national level, define areas to represent 15% of restored ecosystems and also prepare a strategy on how to achieve the desirable conditions, including quantification of the expected financial costs. In the best case, the financial cost estimate should be calculated for the realisation scenario and for the "no action" scenario (e.g. cost of ecosystem services lost using simulation).
- Define (unified and internationally comparable) indicators to be used for monitoring of the ecosystem resilience capacity. Cooperate with relevant authorities such as the Ministry for Industry and Trade to select options and rules for spontaneous development after renewal versus technical recultivation[19].

Case study: Involvement of private sector in the implementation of revitalisation measures in the Czech Republic

Nature conservation and related revitalisation measures are primarily considered as the state priority. In the Czech Republic there are several programmes on national level, which are related to revitalisation measures (e.g. Landscape Management Programme, Natural Landscape Function Restoration Support or Watercourse System Revitalising Programme). An important source of funding are European funds and the Operational Programme "Environment". Also NGOs play an important role in revitalisation and restoration of landscape.

Involvement of private sector in restoration of natural environment is still rather rare.. One of the examples is the project of Peat Bog Restoration in Krušné Mountains implemented since 2009. Its purpose is to restore three natural habitats that were negatively affected by unsuitable human activities in the past. They are the peat bogs Cínovecký hřbet, U Jezera and Hora sv. Šebestiána. The project is a cooperation of Daphne ČR – Applied Ecology Institute and the NGO Ametyst, with financial contribution of the project's main partner, NET4GAS, s.

[19]The project "Recultivation and Management of Non-Natural Biotopes in the Czech Republic" was carried out in years 2007 – 2011 by the Ecopolicy Institute (Ústav pro ekopolitiku, o. p. s.) in cooperation with Geological Institute (Geologický ústav AV ČR, v. v. i.) And with Czech Agricultural University (Česká zemědělská univerzita) in Prague. Biological and ecological research clearly proved, that recultivated areas significantly damaged by mining of minerals and deposits of by-products of energetic industry have high biodiversity of fungi, wild plants and wild animals, which is directly related to high geomorphologic and biotope diversity. In these location there are many endangered species listed in the IUCN Red Book protected according to the MoE public notice No. 395/1992 Coll., which implements some provisions of the Czech National Council act No. 114/1992 Coll., about protection of landscape and nature, as amended. http://ekopolitika.cz/cs/aktuality/rekultivace-a-management-neprirodnich-biotopu-v-ceske-republice-vysledky-vy.html.

r. o.[20]*. Apart from these entities, there are also other partners to this project - Ústí Region, Ministry of the Environment, State Nature Conservancy Agency of the Czech Republic (AOPK ČR), Czech Agricultural University and Czech Forests (Lesy ČR, s.p).*

The Peat Bog Revitalisation is still in progress, therefore its outcomes cannot be objectively assessed yet. However the method of its implementation based on cooperation of so many diverse entities, is an inspiration for future projects

Aichi Target 16 "By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation"

At present legislative steps are being prepared, which are necessary to ratify the Nagoya Protocol and its subsequent implementation at the national level.

Strategic Goal E "Enhance implementation through participatory planning, knowledge management and capacity building"

Aichi Target 17 "By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan"

In the Czech Republic, the Aichi Target 17, which is tied to article 6 of the Convention, setting the obligation to create and implement a national biodiversity conservation strategy, was met by the adoption of NBSAP in 2005 (adopted by government decision No. 620/2005). Another contribution to this objective is also the presented document "Analysis of the Decision COP10 - X/2 Strategic CBD Plan for 2011-2020 and Assessment of the Performance of the Objectives of the Current Biodiversity Strategy as a Basis for the Next National Report on CBD Implementation".

Since the EU and the Czech Republic have met the Strategic Objective 17, the aims and measures of the strategic documents rather focus on other strategic tools for biodiversity conservation.

The EU Biodiversity Strategy provides several priorities in the area of strategic tools for biodiversity conservation, e.g. stronger implementation of legal norms, sufficient financing and support to research, sharing of information about best practice in biodiversity conservation.

[20] http://www.net4gas.cz/cs/napsali-o-nas-645/

In the area of strategic tools at the national level, the SEP proposes different measures focused, just like the EU Strategy, on enforcing and consistency of legal rules. SNCLPP also has a thematic focus, which concentrates on the lack of interconnection among objectives set by the government in different policies and strategies.

The updated NBSAP shall fully reflect the CBD Strategic Plan 2011-2020, just like the EU Biodiversity Strategy 2020 and also, based on performance analysis, it shall set relevant objectives to fully implement the Aichi Target 17 at the national level.

***Aichi Target 18** „By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels"*

Aichi Target 18 focuses on inclusion of traditional and local communities into biodiversity conservation and, on respect towards traditional uses of natural resources and participation of traditional communities in decision making. This objective is tied to article 8(j) of the Convention about participation of traditional communities in biodiversity conservation.

According to the working documents of the Convention[21] one of the indicators of the presence of traditional communities is the number of traditional languages used and the number of their speakers. Other indicator is the proportion of the territory of indigenous people compared to the national territory..

From these indicators is it clear, that the topic of traditional communities is not relevant for the Czech Republic. This fact is already presented in the Fourth National Report to the Convention on Biological Diversity for the Czech Republic, prepared by the Ministry of the Environment in 2004[22].

The topic of traditional knowledge into biodiversity conservation is thus not covered by any strategic documents of the Czech Republic, which deal with biological diversity and it is not in the EU Biodiversity Strategy either.

