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Review of knowledge base and biodiversity research results from the Czech Republic that directly contribute to the sustainable use of biodiversity in Europe

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PREFACE

This national review was elaborated within the international project BioStrat (<http://www.biostrat.org>). It is not expected that it will cover all aspects of the topic, but the compilation of the reviews from different countries will produce an interesting overview, which will help to develop the recommendations at the European Platform for Biodiversity Research Strategy (EPBRS) meetings. The on-coming German EPBRS meeting will deal with aspects of sustainable use of biodiversity in the European Union. Within the national reviews, policy relevant aspects covered in the Action Plan of the EU COM (2006) 216 on “Halting the loss of biodiversity until 2010 and beyond”¹ are discussed. We focused on three priority topics: (i) identifying high value farmland (and forest) areas, (ii) influence of national plans of Common Agricultural Policy implementation on biodiversity, including aspects of cross-compliance, and (iii) developing indicators and monitoring schemes in the above areas. Additionally, we referred particularly to the Objective 2 (To conserve and restore biodiversity and ecosystem services in the wider EU countryside) and to the Objective 4 (To reinforce compatibility of regional and territorial development with biodiversity in the EU).

Regarding this review, the most important information was excerpted from the National Biodiversity Strategy of the Czech Republic (2005), National Capacity Self-Assessment in the CR for Fulfilment of the Obligations of the Rio Conventions (Zima et al. 2006), and from the Third National Report of the CR to CBD (2005). All these documents can be downloaded at the Czech Republic Clearing House Mechanism website (<http://chm.nature.cz>).

Our aim was to address people across various sectors. Each of eight co-authors (scientists publishing in ISI journals, employees of state administrations, member of NGO) has been asked for providing a short review on topic, which is she/he interested in. Most of them are members of the Czech BioPlatform project (<http://www.ibot.cas.cz/biop>) directly related to the EPBRS. Two independent peer reviews were provided finally.

¹The complete text of COM (2006) 216 including the action plan can be found at:
http://ec.europa.eu/environment/nature/biodiversity/current_biodiversity_policy/biodiversity_com_2006/index_en.htm.

INTRODUCTION

(compiled by P. Petřík based on various excerpts)

There are several problems connected with biodiversity sustainable use in the past in the Czech Republic, which continues in present: (i) direct loss of natural species and habitats due to infrastructure building, human induced land use, land cover changes and harvest of biomass, (ii) fragmentation of habitats and populations by insurmountable barriers (e.g. fenced transport routes) results in establishment of small isolated and not viable populations, (iii) extensive drainage of the landscape for the purposes of agriculture and forestry, intensive farming, physical modification of both the longitudinal and transverse profiles of watercourses, their regulation and canalisation, construction of transverse structures (discontinuities), discharging of municipal and industrial wastewater, and (iv) pollution of environment – deposition of acidifying substances, eutrophication etc.

The Czech Republic declares in the **Third National Report of the CR to the Convention on Biological Diversity** (2005) that there were established programmes for scientific and technical education and training in measures for the identification, conservation and sustainable use of biological diversity and its components. In 2005, the Government of the Czech Republic approved the **Long-term Priority Research Orientation** (<http://www.vyzkum.cz>), which is the basic strategic research document. The biodiversity sustainable use is addressed under the area of sustainable development – biological and ecological aspects of the sustainable development. The document gives the framework for novel and integrated approaches to applied biodiversity research. The need for closer connections between the research and the nature conservation and sustainable use of biological resources is highly recognized.

In the Czech Republic, biodiversity related research is implemented in three basic ways: (i) projects in the framework of the **Research & Development of Technologies Programme**. The projects deal in particular with applied issues and the outputs of some of them have been used in developing methods, tools and measures in conservation and sustainable use of biological diversity components, (ii) the **National Research Programme for 2004–2009** stresses the further need to strengthen the links between research community and the general public, e.g. by popularising the outputs of science (see the successful on-going project http://www.otevrena-veda.cz/ov/index.php?site=ov_en&p=index), research and development of technologies, and (iii) the **Agricultural Research Aims at Animal and Plant Production and Forestry**. It includes both basic and strategic/applied research focusing in particular on maintaining and effective use of natural resources and biological capacities of agri-ecosystems, forest ecosystems respectively.

The targets on biodiversity-related research and strategy have been incorporated into the **State Environmental Policy 2004–2010, Strategy of Sustainable Development (2005), State Nature Conservation and Landscape Protection Programme of the CR (2005), National Biodiversity Strategy (2005), National Capacity Self-Assessment in the CR for Fulfilment of the Obligations of the Rio Conventions** (Zima et al. 2006) and many other documents related to specific aspects of sustainable development (the **Horizontal Rural Development Plan of the Czech Republic 2004–2006, Action Plan of the Czech Republic for the Development of Organic Farming, National Forestry Programme 2003–2006** etc.).

The Czech Government approved the National Biodiversity Strategy of the Czech Republic in 2005. This is the first document that outlines the potential for further procedure in

biological diversity conservation and sustainable use². The main objective of the Strategy is to create a document for biodiversity conservation in CR that will be both inter-sectoral and interdisciplinary. All the parts of the document were prepared by and consulted with experts in other sectoral organizations, scientific research institutions, universities and key partners, and, last but not least, a peer review was also provided by non-governmental organizations.

² The Strategy is a fundamental document that is based on the related activities of the Convention on Biological Diversity, i.e. the thematic programmes of work, proposed by the Subsidiary Body on Scientific, Technical and Technological Advice, which are then approved by the Conference of Parties. The Strategy accepts programmes of work of the CBD and suitably modifies the objectives set forth in them on the basis of the current conditions and capabilities in the CR.

DESCRIPTION OF MAIN FINDINGS OF THE SELECTED STUDIES

(edited by P. Petřík and co-authors)

A2.1.3 ACTION: Definition of criteria and identification of high-nature-value farmland and forest areas (including the Natura 2000 network) threatened with loss of biodiversity (with particular attention to extensive farming and forest/woodland systems at risk of intensification or abandonment, or already abandoned), and designation and implementation of measures to maintain and/or restore conservation status.

(reviewed by K. Čámská and L. Vokasová)

The Czech landscape is characterized by a high fraction (38.8%) of the arable land. There has been a slight decrease in the area of agricultural land over the past 10 years, in favour of grasslands and forests; about 7% of the area of agricultural land is endangered by abandonment. More than 40% of the area of agricultural land is classified as endangered, particularly by erosion. At the early 1990s, there was a temporary decrease in the quantities of fertilizers and pesticides employed, but the use of these substances has been increasing again in recent years. The disturbed structure of the agricultural landscape does not currently provide optimal conditions for wild flora and fauna and agricultural production leads to habitat disturbance and spreading of invasive species. In attempts to change agricultural policy, the ecosystem approach frequently has the role of a conceptual guideline, but is employed minimally in practical activities (Zima et al. 2006).

The **Czech Rural Development Plan** (<http://www.mze.cz>, 2006) is one of two main action plans for the next six-year period (the second is National Strategy Plan, 2006), resumes agri-environmental measures (HRDP The Horizontal Rural Development Programme, Less Favoured Areas, ecological agriculture) carried out in the Czech Republic in 2004–2006 and describes the actual state of the rural environment and defines four main streams of subsidized development in 2007–2013. The second RDP's topic has three priorities: (i) preservation and development of high-nature-value farmlands and forest areas and traditional agricultural regions to enhance biological diversity, (ii) water and soil preservation, and (iii) softening of climate changes.

