

ABSTRACTS

001 The 2007 conservation status of habitats and species of European interest: can restoration help?

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In 2007, EU Member States reported to the European Commission on the conservation status of habitat types and species, protected by the Habitat Directive.

For the first time a detailed picture of the status of Europe's most endangered and precious habitats and species can be presented.

Opportunities and constraints for nature conservation and restoration will be discussed.

002 Habitats restoration in the framework of the European conservation policy

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003 Ecological succession after reclamation treatments on eroded area in South-Iceland

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When faced with extensive degraded areas, effective restoration approaches for large scale applications are needed. This requires a good understanding of thresholds affecting ecosystem development and how they can be overcome by restoration manipulations. Over 40% of Iceland is characterized by severely degraded and desertified land. Various approaches have been used for revegetation and reclamation of the eroded areas, but their success is variable. A large-scale, long-term experiment was established in 1999-2000 on a barren area with active soil erosion in South Iceland. In this experiment we study the effects of different reclamation treatments on community succession and ecosystem function in a classical experimental design with forty 1 ha experimental plots. The treatments cover a broad range of goals; to stabilize the surface and stop erosion, trigger vegetation succession and enhance ecosystem function. They include fertilization, seeding of grasses or legumes, and introduction of key plant species of natural woodlands. Various biotic and soil properties have been monitored, including vegetation cover and composition, seedling colonization, soil and surface fauna, soil characteristics and hydrological properties. Concurrently, old reclamation sites of various ages were studied in order to assess the longer term effect of some of the reclamation methods. The results so far indicate that most of the reclamation treatments stimulate successional processes and improve soil properties but their effects depend on the species used, intensity of treatments and level of disturbance (erosion).

004 Reassessment of different methods for revegetation of sandy slopes in continental Northern Norway

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This study reassessed the long-term effects (10 years) of different revegetation methods for the reclamation of a steep sandy slope under sub-arctic conditions. Four different organic based erosion control mats a) coconut, b) straw, c) coconut/ straw and d) wool in combination with the three propagated native plant species i) *Poa pratensis* (seeds), ii) *Festuca rubra* (seeds) and iii) *Betula nana* (transplants) and fertilizer treatments were studied. An assessment three years after establishment of the experiment indicated that the majority of the selected materials and methods gave satisfying results. However, reassessment after 10 years gave a rather opposite result. With exception of the wool mat none of the erosion control mats gave any long-term advantages. The coconut mat had not changed in physical appearance and represented a hinder rather than an advantage for plant establishment and soil development. In contrary few remains of the straw and straw/ coconut mats could be found and there were no obvious signs of any beneficial effect of these materials. None of the seeded native grass species were alive after ten years, but the majority of the *Betula nana* transplants had survived. Apart from increased survival and growth rates of *B. nana*, the most obvious effect of mineral fertilization was a higher appearance of *Polytrichum* sp. Consequently, results

from this study clearly emphasizes the importance of repeatedly reassessment of revegetation efforts to avoid recommendations of short-time operational but long-time inappropriate revegetation materials and methods.

005 Assessment of revegetation efforts: a suggestion for an evaluation scheme

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Though revegetation material and methods getting progressively standardized throughout Europe comparable little attention is paid to assess long-term effects of revegetation efforts. One obvious reason, beside others, is the in general short-time character of the majority of the research projects. Other possible reasons may include an insufficient documentation of earlier applied materials and methods and deficiencies in recording site-specific key factors. The in general individually developed evaluation methods and procedures make it often difficult, if not impossible, to compare study sites in time and space. Thus, the aim of this paper is to suggest the development of a commonly applicable evaluation scheme for the assessment of revegetation efforts. Beside the need for a detailed documentation of the original site-specific conditions and the applied materials and methods, the here proposed scheme includes a concise qualitative and quantitative assessment of a) general soil properties, b) soil erosion, c) soil erosion control mats and mulching material, e) plant growth and development and d) post management efforts.

006 Revegetation of roadsides in Central Spain: factors controlling seed germination and plant establishment

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We investigated the applicability of the hydroseeding technique for the ecological restoration of roadslopes in Central Spain. Hydroseeding is the most widely used revegetation method in these scenarios. However, it often fails to achieve not only the Ecological Restoration goals but even the levels of plant cover required in the constructive project.

We have investigated whether vegetation establishment is limited by site quality (soil fertility and water availability) or by seed input (soil seed bank, seed rain, hydroseeding). We set up an experiment on two types of roadslopes: embankments (covered with topsoil) and roadcuts. In this experiment, we examined the effects of the different types of roadslopes and the effects of hydroseeding with a commercial seed mixture and with an autochthonous mixture, on sedimentation rate, viable seed input, vegetation cover, and species richness.

After 3 years the vegetation cover was much higher on the embankments than on the roadcuts, which could be explained by the difference in initial soil fertility between the two roadslope types. Between the roadslope types there was no difference in seed rain. This leads to the conclusion that the establishment of plant cover was limited by the soil fertility of the sites.

Our results suggest that hydroseeding is not needed in the vicinity of (semi-)natural vegetation, regardless of using a seed mixture of commercial species or autochthonous species. Efforts should be directed to improve the abiotic conditions of the site instead of increasing seed availability.

007 Dealing with ethics in restoration in a pluralistic society

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Ecological restoration in densely populated areas as e.g. Western Europe may meet rather easily opposition. This may happen when e.g. farmland is converted to natural areas. However such conflict often also involves ethics driven opposition because of deeply held visions on the land, nature, animals, and the human community. Ethical conflicts may especially arise when animals are introduced or removed in ecological restoration projects. This may happen especially in the case of mammals, which may suffer by such a practice. In the Netherlands big conflicts have arisen because of the introduction of grazers in new natural areas.