[21]e.g. Further information related to the technical rationale for the Aichi biodiversity targets (UNEP/CBD/COP/10/INF/12/Rev. 1)

[22]Fourth National Report to the Convention of Biological Diversity for the Czech Republic, MoE 2004 (http://chm.nature.cz/cooperation/fol605719/fol397575/fourth-national-report/4NR_CBD_Czech_Republic_FINAL_May_2009.pdf)

Aichi Target 19 "By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied"

Aichi Target 19 is closely connected to open access to knowledge, which is detailed in the one of the NBSAP chapters:

From the perspective of building a scientific and technological base for biodiversity conservation it is important to create technical, scientific, institutional and administrative capacities as well as creating research networks and joint research programmes. It is recommended to create partnerships among governmental agencies, public and private research institutes, private sectors and other stakeholders.

The situation in the Czech Republic is summarised in "Biodiversity research strategy" as a part of NBSAP, which also deals with the related objectives, while highlighting how problematic the biodiversity research focus in the Czech Republic is and how insufficient the interconnection of individual research institutions and their biodiversity cooperation is.

The Czech Republic actively participates in technology transfers in the form of international development cooperation. Bilateral and multilateral projects, which include investments, technical cooperation (providing know-how, training courses, seminars) and provide technologies are ongoing. These projects focus primarily on the implementation of international environmental agreements. Biodiversity conservation *per se* makes only part of the total volume of environmental cooperation[23]. However the strategic documents stipulate that the Czech Republic should be more involved in technical cooperation for biodiversity conservation in the form of foreign development aid and bilateral cooperation. Biodiversity protection was incorporated into the strategy and concept of foreign development cooperation as one of the priorities in the environment conservation area. See more information in the following part related to Aichi target 20.

The main tools for technology transfers for biodiversity conservation are the national clearing-house mechanisms and other electronic databases. The clearing-house mechanism was updated in 2013 and provides efficient interconnection of relevant information about biodiversity protection at the national level in the context of international obligations. At the same time it aims at promoting the biodiversity conservation among different stakeholders including public authorities and general public. (www.chm.nature.cz)

In the Czech Republic there is also an Environment Protection Information System (http://portal.nature.cz), Information System on Technical Protection of Environment (http://zeus.cenia.cz), Biosafety Clearing-House Czech Republic, http://www.mzp.cz/www/webdav_biosafety.nsf$files/Biosafety/index.htm) or the national geo-portal INSPIRE (http://geoportal.gov.cz). A list of other information systems of the

[23] Fourth National Report to the Convention on Biological Diversity for the Czech Republic, MoE 2004 (http://chm.nature.cz/cooperation/fol605719/fol397575/fourth-national-report/4NR_CBD_Czech_Republic_FINAL_May_2009.pdf)

Czech Republic concerning environment is available at the website CENIA (http://www.cenia.cz/web/www/web-pub2.nsf/$pid/CENMSFVGSU09).

Ministry of the Environment also administers the database of Czech Environmental Technologies and Services (ČETS)**,** which is used for presentations abroad, especially in developing countries.

The EU Biodiversity Strategy does not set specific objectives in technology transfers, but it emphasises that the development cooperation shall focused on minimisation of negative effects on biodiversity. From the view of scientific cooperation on biodiversity, the EU undertakes to fill the major gaps in research, including mapping and assessment of ecosystem services in Europe.

NBSAP demands improvements of scientific facilities and support to biodiversity research, cooperation across sciences, providing information and wider applicability of research results.

The main difficulties in spreading knowledge and technologies lie in the variability and lack of interconnection of environmental and biodiversity electronic databases in the Czech Republic. SEP proposes Unified Environmental Information System (UEIS, Czech: JISŽP) as the main tool for environment. This system has not been implemented yet. .

(http://www.mzp.cz/cz/jednotny_informacni_system_zivotni_prostredi).

The updated NBSAP (2015) shall contain clear set of recommendations for this area, and should help to achieve the following:

- Unify the presentation and information materials on biodiversity in the Czech Republic, in connection to the recommendations of the Aichi target 1.
- Integrate and coordinate the individual information databases and portals, which are focused on biodiversity and environment conservation.
- Coordinate the programmes for research and development in the area of environment and sustainable use of biodiversity and ecosystem services.
- Respect biodiversity and the benefits of healthy ecosystem in development aid and technology transfers.

Aichi Target 20 "By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties"

As far as the volume of funding is concerned, the most significant source of financing for environment protection in the Czech Republic is provided by the government in the form of subsidies, no-interest lease and guarantees for commercial loans.

Other significant sources of funding for environmental conservation are the State Environmental Fund of the Czech Republic, regional budgets as well as budgets of municipalities and regions. Environmental spending is monitored by the Czech Statistical Office (investments and non-investment costs for environmental conservation, economical benefit from activities to protect environment) and Ministry of Finance (expenses for environment protection from public budgets) (SEF 2011).

Funding for biodiversity conservation in the Czech Republic is part of the chapter "Protection of Biodiversity and Landscape", which includes:

- all-society function of forests,
- revitalisation of river systems,
- protection of species and stands,
- protected parts of nature,
- recultivation of land after mining activities etc.,
- anti-erosion, anti-avalanche and anti-fire protection,
- aesthetic maintenance of municipalities and public greenery,
- other activities to protect nature and landscape.

Calculation of assets provided for biodiversity protection on national level in 2006-2012 is part of the summary reporting of biodiversity protection costs. (All information were provided in common submission of the EU on the SCBD notification 2013-050)

Since 1995 the Czech Republic has been contributing to Official Development Assistance (ODA) mostly focused on fight poverty, strengthening of local administration capacities, post-conflict situations, environmental conservation and agriculture, reflecting the grounds based by the *Millennium Development Goals*.