The **Horizontal Rural Development Plan of the Czech Republic 2004–2006** included following measures: (i) organic farming, (ii) farm wide measure, e.g. grassland maintenance, (iii) conversion of arable land into grassland, establishment of grass belts on sloping ground, growing of catch crops, permanently waterlogged meadows and peat land meadows, bird habitats on grassland, and bio-belts.

The number of eco-farms grew significantly, covering 6.7% of the overall area of agricultural land in the Czech Republic in 2006. In connection with the increasing numbers of ecological farmers and the area of land cultivated, the production, consumption and export of bio-food also increased. The Czech Republic participates in the project carried out by the European Environmental Agency, which aims at defining high-nature-value farmland areas in the European context and consequently analysing up to which level and how well the current Common Agricultural Policy is able to contribute to protection and maintenance of the areas.

As for biodiversity-based products derived from sources that are sustainably managed, Government Council for Sustainable Development in 2005 has adopted the **Framework of the Programmes on Sustainable Consumption and Production** (SCP) with strategic priorities reaching from education, support of local SCP initiatives to market conditions. In accordance with Czech Acts on organic farming and on administrative fees, the Ministry of Agriculture appointed The **Ecological Farming Inspection** to conduct inspections and award certificates for ecological farmers and bio-products. On the other hand market with products of ecological farming has not been well developed; higher costs of ecological farming are not reflected in consumers' final price.

Main goals of the **Action Plan of the Czech Republic for the Development of Organic Farming until 2010** are *inter alia* (i) to enhance the position of organic farming in the Czech Republic, (ii) to increase the positive influence of organic farming on nature and landscape, (iii) to improve welfare of animals kept at organic farms, (iv) to ensure protection of organic farming products from contamination from genetically modified organisms, (v) to improve specialised consulting, education and research in the organic farming sector, and not last to achieve by 2010 an approx. 10% share of organic farming in the total agricultural land.

The subsidies are granted, laying down the support programmes for non-productive agricultural functions and activities aimed at landscape management, support programmes for less favourable areas and the criteria for the assessment thereof, aiming at the following issues: planting of grasslands, maintenance of grasslands through livestock grazing; ecological agriculture; support for bee-keeping; liming soils with soil reaction up to pH 5.5; establishment of elements of territorial systems of ecological stability (i.e. national ecological network at the supra- and sub-national and local levels).

The **Agricultural Sector Research Programme** in its sub-programme Protective and Management Farming Methods develops priorities of the 2nd theme of RDP. The programme will last for the period 2007–2013 and describes five research directions, among others dealing with environmentally friendly technologies.

In the present, the researchers from only one of three agricultural universities, namely in Prague, participate more in research of sustainable agriculture (www.czu.cz), but they are not in close contact with practice (e.g. Svobodová 2004, Podskalská & Zasadil 2005). Research institutes carry out research applicable directly in farming, e.g. the **National Programme of Conservation and Using of Plant, Animal and Micro-organism Genetic Resources Important for Food, Agriculture and Forestry, Agricultural Farming in Threatened Areas** or **Different Farming Impact on Grasslands in Mountain Areas** (e.g. Pavlů et al. 2006a, 2006b, Hejzman et al. 2007). However, the research neglects wild flora (except weeds).

As to the main tool for maintaining and/or restoring conservation status of the above areas – the agri-environmental programmes, unfortunately, the effect of the programmes is often marginal, or even disserviceable. The biggest barriers of their higher effectiveness are currently as follows: a strong unification of conditions of individual measures that does not permit to take into consideration local and weather particularities, setting a complete set of conditions for farmers for the whole period of obligation, a limited opportunity of the State Nature Conservancy authorities to influence management (nor even in relation to the management plans for the Specially Protected Areas) and an insufficient number of measures on arable land (in comparison with the measures on grasslands the former are strongly underestimated). Furthermore there is not an independent monitoring and high-quality data for evaluating their effectiveness from the nature conservation and landscape protection point of view. The only monitoring is set by the Ministry of Agriculture, but there is no huge interest in a really objective and fully respected monitoring, and at the same time the extent of the monitoring is completely insufficient.

Following main obstacles of present research and its connection with farming may include: (i) poor or no communication and cooperation between agricultural and environmental sectors at all levels, (ii) preservation of traditional methods in agriculture and landscape management (in some areas), (iii) low implementation of the ecosystem approach in agriculture practice due to poor knowledge of real rural and farming problems and priorities among researches (they are only partly participated in international research projects in this field) and officials, and (iv) a lack of research projects dealing with the above problems in the Czech Republic.

A2.1.4 ACTION: Ensuring effective implementation of cross-compliance (which provides a baseline for most of the measures of Axis 2 of the Rural Development Regulation) in ways that benefit biodiversity.

(reviewed by K. Čámská and L. Vokasová)

The Czech government will soon notify its **Rural Development Plan** – the plan for spending European Agricultural Fund for Rural Development money in 2007–2013 – to the European Commission. The implementation of cross-compliance is currently being prepared in the Czech Republic, under the Ministry of Agriculture. Farmers already have to respect the **Good Agricultural and Environmental Conditions**, the first part of the cross-compliance, the **Statutory Management Requirements**, the second part, will be launched in 2009.

There are two main problems concerning this tool from biodiversity conservation point of view. Firstly, for designing the cross-compliance requirements one of the limiting factors are capacities of controlling and checking authorities. There is no political will to provide additional capacities for providing the controls and consequently there is a tendency to limit the requirements to minimum. We also lack methodologies how to control some of the proposed requirements, which is especially evident in the case of forbiddance to destroy various landscape components, which is the reason why the Ministry of Agriculture decided to check only those landscape components which can be easily monitored and controlled. The main problem, however, is that there is a tendency to consider cross-compliance to be just another burden posed to farmers and as a result again to limit the requirements to a minimum acceptable by the European Commission. Farmers are afraid particularly of the new cross-compliance rules, which mean necessary investments in farms such as animal welfare and septic tank capacity. Unfortunately, the rules and administration for management in especially protected areas and future Natura 2000 are not understood well by farmers and realisation of the management of these areas.

As to the research projects, in the period 2002–2005 there was a large international project under the Institute for European Environmental Policy, the United Kingdom, which the Czech Republic participated in. (For the results please see the web page <http://www.ieep.eu/projectMiniSites/crosscompliance/index.php>.) Another project, currently running, is under the European Environmental Agency and is aimed at advisory systems for the cross-compliance. Mr. J. Pražan (former VÚZE – Agricultural Economics Research Institute – and former EEA staffer) participates at this project as a Czech representative. The project **Weed diversity, its conservation and use for bio-indication of farming systems** (<http://aplikace.isvav.cvut.cz>) test the hypothesis that different systems of agriculture practices will elicit typical changes in the weed community structure. The project on **Biodiversity and energy crops** evaluates risks and contributions to the biodiversity when growing energy crops in the landscape at all its levels (genetic, species, ecologic and landscape) and elaborates a methodology for assessing of new energy crops introduced for farming practice from biodiversity point of view.

A2.1.7 ACTION: Ensure future 'less favoured area' (LFA) regime under Axis 2 enhances its contribution to biodiversity and to 'high nature value' farm and forest areas.