Today, ODA is provided according to the ODA Concept 2010-2017 and implemented by the Czech Development Agency. The development assistance is provided both bilaterally and multilaterally in collaboration with the EU, UN, OECD/DAC, international financial institutions and other international organisations. The priority regions for assistance programs are Afghanistan, Bosnia and Herzegovina, Ethiopia, Moldova and Mongolia. There is also bilateral cooperation ongoing in some project countries (e.g. Serbia, Georgia, Kosovo) and others.

The environment is one of the five priority areas of foreign development aid as identified in the Concept. Development projects focusing on environment consist not only of investments, but also practical aid, technical cooperation and transfer of advanced technologies. They focus on the implementation of international environmental treaties, sustainable use of resources, water protection, environmental geology, waste management, sanitation of contaminated areas etc.

In the plan of development assistance for 2015 and in the prospect for future in the environment sector as a priority and with a clear reference to the CBD Strategic Plan 2011-2020 and the decision COP CBD XI/4 projects focused on biodiversity conservation shall be implemented.

Calculation of assets provided through ODA is also part of the reporting of overall costs of biodiversity conservation measures in 2006-2012. (The information was provided in the common submission of the EU on the SCBD notification 2013-050)

Mobilisation of resources to support biological diversity and ecosystem services is dealt with also in the chapter 4.2 of the EU Biodiversity Strategy, where the EU undertakes to make efforts for improvement and better distribution of the existing financial assets in order to meet worldwide obligations for biodiversity conservation, better coordination of resource management and diversification and increase of different sources of funding. The need for ensuring enough funding for development aid to protect biodiversity is also covered by the objectives A7.1 and A7.2 of the Biodiversity Action Plan. Funding from the EU shall be focused on the full implementation of the Natura 2000 system and efficient implementation of the Strategic Plan of the Convention.

The EU Strategy stresses the need to increase the public funding of biodiversity conservation and highlights the potential of innovative financial mechanisms. However in the question of innovative financial mechanisms, no progress has been achieved at the national level in recent years. That is why according to the EU Biodiversity Strategy, the financial sources (including the innovative ones) needed to meet the biodiversity conservation goals should also be included also in the strategic documents of the member states.

Ensuring financial resources to protect biodiversity is covered by several measures in SEP´s chapter on "Tools for Environmental Policy Implementation "and "International Cooperation". As far as the international cooperation is concerned, the measures focus on the involvement of Czech companies into international development programmes.

Due to Aichi target 20 the updated NBSAP strategy shall contain a communication strategy and methodology for using available innovative financial mechanisms and involvement of private sector into the biodiversity conservation financing.

References

Bellow presented references are referring to the Chapter 1, references in the Chapter 2 and 3 are included in these chapters as footnotes.

BAKKENES M., EICKHOUT B. & ALKEMADE J.R.M. (2006): Impacts of different climate stabilisation scenarios on plant species in Europe. Global Environ. Change 16: 19–28.

BEERLING D.J., HUNTLEY B. & BAILEY J.P. (1995): Climate and the distribution of *Fallopia japonica*: Use of an introduced species to test the predictive capacity of response surface. J. Veget. Sci. 6: 269-282.

BELLARD C., THUILLER W., LEROY B., GENOVESI P., BAKKENES M. & COURCHAM F. (2013): Will climate change promote future invasions? Global Change Biol. 19: 3740-3748.

BIRDLIFE INTERNATIONAL (2004): Birds in Europe: Population estimates, trends and conservation status. BirdLife International Cambridge, U. K., 374 pp.

BIRDLIFE INTERNATIONAL (2011): Review of the illegal killing and trapping birds in Europe. European Conference on Illegal Killings of Birds, Larnaca, Cyprus, 6 - 8 July 2011. Council of Europe Strasbourg, 74 pp.

BUČEK A. & VLČKOVÁ V. (2009): Scénář změn vegetační stupňovitosti: deset let poté. Ochrana přírody 64, suppl.: 8-11.

BUČEK A. & VLČKOVÁ V. (2011): Soubor map s prognózou možných důsledků globálních změn na přírodu České republiky. Acta Průhon. 97: 83-87.

BUNCE R.G.H., BOGERS M.M.B., EVANS D., HALADA L., JONGMAN R.H.G., MUCHER C.A., BAUCH B., DE BLUST G., PARR T.W. & OLSVIG-WHITTAKER L. (2012): The significance of habitats as indicators of biodiversity and their links to species. Ecol. Indicators 33: 19-25.

CBD (2014): Invasive alien species. Secretariat of the Convention on Biological Diversity Montreal. http://www.cbd.int/invasive/ (navštíveno 11. 3. 2014).

CENIA (2013a): Zpráva o životním prostředí České republiky 2013. MŽP Praha, 189 pp.

CENIA (2013b): Statistická ročenka životního prostředí České republiky. MŽP Praha, 414 pp.

CENIA (2014a): Klíčové indikátory životního prostředí České republiky. Půda a krajina, zemědělství. Fragmentace krajiny. CENIA Praha. http://issar.cenia.cz/issar/page.php?id=1941 (navštíveno 11.3.2014).

CENIA (2014b): Klíčové indikátory životního prostředí České republiky. Znečišťování a kvalita ovzduší. Kvalita ovzduší z hlediska ochrany ekosystémů a vegetace. CENIA Praha. http://issar.cenia.cz/issar/page.php?id=1584 (navštíveno 11. 3. 2014).