(reviewed by K. Čámská and L. Vokasová)

There is no research concerning the Less Favoured Area measures in the Czech Republic from the biodiversity conservation point of view. The Agricultural Economy Research Institute provides the methodological help with RDP for the Ministry of Agriculture and is involved in e.g. **Analyses and Suggestions to Less Favoured Areas Definition and to Subsidy Conditions after 2010** (<http://www.vuze.cz>). These payments are strongly dependent on the rules and methodologies set by the European Commission, which is why a Czech participation in some international European project in this field would be convenient. The fact that the payments are targeted at grasslands we consider to be a positive aspect. On the other hand proposals of the Ministry of Agriculture (when preparing the Rural Development Plan for the period 2007–2013) to make the conditions of this measure stricter in order to achieve a bigger impact to the environment were rejected at the end because of Agrarian Chamber lobbying.

On the other hand, the terms “high-nature-value farmland and forest areas”, “cross-compliance” and “less-favoured area regime” are topics used now rather in the public education, than in the agricultural research. The Ministry of Agriculture issues manuals and organizes trainings, workshops, seminars and lectures. The Agricultural and Food Information Institute and many advisory services (e.g. ZERA, Ekotoxa, Václavík 2006) and agricultural organizations (Agrarian Chamber, Agricultural Association, etc.) provide the education aimed to farmers, as well. At the end of 2007, projects of **Regional Centres of Professional Education**, associating farmers, education and research institutes, should be subsidized by ESF.

The German MEKA Programme based on floristic field method in agri-environmental scheme in order to rewards farmers to the plant diversity (EEA 2006a) may be a challenge for Czech agriculture research.

A2.1.11 ACTION: Strengthen measures to ensure conservation, and availability for use of genetic diversity of crop varieties, livestock breeds and races, and of commercial tree species in the EU, and promote in particular their *in-situ* conservation.

(reviewed by L. Dotlačil and M. Roudná)

The Czech National Programme on Plant Genetic Resources (NP) was launched by the Ministry of Agriculture in 1993. NP was substantially updated in 2004, after the Act No. 148/2003 on the **Conservation and Utilization of Genetic Resources of Plants** and applicatory Decree No. 458/2003 entered into force. The Czech Republic ratified the **International Treaty on Plant Genetic Resources for Food and Agriculture** in 2004. Internationally recognized principles of “Access and Benefit-sharing” are fully respected also in the Czech version of the **Material Transfer Agreement** (Roudná 2006).

At the present, twelve Czech institutions taking part in the NP hold 50 000 accessions of plant genetic resources. The NP deals with gathering (including collecting missions), documentation, characterization, evaluation and conservation of plant genetic resources and provides services to users. **The Gene Bank** in the Crops Research Institute (<http://www.vurv.cz>) provides long-term storage of seed samples (under –18 °C or –5 °C respectively) for all seed-propagated collections and provides services of the **National Information System on Plant Genetic Resources** (so-called EVIGEZ, see genbank.vurv.cz/genetic/resources/asp2/1_evigez_c.htm, Dotlačil et al. 2005 a, b). All institutions participating on the NP have close partnerships with users within the country and abroad and provide them samples of genetic resources (yearly 4–5 thousand accessions!), in harmony with the International Treaty. International collaboration and effective cooperative links have been set up particularly within the **European Cooperative Programme**.

All Czech collections are fully documented in passport and evaluation data (based on National Descriptor Lists for over 40 crops) are available for 62% of accessions. Recently, detailed inventory has been carried out and current data were completed by newly collected information, including data on viability and accessibility of accessions and regeneration needs. Among all accessions 74% are freely available, while other 18.4% are accessible under the particular conditions and 5.7% need urgent regeneration.

An intensive characterization and evaluation of genetic resources are carried out to strengthen their use in breeding and in agricultural practice. Also collecting missions as well as conservation and surveying of valuable resources conserved *in situ* contribute to preserve and evaluate local resources. “*On farm*” conservation is being developed in fruit trees’ landraces and few other crops. Cultivars and landraces of neglected crops (buckwheat, millet, hulled wheat species, some fruit trees and forage crops, see Stehno et al. 2005) were successfully used for agri-biodiversity enrichment as well as for specific use particularly in human nutrition. Close collaboration with producers (mainly organic farmers) and processing industry has been developed. Selected alternative crops and catch crops have been studied with the aim to introduce them into growing and contribute to the soil fertility improvement.

Unfortunately, the majority of assessments is conducted *ex-situ* and does not address ecosystem consequences of agri-biodiversity. Assessing the contribution of agriculture is not provided – their importance is widely accepted and their conservation supported by government via the appropriate conservation programme. Some genetic resources serve for restoration of damaged areas and for breeding.

A2.1.13 ACTION: Ensure that the forthcoming EU Forest Action Plan addresses forest biodiversity among the priorities, in line with the EU Forest Strategy and the 6th Environment Action Programme.

A2.1.14 ACTION: Implement Vienna Ministerial Conference resolution on forest biodiversity (2003) through forest policies of MS and EU Forest Action Plan with particular reference to the CBD Expanded Programme of Work on Forest Biological Diversity.

A2.1.15 ACTION: Assess potential impact on biodiversity of plans, programmes and projects for afforestation (or, should the case arise, deforestation); adjust accordingly in order to ensure no overall long-term negative impact on biodiversity.

(reviewed by J. Fanta, P. Petřík, and J. Hruška)

Forests cover 34% of the Czech Republic and this area has been slightly increasing since the beginning of the 19th century. The Czech State owns more than 60% of the area of forests. Czech forest stands are divided into the category of production forests (76% of total area), protective forests (3.5%) and special-purpose forests (20.5%). They are important not only as a timber source but they markedly influence local climate, increase the landscape water retention capacity, prevent erosion on steep slopes, and provide an irreplaceable environment for recreation.

Despite the reduction in air pollution during the 1990s, the environmental conditions of some (particularly mountain) Czech forests remain poor (Hruška & Cienciala 2003). The health conditions of forests in the CR have been monitored by the ICP – Forest Programme since 1986 (<http://www.vulhm.cz/?did=290&lang=en>). Over 70% of the coniferous and 34% of the deciduous trees show the loss of foliage or needles at present.

The poor conditions of Czech forests are caused not only by the air pollution in the past, which resulted in the soil acidification and consequent forest dieback in some Czech mountain regions between the 1960s and 1980s. There are still cases of large-scale forest damage caused by windfall and bark beetle attacks (partly by fungal diseases) resulting from large-scale monoculture plantations of the Norwegian spruce (*Picea abies*) and Scotch pine (*Pinus sylvestris*) and from depleted soils. Salvage cuts have contributed to wood production with dozens of percent in last years (Ministry of Agriculture 2005). Wood and timber production, and technical issues are being preferred by Czech forestry; multifunctional use of forests, biodiversity, environmental and ecological as well as social issues are not given an appropriate attention. This has had a negative effect on completing various tasks and issues of the global and European policy, among others the Convention on Biological Diversity. In contrast, Ministry of the Environment implement ecosystem approach into basic policy and legislative documents and practise. However, the Ministry of the Environment has only supervision and not decision-making competences.