CENIA (2014c): Klíčové indikátory životního prostředí České republiky. Zdraví a životní prostředí. Zátěž obvyatelstva vybranými chemickými látkami. CENIA Praha. http://issar.cenia.cz/issar/page.php?id=1693 (navštíveno 11.3.2014).

CIVIS P., VOJAR J. & BALAZ V. (2010) : Chytridiomykóza – hrozba pro anše obojživelníky. Ochrana přírody 65 (4) : 18-20.

COX N.A. & TEMPLE H.J. (2009): European Red List of Reptiles. Office for Official Publ. of the European Communities Luxembourg, 32 pp. + viii.

CUTTELOD A., SEDRON M. & NEUBERT E. (2011): European Red List of Non-marine Molluscs. Publ. Office of the European Union Luxembourg, 97 pp. + iv.

ČERVENÝ J., KOUBEK P. & BUFKA L. (2005): Velké šelmy v České republice I. Mýty a skutečnost. Vesmír 84: 656-661.

ČIHÁK K. & VERMOUZEK Z. (2011): Vliv úmyslných a neúmyslných otrav pesticidy na populace volně žijících ptáků v ČR. Česká společnost ornitologická Praha, 37 pp.

ČÍŽEK L., KONVIČKA M., BENEŠ J. & FRIC Z. (2009): Zprávu o stavu země: odhmyzeno. Jak se daří nejpočetnější skupině obyvatel České republiky? Vesmír 88: 386-389.

ČSO (2014): Karbofuran stále zabijí, pomozte ho zastavit! Česká společnost ornitologická Praha. www.karbofuran.cz (navštíveno 11.3.2014).
DANIEL M., DANIELOVÁ V. & KŘÍŽ B. (2006): Tick-borne encephalitis. IN MENNE B. & EBI K.L. (eds.): Climate change and adaptation strategies for human health. Steinkopf Verlag Darmstadt: 189-205.
DANIHELKA J. (2013): Botanické součty, rozdíly a podíly. Živa 61: 69-72.
DEFRA (2008): Restoring floodplain woodland for flood alleviation. Project SLD2316, Final report. Department for Environment, Food and Rural Affairs London, 40 pp.
DOLEŽALOVÁ J. (2012): Regulace šíření invazních nepůvodních druhů rostlin a živočichů. Rigorozní práce, Právnická fakulta Masarykovy univerzity Brno, 129 pp.
EEA (2010): The European environment. State and outlook 200. Land use. Publ. Office of the European Union Luxembourg, 52 pp.
EEA (2011): Landscape fragmentation in Europe. Joint EEA-FOEN report. Publ. Office of the European Union Luxembourg, 87 pp.
EEA (2012a): The impacts of invasive alien species in Europe. Publ. Office of the European Union Luxembourg, 114 pp.
EEA (2012b): Climate change, impacts and vulnerability in Europe. An indicator-based report. Publ. Office of the European Union Luxembourg, 300 pp.
ERISMAN J.W., LEACH A., ADAMS M., AGBOOLA, AHMETAJ, ALARD D., AUSTIN A., AWODUN M.A., BAREHAM S., BIRD Th., BLEEKER A., BULL K., CORNELL S.E., DAVIDSON E., DE VRIES W., DIAS T., EMMETT B., GOODALE Ch., GREAVER T., HAEBER R., HARMENS H., HICKS W.K., HOGBOM L., JARVIS P., JOHANSSON M., MASTERS Z., MCCLEAN C., PATON B., PEREZ T., PLESNIK J., RAO N., SCHMIDT S., SHARMA Y.B., TOKUCHI N. & WHITFIELD C.P. (2014): Nitrrogen deposition effects on ecosystem services and interactions with other pollutants and climate change. In SUTTON M.A., MASON K.E., SHEPPARD L.J., SVERDRUP H., HAEUBER R. & HICK W.K. (eds.): Nitrogen deposition, critical loads and biodiversity. Springer Dordrecht, The Netherlands, in press.
FARKAČ J., KRÁL D. & ŠKORPÍK M. eds. (2005): Červený seznam ohrožených druhů České republiky. Bezobratlí. Agentura ochrany přírody a krajiny ČR Praha, 760 pp.
FREYHOF J. & BROOKS E. (2011): European Red List of Freshwater Fishes. Publ. Office of the European Union Luxemburg, 60 pp. + viii.
GENOVESI P. & SHINE C. (2004): European Strategy on Invasive Alien Species. Council of Europe Publ. Strasbourg, 67 pp.
GRULICH V. (2012): Red List of vascular plants of the Czech Republic: 3rd edition. Preslia 84: 631-645.
HALADA L., EVANS D., ROMÃO C. & PETERSEN J.-E. (2011): Which habitats of European importance depend on agricultural practices? Biodiv. Conserv. 20: 2365-23278.
HEMERKA J. & VYBÍRAL P. (2010): Ochrana ovzduší. ČVUT Praha, 148 pp.
HLASNY T., HOLUŠA J., ŠTĚPÁNEK P., TURČÁNI M. & POLČÁK N. (2011): Expected impacts of climate change on forests: Czech Republic as a case study. J. Forest Sci. 57: 422-431.
HOLEC J. & BERAN M. (2006): Červený seznam hub (makromycetů) České republiky. Příroda 24: 1-280.
HOMOLKA M., HEROLDOVÁ M. & ZEJDA J. (2013): Škody způsobené hraboši na lesní vegetaci v kontextu globálních změn klimatu. Lesnická práce 92: 22-23.
HOŠEK J., SCHWARZ O. & SVOBODA T. (2007): Výsledky desetiletého měření atmosférické depozice v Krkonoších. Opera Corcon. 44: 179-191.
HRUŠKA J. & KOPÁČEK J. (2005): Kyselý déšť stále s námi – zdroje, mechanismy, účinky, minulost a budoucnost. Planeta 12 (5): 1-24.