Started in spring 2006, a group of Czech scientists has protested against such an unsustainable management and suggested improvements focusing on biodiversity (<http://lesy.drosera.cz/?eng>). In their statement, they call for adopting the following important measures: elimination of clear-cutting, restoration of the natural tree composition, retaining old trees and deadwood in forests, elimination of liming and fertilization, sharp reduction of deer populations, more effective protection within Specially Protected Areas, and regulation of afforestation and reforestation. Publication of the document in media led primarily to a refusal mostly from professional foresters, maybe due to asymmetric support of mainly biological aspects at the expense of the economical ones. Further, the document raised broad public discussion.

In summer 2006, The Institute of Botany of the Academy of Sciences of the Czech Republic (administrator of the Czech Bioplatform³), decided to organize a meeting to bring both scientists and practical managers together to discuss the above topics. The final document defining main goals for forest management was accepted by the majority of participants (see Petřík 2006). However, the discussion is not over and continues (<http://www.chm.nature.cz>) as an e-conference under coordination of the BP and Agency for Nature Conservation and Landscape Protection of the CR. Main task of the BP group is reduction of deer population and using assessment of deer stock according to damaged vegetation (in Europe, only in the CR and Hungary the method is not applied). Second, despite involvement of some old and open forests into the European Community Natura 2000 network, some organisms living there are close to extinction due to the current forest management. In this case, alternative management (e.g. forest grazing or coppicing) is proposed by the BioPlatform group (see also other part of this review on the Natura 2000 target). There is a rather high professional potential in some practicing foresters to introduce a new approach and methods of a sustainable forestry (see e.g. integrated ecological concept of the Czech forestry by Ministry of the Environment, Lindenmayer et al. 2006). Such initiatives have a high innovative potential, can represent the Czech forestry sector at the international scene and can contribute, in a creative way, to the forming of a modern, contemporary European forestry policy.

In 2003, the **National Forestry Programme** was adopted by the Government of the Czech Republic and the Ministry of Agriculture prepared the **Basic Principles of the State Forestry Policy**. The National Forest Programme in 2003 included following environmental issues, which seem to be quite well-balanced: (a) forestry management based on the sustainable development, (b) development of production and non-production functions of forests, (c) maintenance and development of biodiversity of forest ecosystems, (d) forest management in Specially Protected Areas, and (e) protection of forest ecosystems against harmful factors.

At present, the National Forest Programme II for 2007–2013 is being prepared in the CR and scientists from BioPlatform participate in negotiation process together with forest scientists, managers and policy makers (see above). However, the Czech Bioplatform has criticized its low professional standard, particularly concerning the environmental issues. In the last draft the Programme can be hardly seen as a contribution to the European forestry policy. Discussion is further coordinated by the Ministry of Agriculture (administrator of forestry in the CR) with very active participation of Ministry of the Environment, which attempts to establish nature-close non-clearing forms of forestry, and it will result in a new forest law in the near future.

Until now, the Czech forestry research did not develop any concentrated action towards strategic goals formulated within the European Framework Programmes (see Šanc 2006). Czech forest scientists hardly participated in integrated European projects. Czech names hardly appear in international scientific journals (if any, then it is a biologist working on forestry issues). Only very few Czech foresters are members of international forestry bodies (e.g. Forest-Based Sector Technology Platform) or research centres (e.g. Joint Research Centre). Topics promoted by the EU have been hardly investigated in the last years.

There are numerous gaps in ecological and environmental issues in forestry such as nature and biodiversity conservation, role of forests in landscape protection and restoration, etc.; multifunctional use of forests is heavily underestimated. Research on structure and dynamics of natural forests (see e.g. Vrška et al. 2006) is fully managed by Ministry of the Environment, which is, however, non-responsible for forestry management. There is no

³ The goal of the Bioplatform is to maintain such a discussion, see <http://www.ibot.cas.cz/biop> and the ongoing project BioStrat; see <http://www.biostrat.org>.

serious research on assessing the ongoing forestry policy. Only few Czech forest scientists are working on the CO₂ sequestration and related issues of climatic change (e.g. Cienciala & Tatarionov 2006 and see activities of the Institute of Systems Biology and Ecology tackling grant on carbon sequestration Czech Carb, <http://www.usbe.cas.cz>). As for forest biodiversity research, there is one project dealing with **Biodiversity management in the Krkonoše & Šumava Mts.** (<http://aplikace.isvav.cvut.cz>). The basic goal of this project consists in an integration of knowledge on biodiversity development under some management practices in two national parks.

There is no comprehensive methodology for monitoring changes in species diversity in forests that would include assessment of adverse impacts. The system of forest categorization has remained unsatisfactory, there are inadequate rules for felling and control of compliance and there is insufficient emphasis on introduction of suitable systems of forest certification. The system of valuation of the non-productive function of forests based on ecosystem approach and supported by Ministry of the Environment is a subject of very hard discussions with representatives of market approaches.

In the Rural Development Plan there are subsidy schemes in agricultural sector for forest restoration, recovery and conservation in aggravated conditions in the areas affected by air pollution. However, there are also some questionable financial support for protection of cultures against forest weed, pine weevil and rodents (chemical use in forests may be harmful for biota), construction of new game-proof fences (the problem of high stocks of deer cannot be resolved by this expensive way), forest stands fertilisation and liming (using such methods can be harmful for soil), water drainage, alteration and embankment of rivers and/or streams and dykes, construction of new forest roads, afforestation of non-forest land⁴ (it can have potentially unfavourable impact on the biodiversity). There are under-funded measures such as Natura 2000 payments in forests, planting of trees and shrubs in agricultural landscape, and forest-environment payments. On the other way, there is also subsidy for supporting in environmentally sound technologies during the forest management (e.g. primary extraction and skidding of wood by cableway or by horse in forest stand). Some clauses in the Rural Development Plan may be in conflict with the European Agricultural Fund for Rural Development (EAFRD) goals and objectives, and those of the EU Sustainable Development Strategy and other documents (Bláha & Kotecký 2006a, b). Without clear environmental eligibility criteria, several proposed measures risk undermining some of the Union's, and EAFRD's own, goals and objectives. Vague definition of some measures undermines possible synergies and leads to unnecessary loss of the potential to achieve EAFRD environmental and biodiversity objectives. Some of the crucial measures are worryingly under-funded.

As a result, the current Czech forestry sector as a whole (i.e. policy, management, research and education) does not react properly until now on the new situation forthcoming from the EU membership, EU Forest Strategy, concept of the European forestry policy and challenges for change and innovation although the ecosystem approach has been a traditional alternative to economic and profit-oriented forest management for several centuries in forest management.

⁴ The "Afforestation of unused agricultural lands" is one of measures in forestry management, which attempts to convert uncultivated agricultural land to forests with a wide range of tree species, and to increase the biodiversity by extending afforested areas, particularly in the agricultural landscape.

TARGET A2.2: Risks to soil biodiversity in EU substantially reduced by 2013.

TARGET A2.4: Principal pollutant pressures on terrestrial and freshwater biodiversity substantially reduced by 2010, and again by 2013.

(reviewed by J. Hruška)

During last 15 years air pollution by acidifying compounds was significantly reduced. There was almost 90% reduction in SO₂ emission between 1990 and 2006 resulting in sulphur deposition decrease by 75%. The main reduction occurred done between 1990 and 1999. Since 1999 sulphur deposition has been stable and typical deposition for forested areas is between 8–20 kg.ha⁻¹ per year. Nitrogen compounds deposition has been stable since the mid-1990s and slightly increases during last five years, probably as a result of road traffic increasing. Common nitrogen deposition in forested areas is now between 10–20 kg.ha⁻¹ per year!

Biodiversity of Czech mountain forests and freshwaters has been significantly reduced by high acidification and eutrophication since the 1950s. Soil and streams became acidic and soil acidification and high SO₂ concentrations in the air resulted in widespread dieback of the Norway spruce monocultures/plantations. In general, soil organisms (Rusek in Hruška & Cienciala, 2003) and aboveground plant communities' biodiversity was reduced significantly due the three main reasons: 1. acidification, 2. exceeded nitrogen, and 3. forest and agricultural management.

1. Acid deposition itself, caused mainly by sulphuric acid was reduced significantly, but previously acidified soils have been only slightly restored. Situation at many sites and areas (northern mountains of the Czech Republic, well known as the Black Triangle, see e.g. Fanta 1997) has not been significantly improved. Results from biogeochemical models show that soil chemistry will be similar to the current one in the next 30 years and soil restoration will be very slow. There will be regeneration in upper most soil horizons, but mineral soils will continue in acidification. Consequently, mountains and forest freshwaters will stay acidic with harmful effect on freshwater biota particularly during high flow episodes (Laudon et al. 2005) when acidity will decrease and mobilized toxic elements in the water will reduce biodiversity.

2. Nitrogen deposition exceeded the critical loads for nutrient nitrogen on the almost whole territory of the Czech Republic (Skořepová in Hruška and Cienciala 2003). For forested areas, the critical load is exceeded by 50–100%. The typical critical load for mountain forests is between 5–9 kg.ha⁻¹ per year (Hofmeister & Hruška 2005) but see above for current state. Target, nitrogen sensitive species such as epiphytic lichens withdraw, despite historical records (beginning of the 20th century) documented their high abundance and diversity.

3. Also forest and agricultural management practices are important beside pollution and deposition level (see also other part of the present review or Emmer et al. 1998). Plantations of high productive Norway spruce decrease biodiversity at all the three main levels. The monocultures also enhance acidic deposition (dry deposition onto canopy) and consume a lot of essential nutrients from soils (mainly Ca and Mg). But the nutrients are also essential for mitigation of the acid rain effect. Moreover, foresters fertilized soils with nitrogen in forests despite of its high level in the air and water solutions. Thus forestry dramatically delayed soil and water recovery in respect to chemistry as well as biodiversity.

Use of pesticides, industrial fertilizers and heavy machinery by modern agriculture is responsible for significant depletion of agricultural soil biodiversity (Rusek in Vačkář 2005). There is some evidence that organic farming practices relying on natural processes and manure can restore soil biodiversity. The Czech Republic has already implemented the Nitrates Directive (91/676/EC), which is now obligatory in cross-compliance scheme (including treatment of sewage sludge, persistent organic pollutants etc.).

A4.3.1 ACTION: Develop and implement spatial and programmatic plans that support the coherence of the Natura 2000 network (in line with the requirements of the nature directives to ensure such coherence) and maintain and/or restore the ecological quality of wider landscape

(reviewed by P. Petřík and P. Peterová)

The ecosystem approach principles as developed by CBD have not been explicitly tested in the CR in any specific programme or project; nonetheless many of projects can be closely related to the above concept. For example, the mapping being carried out for identification of the Natura 2000 sites is an effective instrument for identifying highly valuable ecosystems in unprotected areas, i.e. in the non-reserved landscape. The Specially Protected Areas network has been established in the Czech Republic, including national parks, protected landscape areas, and several types of small-size Specially Protected Areas (Natural Reserves and Natural Monuments). Various activities are being carried out for developing the Natura 2000 network. Procedures to establish and manage the Natura 2000 network in the Czech Republic are regulated by the **Act on the Protection of Nature and the Landscape** No. 114/1992, which has been therefore amended according to the European Community directives on nature conservation (Birds Directive, Habitats Directive). Below, there are two selected research-related targets taken from the State Environmental Policy 2004–2010, Czech Sustainable Development Strategy and National Biodiversity Strategy of the CR (*in-situ* conservation), redrafted and used by Natura 2000 experts:

1. through monitoring in the network, identify trends in ecosystems and species at the national level. Collect scientific and technical results according to the standardized criteria in reference networks in national ecosystem and species databases of ecosystems and species (database of natural forests, distribution databases of species and types of habitats)
2. continue in standardization of approaches in preparing management plans, provision for Specially Protected Areas management and evaluation of the management outputs, using the ecosystem approach.

Since September 1999, the Agency for Nature Conservation and Landscape Protection of the Czech Republic (<http://www.nature.cz>) in cooperation with the Ministry of the Environment have been coordinating the preparation of technical/expert documents for establishing the Natura 2000 network in the Czech Republic and the target wildlife species and habitat mapping. The Agency has been collaborating with other State Nature Conservancy authorities and the Forest Management Institute (<http://www.uhul.cz>) and with external co-workers in mapping natural habitat types in the field. The habitat mapping includes collection of the information on the areas of natural habitats for identifying the Natura 2000 sites (<http://mapmaker.nature.cz>). However, the habitat mapping methodology has been improved more times during field mappings and some recorders involved in the field mapping lacked the basic knowledge of mapping vegetation. The Agency for Nature Conservation and Landscape Protection of CR also coordinates digitisation of the results obtained. The outputs are intended to be used as the updated information source, as a basis for data time series for monitoring at permanent plots and as a basis for managing a database. However, this coordination of the digitisation process was very poor and personally underestimated. Therefore, the technical preparation of the pSCIs (proposed Sites of Community Importance) was delayed. In spite of the variable quality of the individual work, database and map documents in the the Natura 2000 network provide a unique opportunity for commencing identification and monitoring programmes on a joint time basis.

The pSCI sites were proposed for habitats and species (listed in Annex I and Annex II of the Habitat Directive), which require territorial protection. In 2004 the Czech Government

approved 863 pSCIs out of totally proposed 883 (covering 9.2 % of the CR) and in 2005, the National List of pSCIs was submitted to the European Commission headquarters. There are also 38 Special Protection Areas (SPA) identified and approved by the Government in the Czech Republic. The national Specially Protected Areas network has been enlarged due to the Natura 2000 sites (see further information on <http://www.natura2000.cz>).

The Czech Republic already obtained results from the European Commission for both biogeographical regions, which are extended to the Czech Republic – the Pannonian and Continental ones. At two biogeographical seminars, the suggestions of NGOs and experts for Natura 2000 species and habitats were the key ones for final elaborations. In total, 62 of the 92 species were assessed by European Commission to be sufficiently covered; however, this was the case only by 14 of 59 habitats suggested. Recently, the final report is under preparation. In the Pannonian region the sites for addition were selected at the end of 2006. At present, the Ministry of the Environment in cooperation with the Agency for Nature Conservation and Landscape Protection of the Czech Republic discuss with stakeholders the conditions and management for habitats and species at the new proposed Pannonian sites (first quarter of 2007). Continuously, in the Continental region the Czech Republic is preparing addition to National list (the first half of 2007).⁵

If there is intent to build/do something in a Specially Protected Area, the interpretation of the Act No. 114/1992 on the Protection of Nature and the Landscape is being used. Moreover, there is a new assessment – the Natura 2000 assessment – for activities, which could negatively affect the Natura 2000 site. The type of preliminary protection is not common in other EU Member States hence there is a need for accelerating the up-dating of the Community list. The final process – an adopting the National lists by the European Commission – is now accelerated also in the CR. The sites on the Czech National list do have a preliminary protection according to the above Act on the Protection of Nature and the Landscape. Unfortunately, there are cases when pre-selected site with targeted protection within the Natura 2000 network was destroyed before its official protection declaration.