HULME P. E., PYŠEK P., PERGL J., JAROŠÍK V., SCHAFFNER U. & VILÀ M. (2013): Greater focus needed on plant invasion impacts in protected areas. Conserv. Lett, doi: 10.1111/conl.12061).
HUNTLEY B., COLLINGHAM Y.C., WILLIS S.G. & GREEN R.E. (2008): Potential impacts of climate change on European birds. PLoS ONE 3: e1439.
HUNTLEY B., GREEN R.E., COLLINGHAM Y.C. & WILLIS, S.G. (2007): A climatic atlas of European breeding birds. Lynx Edicions Barcelona, 528 pp.
CHOBOT K., JEŘÁBKOVÁ L., TUROŇOVÁ D., LINHARTOVÁ R., VOJTĚCHOVSKÁ E., ŠTAMBERGOVÁ M. & HANZAL V. (2008): Základní analytické vyhodnocení rozšíření silně a kriticky ohrožených zvláště chráněných druhů vzhledem k předpokládaným změnám v kompetencích orgánů ochrany přírody v novele zákona o ochraně přírody a krajiny. AOPK ČR Praha, 14 pp.
CHYTRÝ M., PYŠEK P., TICHÝ L., KNOLLOVÁ I. & DANIHELKA J. (2005): Invasions by alien plants in the Czech Republic: a quantitative assessment across habitats. Preslia 77: 339–354.
CHYTRÝ M., WILD J., PYŠEK P., TICHÝ L., DANIHELKA J. & KNOLLOVÁ I. (2009): Maps of the level of invasion of the Czech Republic by alien plants. Preslia 81: 187–207.
IUCN (2013a): Czech Republic´s biodiversity at risk. IUCN Gland, Switzerland, 8 pp.
IUCN (2013b): IUCN Red List of Threatened Species. Version 2013.2. IUCN Gland, Switzerland. www.iucnredlist.org (navštíveno 11.3.2014).
JANKOVSKÝ L. (2002): Riziko aktivizace chorob lesních dřevin v podmínkách klimatické změny. Lesnická práce 81 (5): 206-208.
JOHNSON T.E., JAMES N. & HART D.D. (2007): Stream ecosystem responses to spatially variable land cover: An empiracally based model for developing riparian restoration strategies. Freshwat. Biol. 52: 680-695.
JONGEPIEROVÁ I., PEŠOUT P., JONGEPIER J.W. & PRACH K. eds. (2012): Ekologická obnova v České republcie. Agentura ochrany přírody a krajiny ČR Praha, 147 pp.
KALKMAN V.J., BOUDOT J.-P., BERNARD R., CONZE K.-J., KNIJF DE G., DYATLOVA E., FERREIRA S., JOVIĆ M., OTT J., RISERVATO E. & SAHLÉN G. (2010): European Red List of Dragonflies. Publications Office of the European Union Luxembourg, 28 pp. + vii.
KANTOR P. (1992): Změny vodní balance smrkového porostu po jeho obnově holou sečí. Lesnictví-Forestry 38: 823-838.
KEDZIORA A. & OLEJNIK J. (2002): Water balance in agricultural landscape and options for its management by change in plant cover structure of landscape. In RYSZKOWSKI L. (ed.): Landscape ecology in agroecosystem management. CRC Press Boca Raton, FLA: 57-110.
KOCMÁNKOVÁ E., TRNKA M., EITZINGER J., FORMAYER H., DUBROVSKÝ M., SEMERÁDOVÁ D., ŽALUD Z., JUROCH J. & MOŽNÝ M. (2010): Estimating the impact of climate change on the occurrence of selected pests in the Central European region. Clim. Res. 44: 95-105.
KOLÁŘ F., MATĚJŮ J., LUČANOVÁ M., CHLUMSKÁ Z., ČERNÁ K., PRACH J., BALÁŽ V. & FALTEISEK L. (2012): Ochrana přírody z pohledu biologa. Proč a jak chránit českou přírodu. Dokořán Praha, 214 pp. + xvi.
KONVIČKA M., MARADOVÁ M., BENEŠ J., FRIC Z. & KEPKA P. (2003): Uphill shifts in distribution of butterflies in the Czech Republic: Effects of changing climate detected on a regional scale. Global. Ecol. Biogeogr. 12: 403-410.
KOZUBÍKOVÁ-BALCAROVÁ E. (2013): Biologické invaze a paraziti – příběh račího moru. Živa 61: 31-34.
KOZUBÍKOVÁ E. & PETRUSEK A. (2009): Račí mor – přehled dosavadních poznatků o závažném onemocnění raků a zhodnocení situace v České republice. Bulletin VÚRH Vodňany 45 (2-3): 34-57.
KRÁSA J., ROSENDORF P., HEJZLAR J., BOROVEC J., DOSTÁL T., DAVID V., JANOTOVÁ B., BAUER M., DEVÁTÝ J., STROUHAL L., VRÁNA K., ANSORGE L., FIALA D. & DURAS J. (2013): Hodnocení