The methodology of monitoring has not been fully running for the Natura 2000 sites, because this network is quite new. On the other hand, in 2003 intensive activities are carried out within the **Monitoring of Specially Protected Species of Animals, Plants and Habitat Types Highly Significant in Terms of the European Community Legislation**, which aims to establish the rules and a monitoring system at the Natura 2000 sites. Guidelines and methods for scientifically sound monitoring had been developed, including consultation rounds with scientists and experts.

Research on grassland and forest ecosystems has a long tradition in the Czech Republic and has provided information that can readily be used at the present for introduction of an ecosystem approach for their conservation. In the framework of mapping for the Natura 2000 system of protected areas, optimal management methods of species-rich grasslands and forest ecosystems have been proposed (Anonymous 2006). Generally, nevertheless, the research linked to Natura 2000 sites is quite extensive in the Czech Republic.

⁵ The European Commission recognized the necessity for up-dating the Community lists for the different biogeographical regions in an accelerated procedure. The European Commission will not wait for the completing of the National lists from the new Member States. The reason is that the preliminary protection of the Natura 2000 sites is not declared by each Member States (according to 'Bund Naturschutz judgement').

A2.3. TARGET: Substantial progress made to good ecological status of freshwaters by 2010 and further substantial progress made by 2013

A2.4 TARGET: Principal pollutant pressures on terrestrial and freshwater biodiversity substantially reduced by 2010, and again by 2013.

A2.5 TARGET: Flood risk management plans in place and designed in such a way as to prevent and minimise biodiversity loss and optimise biodiversity gains, by 2015.

(reviewed by Z. Poštulka)

Inland water and wetland ecosystems are subject to strong anthropogenic effects in the Czech Republic and are generally considered to be endangered more than terrestrial ones. Extensive drainage of the landscape has occurred over the past 50 years and only one quarter of the original 1 300 000 ha of wetlands has been preserved. In general, water quality in watercourses has been significantly improving over the past decade in the CR. The long-term improvement in water quality was caused primarily by the construction or intensification of decisive **Waste Water Treatment Plants**, the shutdown or reduction of production in a lot of industrial enterprises and by decrease in the use of fertilisers in farming production.

In spite of the improvement achieved, the current conditions cannot be considered fully satisfactory; problems have persisted mainly in the parts of watercourses with lower flow rates and high accumulation of pollution sources. The most of forest streams are significantly altered, mostly due to incision and a lack of large woody debris elements in the Czech Republic (Stevens 1997). It has been resulting in higher erosion, smaller retention and changed hydraulic characteristics of the streams. The process has last for many centuries and there are nearly no natural streams left as a reference. Due to clear-cut logging and plantation like forest stands there is a significant drainage of catchments due to accelerated erosion and humus degradation. There is a slight progress towards the restoration of polders and ponds, yet the streams and most of wetlands are regulated and drained and both result in high rate of diffusion pollution of our surface waters (Davis et al. 2002). Due to the lack of action within previous parts of river basins, together with piecemeal fragmentation (buildings, infrastructure, arable land) of floodplains, the River Basin Administrations enterprises have been constantly forced to accept measures damaging river dynamics and to canalise rivers, which results in terrifying biodiversity loss (Jungwirth et al. 2002).

The numbers of wetlands that can increase biodiversity and improve water retention in the Czech landscape are gradually decreasing. Eutrophication was reported in a number of water reservoirs in 2003 (caused by pollution of water by municipal waste, and partly also by inflow of nutrients washed out from the agricultural land and from commercial fishing activities, particularly the compounds of phosphorus and nitrogen in the water).

The quality of surface and ground waters is significantly affected by diffusive pollution sources, especially pollution from agricultural activities, atmospheric deposition and erosion run-off. The importance of diffusive pollution is increasing with the continuing decrease in pollution from point sources. In 2003, the Government issued the Act 103/2003 on **Designation of Vulnerable Areas and on the Use and Storage of Fertilisers and Barnyard Fertilisers, Alternation of Crops and Implementation of Anti-erosion Measures in Those Areas**, in which farming contributes significantly to the ground and surface water pollution with nitrates and in which certain measures are in place to control the adverse impact.⁶ In the **Concept of Agrarian Policy of the Czech Republic for the Period**

⁶ The European Community **Water Framework Directive** 2000/60/EEC is a fundamental document stipulating the EU approach, as well as that of the Czech Republic, as the EU Member State, to surface water and groundwater protection and management. Its implementation includes the establishment of a register/s of all areas located within each river basin, which have been designated as requiring special protection under the specific European Community legislation for the protection of their surface water and groundwater or for the

After Accession to the EU (2004–2010) and in the **State Environmental Policy of the Czech Republic 2004–2010** – in line with the National Biodiversity Strategy, the goals for sustainable use of water resources were formulated.

Aquatic and wetland ecosystems have long been monitored in a quite consistent manner in the CR (Straškrabová et al. 1998, Jelínková & Straškrabová 2001). A detailed survey of current conditions and trends has been supported by programmes and inventories performed in the framework of fulfilling the obligations of the Ramsar Convention and also habitat and species mapping for establishing the Natura 2000 system. Important results have been obtained from long-term hydro-biological study of lakes, artificial freshwater reservoirs and watercourses.

There are funds for supporting retention ability of the landscape, prevention and reduction of the detrimental effects of floods and increasing the biodiversity of watercourses and their surroundings. Supported projects include restoration of watercourses, elimination of migration barriers on watercourses for wild fauna (e.g. construction of fish ladders), modifications aimed at renewal of the function of spring areas and wetlands and the construction of retention reservoirs and dry polders. The **Operational Programme Environment** will fund complex revitalization projects related to fluvial ecosystems if they would be involved in River Basin Plans. The projects for retention enhancement and biodiversity in the landscape will be funded without connection to River Basin Plans.

We are facing growing flood and drought risks (see extreme seasons with floods in 1997, 2002 and heats in 2006 in the CR, <http://www.chmi.cz>) due to the destabilization of climate and due to the decrease of the retention capacity of river basins (Brown 2002, Prach et al. 2003). In the Czech Republic, there are three basic elements within river basins with different administrative and management authorities responsible for those three pillars.

1. Forested mountain river basins are under the governance of the Forests of the Czech Republic (LČR, <http://www.lcr.cz>), the state owned enterprise. The most lacking is the geomorphologic and eco-hydrologic research estimating best management practices within sensitive catchments. We need to estimate, what is the retention potential of undisturbed catchments vs. disturbed catchments (Gurnell et al. 1995). We need a swift change towards water sensitive forestry using natural forest restoration/recovery as a basic tool. It needs a research on economy, on new forestry methods, etc. However, there is no negative interference between biodiversity-oriented sustainable forestry and mountain forest river basins restoration, just only positive interrelationship.

2. Small agricultural streams (catchments) are under the management of the **Agricultural Water Management Board** (<http://www.zvhs.cz>). The most important research is needed to estimate the water retention achievable by means of soft restoration methods (landscape management), as e.g. restoration of contour coppice woods combined with contour ditches, ponds, infiltration pits, wetlands, stream restoration and so on (Vašků 2003). The measure can bring not just only water retention, but it also increases biodiversity, improves the landscape thermodynamics and contributes to carbon sink (Ripl 1997, Eiseltová & Pokorný 1998). There is mostly no negative interference between the biodiversity-oriented agricultural river basins restoration, as the restoration aims to bring the landscape closer to its traditional biodiversity-rich structure. There might be conflict if coppice woods were planned on biodiversity-rich meadows.

3. Large rivers and their floodplains are administrated by various local **River Basin Administrations**, the state owned enterprise. River landscape is very fragmented in the Czech Republic, it has lost its dynamics and there are mostly occurring only isolated island

conservation of habitats and species directly depending on water. The Act No. 254/2001 on waters and the Act No. 99/2004 on fishing are concerned with protection of these sensitive ecosystems. The Czech Republic has become a Party to the Ramsar Convention on Wetlands.

populations of rare organisms recently (Šeffler & Stanová 1999, Petts 2001). It would bring a problem: If we would like to restore the river dynamics and flooding, we could sometimes endanger some of the last island habitats, if we won't restore the river dynamics, the populations will become extinct (but still this strategy of inaction is being preferred). We need a research, how to combine flooding and river restoration together with supporting endangered species (Leuven & Poudevigne 2002). Still there is no other alternative to restoration of the natural river and flood dynamics, rehabilitation of river continuity, connection of the river to its floodplain, replanting floodplain forests (Gurnell et al. 2002) and renewing floodplain meadows instead of arable land and recreational buildings protected by levees (Church 2002). Generally speaking, the restoration of the river continuum is very beneficial for biodiversity (Matthaei et al. 005).

Apart from research, there is a need (i) to finalize the system of effective treatment of wastewater in the territory of the Czech Republic, (ii) at the national level, reduce the use of fertilizers and pesticides and, thus, support the reduction of intensity of pollution of the aquatic environment from diffuse sources, (iii) to reduce the risks of pollution of groundwater and surface waters from old environmental burdens and ecological accidents, and (iv) to ensure sustainable farming in the landscape, with respect to the principles of good agricultural practice and with support for development of organic farming.

CONCLUSIONS

(edited by P. Petřík based on compilations of all co-authors)

Based on the review there are following gaps of knowledge and need for further research concerning:

Sustainable rural and agricultural management

There is insufficient application of the ecosystem approach in Czech agriculture practice due to poor knowledge of real rural and farming problems and priorities among researches (they are only partly participated in international research projects in this field) and officials. The research concerning agriculture sector is almost fully oriented on commercial use. Czech agricultural production results very often in wildlife species and habitat depletion, destruction and loss and spreading of invasive species. In addition, there is a poor communication and cooperation between agricultural and environmental sectors.

Financial support is used for the implementation of some agri-environmental programmes. On the other hand, agriculture (farming) may accelerate reduction of agri-biodiversity due to some technologies and management unification. The effect of these programmes is often marginal, or even disserviceable. There is no research concerning the Less Favoured Areas measures and no independent monitoring and high-quality data for evaluating their effectiveness from the nature conservation and landscape protection point of view.

The main recommendations are:

1. setting a systemic, reliable and long-term monitoring scheme/programme of impact of the existing programmes, particularly the Rural Development Plan, respectively agri-environmental measures; we consider agri-envi measures impact monitoring as a significant issue for international project,
2. support a research based on indicator analysis to fill lack of data underpinning causal links between sustainable management and biodiversity loss,
3. the Rural Development Plan (including the agri-environmental programmes, forest-environment payments, Natura 2000 payments for agricultural land and forests, non-productive investments on the agricultural land and in forests and natural heritage) is entirely managed by the Ministry of Agriculture. Therefore, it is very difficult for the Ministry of the Environment to enforce making the measures more targeted in favour of biodiversity conservation. We call for to put at least part of the RDP's measures (particularly those in the Axis 2) under the Ministry of the Environment.

Conservation of genetic resources ex-situ

Generally, the Czech Republic strengthens measures to ensure conservation, and availability for use, of genetic diversity of crop varieties and livestock breeds and races *ex-situ*. The steps have been taken to reduce hazards to plant genetic resources, to increase their safety. Following measures are suggested how to improve access to plant genetic resources (including prompt and suitable restoration, safe conservation and effective evaluation and documentation):

1. sufficient and stable funding of the Czech National Programme on Plant Genetic Resources (NP),
2. support for research projects linked to the NP, to extent study and use of genetic resources and agri-biodiversity for sustainable development; systematic transfer of

valuable materials and data from research projects into the NP. The cryo-preservation should be enlarged also for wild species,

3. to promote in particular *in situ* conservation of genetic resources
4. improved control and monitoring of the health status of plant genetic resources,
5. extension of evaluation and characterization, broad and effective implementation of new technologies and wider international cooperation and support of exchange of genetic resources and information.

Sustainable forest management

The Czech forest management mostly keeps on the old practice based on even-aged monocultures/plantations and clear-cutting, widely ignoring natural processes and biological diversity in favour of economical benefits. There were recognized three main aspects regarding Czech forestry sector: (i) an old-fashioned forest act, which fixed traditional forestry concepts and working methods; (ii) an improper organization; and (iii) a low level of modern scientific information, particularly in ecological issues and ecosystem approach.

There is no comprehensive methodology for monitoring changes in forest species diversity; current forest categorization and certification systems are unsatisfactory. There is questionable financial support for unsustainable management in forests contrary to under-funded biodiversity-related measures.

A strong remedial action is necessary to get the Czech forest research out of its today's strange position and isolation. The action has to be executed successively at all four levels of management: (i) political, (ii) strategic, (iii) tactical/normative, and (iv) operational.

(i) political level:

A new political vision on the Czech forestry sector must be formulated and political task must be set, taking into account the obligations from international agreements ratified by the Czech government (e.g. the CBD, the Pan-European Strategy of Biological and Landscape Diversity, the European Landscape Convention), and from obligations forthcoming from the EU membership (including, among others, also the EC Biodiversity Strategy);

(ii) strategic management:

Forthcoming from this political vision and tasks, forest strategic programmes (e.g. Forest National Programme), action plans and goals must be formulated for the forestry sector as a whole and for its parts (e.g. the tasks concerning the biological diversity);

(iii) tactical/normative management:

To achieve strategic goals, proper tactical measures, tools and instruments, means and measures must be chosen, involving organization, finance⁷, social capital, planning methods, research and education, cooperation with stakeholders, etc., altogether forming a proper professional background of the sector and its working culture.

⁷ For example, the finance for Czech Rural Development Plan afforestation measure should be: (i) substantially reduced (with funds transferred to forest-environment payments, Natura 2000 payments in forests and non-productive investments in agricultural land); (ii) restricted to arable land in order to prevent habitat damage and loss and improve cost efficiency; (iii) targeted on projects in lowland, low-forest areas, with river margins and floodplains as the key priority, and (iv) explicitly restricted to projects with the appropriate tree species mix and use of pioneer species planting before the final tree mix.

(iv) operational management:

Operational management is the crowning piece of the whole management process. It gives feedback to the goals set by strategic planning include conservation planning. Without this feedback, strategic goals cannot be achieved.