ohroženosti vodních nádrží sedimentem a eutrofizací podmíněnou erozí zemědělské půdy. Fakulta stavební ČVUT Praha, 55 pp.
KUČERA J., VÁŇA J. & HRADÍLEK Z. (2012): Bryophyte flora of the Czech Republic: updated checklist and Red List and a brief analysis. Preslia 84: 813–850.
KUNC L. & BARTOŠOVÁ D. (2005): Patří velké šelmy do Beskyd? Živa 53: 37-40.
LANGHAMMER J. ed. (2007): Povodně a změny krajiny. Přírodovědecká fakulta Univerzity Karlovy a MŽP Praha, 396 pp.
LIŠKA J. & PALICE Z. (2010): Seznam a červený seznam lišejníků České republiky. Příroda 29: 1-135.
MARKOVÁ Z. & HEJDA M. (2011): Invaze nepůvodních druhů rostlin jako environmentální problém. Živa 59: 10-14.
MENZEL A., SPARKS T.H., ESTRELLA N., KOCH E., ASSA A., AHAS R., ALM-KŐBLER K., BISSOLLI P., BRASLAVSKÁ O., BRIEDE A., CHMIELEWSKA F.M., CREPINSEK Z., CURNEL Y., DAHL A., DEFILA C., DONNELY A., FILELLA Y., JATCZAK K., MAGE F., MAESTRE A., NORDLI Ø., PEÑUELAS J., PIRINEN P., REMIŠOVÁ V., SCHEIFINGER H., STRIZ M., SUDNIK A., VAN VLIET A.J.H., WIELOGALASKI T.E., ZACH S. & ZUST A. (2006): European phenological response to climate change matches the warming pattern. Global Change Biol. 12: 1969-1976.
MIKO L. & HOŠEK M. eds. (2009): Příroda a krajina České republiky. Zpráva o stavu 2009. Agentura ochrany přírody a krajiny ČR Praha, 102 pp.
MINISTRY OF THE ENVIRONMENT OF THE CZECH REPUBLIC (2009): Fifth National Communication of the Czech Republic on the UNFCCC including supplementary information pursuant to Article 7.2 of the Kyoto Protocol. Ministry of the Environment of the Czech Republic Prague, 195 pp.
MLÍKOVSKÝ J. & STÝBLO P. eds. (2004): Nepůvodní druhy fauny a flóry České republiky. ČSOP Praha, 496 pp. (in Czech).
MZe (2012): Situační a výhledová zpráva. Půda. MZe Praha, 102 pp.
MZe (2013a): Zpráva o stavu zemědělství České republiky za rok 2012. MZe Praha, 403 pp.
MZe (2013b): Zpráva o stavu lesa a lesního hospodářství České republiky za rok 2012. MZe Praha, 135 pp.
MZe/MŽP (2010): Koncepce řešení problematiky ochrany před povodněmi v České republiky s využitím technických a přírodě blízkých opatření. MZe a MŽP Praha, 39 pp.
MZe/MŽP (2013): Zpráva o stavu vodního hospodářství České republiky 2012. Stav ke dni 31. 12. 2012. Ministerstvo zemědělství Praha, 135 pp.
MŽP (2005): Strategie ochrany biologické rozmanitosti České republiky/National Biodiversity Strategy of the Czech Republic. MŽP Praha, 137 pp. + cxxix.
OECD (2013): Water and climate change adaptation. Policies to navigate uncharted waters. OECD Publ. Paris, 228 pp.
PELC F. (1999): Význam velkoplošných chráněných území pro ochranu mokřadů a záchyt vody v krajině. In NĚMEC J. (ed.): Krajina a voda. Sborník z konference 22. - 24. 4. 1998 Veselí nad Moravou. AOPK ČR, MŽP a MZe Praha: 17 –18.
PELC F. ed. (2009): Strategie Ministerstva životního prostředí k adaptačním opatřením v krajině v souvislosti s klimatickou změnou. MŽP Praha, 56 pp. + ix.
PELC F. ed. (2010): Aktualizace Státního programu ochrany přírody a krajiny České republiky. MŽP Praha, 56 pp.
PETŘÍČEK V. (1997): Stoletá voda a ochrana přírody a krajiny. Eko 8 (5): 2-5.
PETŘÍČEK V. (1999): Příčiny, průběh, důsledky povodní a náprava účinků na přírodu a krajinu. In NĚMEC J. (ed.): Krajina a voda. Sborník z konference 22. - 24. 4. 1998 Veselí nad Moravou. AOPK ČR, MŽP a MZe Praha: 142 –144.
PETŘÍČEK V. & CUDLÍN P. (2003): Máme bojovat proti povodním? Život. Prostr. 37: 177-179.