Soil, water and air pollution and sustainable use of natural resources

Acid deposition itself, caused mainly by sulphuric acid was reduced significantly during last 15 years emissions in the Czech Republic, but previously acidified soils recovery only slightly. Nitrogen deposition exceeded the critical loads for nutrient nitrogen almost on the whole territory of the Czech Republic. Among others, forest and agriculture management practices are important beside pollution and deposition level. In spite of some improvement in Czech water sources achieved, the current conditions cannot be considered fully satisfactory; problems have been persisting mainly in the parts of watercourses with lower flow rates and high accumulation of pollution sources. High productive Norway spruce monocultures/plantations decrease biodiversity itself and by using fertilization both in forests and arable land, both Czech forestry and agriculture delayed thus dramatically soil and water recovery in respect to chemistry as well as biodiversity.

In the Czech Republic there is not enough intensive and widespread research dealing with forest and water ecosystems biodiversity⁸. Teams dealing with biology and landscape ecology are usually not well contacted with those studying atmospheric deposition, soil science, soil, and water chemistry. There is no cooperation between academic natural science (meaning biology, geochemistry etc.) and so-called forest and agricultural science. The forest and agricultural science is oriented to production and benefits increasing and biodiversity is not yet the important goal for such research. There is also a huge gap between findings of natural scientists and industrial forestry and water management. Coordination of activities amongst the individual sectors is unsatisfactory and the competence is not clearly defined (e.g. amongst the administrators of watercourses, fishing organizations and private owners). Conservation and management of inland water biodiversity is inconsistent, extensive pollution is not tackled sufficiently, and there is no clear programme for remedying unsuitable hydrological regulation of watercourses, which contributes to the progressive destructive consequences of floods. There is a lack of attention to river basin integrated management (i.e. in river basin plans). Economic management of fishponds emphasizes production benefits and the management is in no way based on the ecosystem approach. There is not enough demand for knowledge at responsible institutes (Ministry of the Environment and Ministry of Agriculture). As a result, national funding sources for complex biodiversity research are very limited.

There are two actions needed: (i) reduce emission and deposition of nitrogen within the National Emission Ceiling Directive and (ii) change paradigm of strictly benefit-oriented forestry and agriculture toward to sustainable management, which is able to increase or at minimum conserve biodiversity.

To fulfil these actions, the most important research is than needed:

1. at comparison of undisturbed catchments and long-term disturbed, altered catchments in the Czech Republic;

⁸ Carrying out the research at the river basin level and finding out how to integrate all the most cost effective environmental measures are the only ways how to decrease the impact of droughts and floods and how to assure a sufficient quality and quantity of water within catchments in the Czech Republic (Petts 2001).

2. to estimate the water retention achievable by means of soft restoration methods (landscape management), as restoration of contour coppice woods combined with contour ditches, ponds, infiltration pits, wetlands, stream restoration, etc.;
3. how to combine flooding and river restoration together with supporting endangered species;
4. on system of effective measures preventing eutrophication, erosion and excessive transport of sediments in the cultural landscape.

Natura 2000 network

Despite some initial problems during habitats mapping and digitisation of the outcomes, the final process – an adopting the National lists by the European Commission – is now accelerated in the CR. Optimal methods of grasslands and forest ecosystem management have been proposed within the Czech Natura 2000 network. Unfortunately, preliminary protection of pSCI has not been fully ensured, the methodology of monitoring is not yet fully running for the Natura 2000 sites and there is unsatisfactory involvement of all stakeholders and low public awareness of the Natura 2000 topic.

Hence, ecological coherence and functioning of Natura 2000 sites strengthened through spatial planning cannot be fully ensured from 2006 onwards in the Czech Republic if the above-mentioned steps will not be fulfilled. The research linked to Natura 2000 sites must be developed in the Czech Republic.

Based on this review there are ten main messages:

1. It is necessary to integrate new methods of evaluation of the carrying capacity and vulnerability of the ecosystems and their services in land-use planning.
2. There are various systems of monitoring some biodiversity components, which are not integrated or mutually complementary in the framework of evaluation of the condition of forest ecosystems, the impact of agri-environmental measures and monitoring of the ecological condition of water bodies. Hence, the integration and harmonisation of monitoring systems is needed.
3. Although the indicator-based assessment of biodiversity changes was completed (Vačkář 2005), there are still significant gaps in our knowledge of long-term biodiversity trends and its causes. There is a visible lack of studies on the impact of the use of biodiversity on ecosystems and studies on evaluation of biodiversity values and on evaluation of mechanisms and sources of changes revealed. This is a task for scientific community and should be studied on genetic, species, population, ecosystem, and landscape levels. We recommend focusing research on priorities as they were formulated in several recommendations of the European Platform for Biodiversity Research Strategy (<http://www.epbrs.org>) or in other strategic documents (EEA 2006a,b) and projects (e.g. Life Watch – <http://www.lifewatch.eu>; The European Strategic Forum for Research Infrastructures ESFRI – <http://cordis.europa.eu/esfri>).
4. There is no training system in education for biodiversity of priority target groups (employees of the State Administration, representatives of local governments, managers and decision-makers in agricultural, forestry and water management companies, staff members and activists in NGOs and project planners). The decrease of specialists in taxonomy knowledge and need for higher standard of education has been widely recognized in the present (see, e.g., the Global Taxonomic Initiative on

<http://www.biodiv.org/programmes/cross-cutting/taxonomy/default.shtml>). In the Czech Republic, there is an urgent need for establishment of a centre for taxonomic knowledge and identification of organisms. The centre should serve for post-doc studies and officials involved in nature conservation⁹. Therefore, the Ministry of the Environment in cooperation with GBIF should coordinate data accessibility and form some data platform.

5. There is a lack of individual capacities in the exchange of information. Only two national coordinators are responsible for establishing and up-dating of the CBD Clearing House Mechanism and the Biosafety CHM. However, this work frequently consists of single actions and does not ensure regular up-dating and maintenance of the systems.
6. There is a need for developing of methodologies for better understanding of evolutionary relationships and trajectories of species, the adaptive variation within them and methods to analyse the data produced.
7. We need analyse and develop methods for conservation and sustainable use of genetic biodiversity through area-approaches in management (e.g. Natura 2000).
8. We urgently need to explore the role of genetic diversity in the productivity, stability and health of agri-ecosystems and their resistance under changing climatic, environmental etc. conditions in interdisciplinary research.
9. There is a need for monitoring the effectiveness of management methods in nature conservation and landscape protection (see http://www.wsl.ch/event_07/monitoring/) and call for evidence-based nature conservation (see Centre for Evidence-Based Conservation and <http://www.cebc.bham.ac.uk>). In the Czech Republic, sectoral programmes fund the main research addressing these issues. However, such research should be independent of any interest (particularly of the economical one) and should be inter-sectoral. Conservation in sectoral policies in the sense of sustainable development should not be limited only to the area of the sector of Ministry of the Environment only.
10. There are several research projects dealing with biodiversity in the Czech Republic (<http://aplikace.isvav.cvut.cz>). The central role of concerted action has the **Biodiversity Research Center** (a network of research institutions involved in biodiversity studies and international projects or centers of excellence with aim to educate young researchers in the field involved in).

Průhonice, Czech Republic, 9th March 2007

⁹ For example, despite a long tradition of floristic and phytogeographical research in the Czech Republic, no complete national distribution dataset based on an up-to-date systematic field survey is available. This fact is in contradiction with assignment of the CR to the Memorandum of Understanding for the Global Biodiversity Information Facility (GBIF) in 2002. Nevertheless, the Memorandum of Understanding has not been recently resigned by the Government of the Czech Republic.

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