PITHART D., KŘOVÁKOVÁ K., ŽALOUDÍK J., DOSTÁL T., VALENTOVÁ J., VALENTA P., WEYSKRABOVÁ J. & DUŠEK J. (2010): Ecosystem services of natural floodplain segment – Lužnice River, Czech Republic. In WRACHIEN,D., BREBIA C.A., PROVERB D. & MAMBRETI S. (eds.): Flood recovery, innovation and response. WIT Press Ashurst, Southampton, U.K.: 129-143.
PLESNÍK J. (2004): Biologická rozmanitost v České republice: Současný stav, hlavní problémy a perspektivy. In SEKRETARIÁT ÚMLUVY O BIOLOGICKÉ ROZMANITOSTI: Biologická rozmanitost na Zemi: stav a perspektivy. Scientia Praha: 197-261.
PLESNÍK J. (2009): Biologická rozmanitost a změna podnebí. Současný stav a předpověď dalšího vývoje. Ochrana přírody 64, suppl.: i-xii.
PLESNÍK J. (2011a): Někdo to rád horké. Invazní nepůvodní druhy. Ochrana přírody 66 (45): 26-29.
PLESNÍK J. (2011b): The European context for adapting nature conservation to climate change: From science to policy and back. British Ecological Society London. http://www.britishecologicalsociety.org/documents/policy_documents/policy_meetings/BES_NE_Conference/Jan_Plesnik.pdf. (navštíveno 11.3.2014).
PLESNÍK J., HANZAL V. & BREJŠKOVÁ L. eds. (2003): Červený seznam ohrožených druhů České publiky. Obratlovci. Příroda 22: 1-184.
PLESNÍK J. & PELC F. (2009): Příroda a krajina v České republice a jejich přizpůsobení změnám podnebí. Ochrana přírody 64, suppl.: 30-34.
PLESNÍK J. & STAŇKOVÁ J. eds. (2001): Status of biological resources and implementation of the Convention on Biological Diversity in the Czech Republic. First report. Ministry of the Environment of the Czech Republic Prague, 72 pp.
PRACH K. (2006): Příroda pracuje zadarmo. Technické, nebo přírodní rekultivace? Vesmír 85: 272-277.
PRETEL J. (2009): Současný vývoj klimatu a jeho výhled. Ochrana přírody 64, suppl.: 2-7.
PRETEL J. ed. (2011): Zpřesnění dosavadních odhadů dopadů klimatické změny v sektorech vodního hospodářství, zemědělství a lesnictví a návrhy adaptačních opatření. Technické shrnutí výsledků projektu 2007 – 2011. MŽP projekt VaV-SP/1a6/108/07. Český hydrometeorologický ústav Praha, 67 pp.
PYŠEK P., DANIHELKA J., SÁDLO J., CHRTEK J. JR., CHYTRÝ M., JAROŠÍK V., KAPLAN Z., KRAHULEC F., MORAVCOVÁ L., PERGL J., ŠTAJEROVÁ K. & TICHÝ L. (2012): Catalogue of alien plants of the Czech Republic (2nd edition): Checklist update, taxonomic diversity and invasion patterns. Preslia 84: 155–255.
PYŠEK P., JAROŠÍK V. & KUČERA T. (2002): Patterns of invasion in temperate nature reserves. Biol. Conserv. 104: 13 – 24.
PYŠEK P., JAROŠÍK V. & KUČERA T. (2003a): Inclusion of native and alien species in temperate nature reserves: An historical study from Central Europe. Conserv. Biol. 17: 1414 – 1424.
PYŠEK P., SÁDLO J., MANDÁK B. & JAROŠÍK V. (2003b): Czech alien flora and a historical pattern of its formation: What came first to Central Europe? Oecologia 135: 122 – 130.
PYŠEK P., GENOVESI P., PERGL J., MONACO A. & WILD J. (2013): Plant invasions of protected areas in Europe: an old continent facing new problems. In FOXCROFT L. C., PYŠEK P., RICHARDSON D. M. & GENOVESI P. (eds): Plant invasions in protected areas: Patterns, problems and challenges. Springer Dordrecht: 209-240.
REIF J., VOŘÍŠEK P., ŠŤASTNÝ K., KOSCHOVÁ M. & BEJČEK V. (2008): The impact of climate change on long-term population trends of birds in a central European country. Anim. Conserv. 11: 412-421.
REIF J., VOŘÍŠEK P., VERMOUZEK Z., ŠŤASTNÝ K., KOSCHOVÁ M. & BEJČEK V. (2009): Vliv globálních klimatických změn na vývoj početnosti ptáků v ČR. Ochrana přírody 64, suppl.: 35-39.
ROŽNOVSKÝ J. (2014): Sucho na území České republiky. Živa 62: 2-3.
STDF (2013): International trade and invasive alien species. WTO Geneva, Switzerland, 64 pp.

ŠEFROVÁ H. & LAŠTŮVKA Z. (2005): Catalogue of alien animal species in the Czech Republic. Bull. Org. Eur. Medit. Prot. Plants 53: 1451 -170.
TEMPLE H.J. & COX N.A. (2009): European Red List of Amphibians. Office for Official Publ. of the European Communities Luxembourg, 32 pp. + viii.
TEMPLE H.J. & TERRY A. (2007): The status and distribution of European mammals. Office for Official Publ. of the European Communities Luxembourg, 48 pp. + viii.
UHLÍKOVÁ J., MINÁRIKOVÁ T. & ČERVENÝ J. (2008): Rys ostrovid v České republice. Ochrana přírody 63 (2): 21-23.
VAN SWAAY CH., CUTTELOD A., COLLINS S., MAES D., LÓPEZ MUNGUIRA M., ŠAŠIĆ M., SETTELE J., VEROVNIK R., VERSTRAEL T., WARREN M., WIEMERS M. & WYNHOF I. (2010): European Red List of Butterflies Publ. Office of the European Union Luxemburg, 44 pp. + xii.
VAŠKŮ Z. (2007): Podnebí v České republice. Retrospektivní pohled do budoucnosti. Vesmír 86: 710-713.
VĚTROVCOVÁ J., POLEDNÍKOVÁ K., POLEDNÍK L., BERAN V. & HLAVÁČ V. (2011): Databáze údajů o uhynulých jedincích vydry říční v ČR. Ochrana přírody 66 (4): 15-29.
VOPRAVIL J., KHEL T., VRABCOVÁ T., HAVELKOVÁ L., PROCHÁZKOVÁ E., NOVOTNÝ I., NOVÁK P., FUČÍK P., DUFFKOVÁ R., JACKO K., TYLOVÁ J. & HODEK T. (2010): Vliv činnosti člověka na krajinu českého venkova s důrazem na vodní režim a zahřívání vody v krajině. VÚMOP Praha-Zbraslav, 75 pp.
WALTHER G. R., ROQUES A., HULME P. E., SYKES M. T., PYŠEK P., KUHN I., ZOBEL M., BACHER S., BOTTA-DUKAT Z., BUGMANN H., CZUCZ B., DAUBER J., HICKLER T., JAROŠÍK V., KENIS M., KLOTZ S., MINCHIN D., MOORA M., NENTWIG W., OTT J., PANOV V. E., REINEKING B., ROBINET C., SEMENCHENKO V., SOLARZ W., THUILLER W., VILA M., VOHLAND K. & SETTELE J. (2009): Alien species in a warmer world: risks and opportunities. Trends Ecol. Evol. 24: 686–693.
ZEDEK V., HOŠEK M., VAVŘINOVÁ J. & SUKENÍKOVÁ K. eds.(2010): Zpráva o naplňování Cíle 2010 v ochraně biodiverzity v ČR. Ministerstvo životního prostředí ČR Praha, 76 pp.

MoA (2011): Zemědělství a změna klimatu. MoA Prague, 28 pp. (only in Czech)
MoA (2012): Situační a výhledová zpráva. Půda. MoA Prague, 102 pp. (only in Czech)
MoA (2013a): Zpráva o stavu zemědělství České republiky za rok 2012. MoA Prague, 403 pp. (only in Czech)
MoA (2013b): Zpráva o stavu lesa a lesního hospodářství České republiky za rok 2012. MoA Prague, 135 pp. (only in Czech)
MoA/MoE (2010): Koncepce řešení problematiky ochrany před povodněmi v České republiky s využitím technických a přírodě blízkých opatření. MoA and MoE Prague, 39 pp. (only in Czech)
MoA/MoE (2013): Zpráva o stavu vodního hospodářství České republiky 2012. Status as of 31. 12. 2012. Ministry of Agriculture, Prague, 135 pp. (only in Czech)

ANNEX 1 – LIST OF ABBREVIATIONS

AEGIS - Project of integration of European gene banks
ANCLP - The Agency for Nature Conservation and Landscape protection of the Czech Republic
AnGR - animal genetic resources
AP – Action Plan
BOD - Biological Oxygen Demand
CBD – Convention on Biological Diversity
CENIA - Czech Environmental Information Agency
CGIAR (The Consultative Group on International Agricultural Research),
CGS Czech Geological Survey– Geofond
CLC - CORINE Land Cover
CR – Czech Republic
CSOP - Czech Union for Nature Conservation
CZ – Czech Republic
CZK - Czech Crowns
EAP – European Action Plan
EC - European Commission
EEA - European Environmental Agency
EEC - European Economic Community
EUROSTAT - the statistical office of the European Commission
FAO - Food and Agriculture Organisation
FGMRI - The Forestry and Game Management Research Institute
FMI - The Forest Management Institute
FSC - Forest Stewardship Council
GEF - Global Environment Facility
GIS - Geographic Information System
GISP - Global Invasive Species Programme
GPA - Global Plan for Action
GR – Genetic Resources
CHM – Clearing House Mechanism
CHMI - Czech Hydrometeorological Institute
IAS - Invasive Alien Species
IPPC - Integrated Pollution and Prevention Control
ITPGR - International Treaty on Plant Genetic Resources
IUCN - World Conservation Union
LAT - Lower Assessment Treshold
LULUCF - Land Use, Land-use Change and Forestry
LV - Limit Value
MDG - Millennium Development Goals
MEA – Multilateral Environmental Agreement
MoA – Ministry of Agriculture
MoE – Ministry of the Environment
MTA- Material Transfer Agreement
Mts. - Mountains
NBS - The National Biodiversity Strategy of the Czech Republic
NFC - National Focal Centre
NFP – National Forest Programme
NGO – Non-governmental organisation

NIL - National Forest Inventory
NM - Nature Monuments
NNM - National Nature Monument
NNR - National Nature Reserve
NP – National Park
NR - Nature Reserve
ODA – Official Development Assistance
OECD - Organisation of Economic Cooperation and Development
PA – Protected Area
PLA – Protected Landscape Area
PoW – Programme of Work
RIAP - The Resource Institute of Animal Production
RS - Ramsar Site
SAC- Special Areas of Conservation
SCI - Sites of Community Importance
SCP- Sustainable Consumption and Production
SDS CR - Czech Republic Strategy for Sustainable Development
SEA - Strategic Environmental Assessment
SEBI 2010 - Streamlining European 2010 Biodiversity Indicators
SEP – State Environmental Policy
SNCLPP - The State Nature Conservation and Landscape Protection Programme of the Czech Republic
SP - Strategic Plan
SPA - Special Protected Areas
SPP - Species Plantarum Programme
TSES - Territorial System of Ecological Stability
TSP - Total suspended particulates
TZL - Particulate Matters
UAT - Upper Assessment Treshold
UN - United Nations
UN FCCC - United Nations framework Convention on Climate Change
UPOV - The International Union for the Protection of New Varieties of Plants Convention
VOC - Volatile Organic Compounds
VUMOP - Research Institute of Ameliorations and Soil Conservation Prague
WFCC - World Federation for Culture Collection
WFD - The Water Framework Directive

ANNEX 2 – LIST OF FIGURES AND TABLES