Because the public is an important factor, restorationists cannot escape to deal with these ethical disputes. Indeed, current western society is a pluralistic society and several authors have therefore proposed to follow a pragmatic way of ethical reasoning in such conflicts. However, even pragmatic approaches need guidelines, models, or rules of thumbs to deal with the palette of different, sometimes competing perspectives. With the realization that contextual and situational circumstances are important in pragmatic ethics, such guidelines should indicate what kind of principles or ethical domains should have the leading role in a given situation. Thus, these guidelines do not unify but rather distribute different ethical perspectives in relation to given circumstances and the knowledge we have. An example of this approach is the model of specific and non-specific care for animals which will be outlined and discussed with respect to the (re)introduction of animals in ecologically restored areas.

008 Ecological footprint of tourism in protected areas

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Different kind of tourism can have different impact on the environment; therefore to preserve natural resources of tourist destinations, especially where protected areas are involved, there is the need to develop valuable tool to assess sustainability of different issues related to tourism. Ecological footprint is a relatively simple and communicative method that could be useful to evaluate the level of consumption related to tourism activities and also to raise awareness about the impacts of human activities among policy makers and tourists themselves. In this study, EF method was fitted to Italian situation and to an assessment of potential impact of tourism at local scale, underlining how tourists' choice could affect the quality of the environment in a tourist destination. The assessment of the sustainability of tourism in respect of the natural stock of the destination, through the comparison of ecological footprint of tourists and local residents with biocapacity of the area, represents an attempt to provide a supporting tool to decision makers, with the aim to address tourism strategies for the future development of destinations in a more sustainable way. Moreover, the present study focuses on the importance of tourist's choice identifying the impacts generated by different kind of holiday (due, for instance, to energy consumption or to the extension of built-up land); final aim is to evaluate the current situation and to suggest solutions that assure the development of tourist with fewer environmental costs on the destination area.

009 Stay at home: cultural tourism of the local

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Pool is a project that innovatively fosters discussion with 'hard to reach' groups of liverpool's population about the past and its current parallels in order to empower people to influence action in the future. the origins of the city are explored and revealed by practical exposure to different ideas and perceptions in an inter-generational project using informal, inclusive / accessible discussion processes. the possibilities of local heritage is re-examined through various activities; urban walks, picnics, celebrations, website, free publication distribution, street theatre and conferrings.

The current focus is on the forgotten history of liverpool commoners. liverpool's historic and sustainable geography is experienced through inclusive performances in public urban space to learn from the parallels of past and current local experience of land use and property development.

The final objective is to develop a local philosophy of sustainability based on objective data to develop a people plan as opposed to a master plan for sustainable development and heritage preservation.

010 Bringing people together through Natura 2000. Tell me and I will forget..... Show me and I may remember....Involve me and I will understand!

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Natura 2000 is the centrepiece of the EU nature & biodiversity policy and brings people together. It asks for commitment of all influenced by Natura 2000. This can be achieved through a participative approach. Alterra and DLG have applied this in -amongst others- The Netherlands and Poland.

Process approach: Our participative approach was implemented in various socio-political contexts and in different ways, e.g. workshop series, steering- and advisory-groups. It generated enthusiastic co-operation

between stakeholders and always resulted in an increased quality of the final management plan.

Operational approach: The main purpose of a management plan is to maintain the favourable conservation status of habitats and species. During lively discussions in our workshops, stakeholders managed to capitalize on economic chances while benefiting biodiversity. These chances were translated into detailed objectives, forming the heart of the management plan. Stakeholders used these objectives to define specific (restoration) measures taking into account social, economic and legal aspects.

Conclusions: Because our approach brought trust among stakeholders, gave insight in each other's interests and strengthened their networks leading to increased sustainability of Natura 2000 site management. The resulting management plans are widely supported and therefore implemented more easily. In Alterra and DLG's experience, this approach is the best way to effectively use Natura 2000 in maintaining Europe's biodiversity.

011 Natura 2000: environmental conditions and external influences on habitats

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Legal protection and adequate land use alone are not sufficient for the lasting conservation of habitat types that are protected under the European Habitats Directive. The environmental conditions that are essential for the conservation of the habitat types are often difficult to maintain in a landscape heavily influenced by human activities. Changes in hydrology and pollution of atmosphere, surface and ground water in many cases undermine the ecological functioning of ecosystems protected under the directive. Knowledge of the required ecological conditions is essential for the sustainable conservation and the restoration of habitats.

This special session deals with the questions:

- how to identify and quantify the environmental conditions that are essential for the conservation of the habitat types;
- how to identify external factors that negatively influence ecosystem functioning;

Each EU country has developed its own approach how to deal with these topics. This session offers the opportunity to compare the different concepts and approaches and learn from each other. This is not only of practical importance, but also helps to identify the gaps in our knowledge of ecosystem functioning that hamper adequate environmental protection.

012 Ecological requirements of habitats in Dutch Natura 2000 sites

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The protection of Natura 2000 sites requires a thorough understanding of the abiotic conditions that are needed to maintain or restore habitats. This knowledge is crucial for defining measures in management plans and for the assessment of potentially harmful activities. The project 'Ecological requirements Natura' aims to provide local authorities and nature managers with this information. A distinction is made between (a) operational site conditions that more or less directly influence plant growth and competition, such as aeration and pH, and (b) conditioning factors and processes that determine site conditions, such as hydrological processes and management.

For operational site conditions, critical ranges are given for habitat types and for the vegetation types that make part of the habitat types. However, this information alone is insufficient for the planning of measures. For that purpose, additional information is needed on the factors and processes that determine the operational site conditions. The conditioning factors are site specific, and depend upon the geomorphological and hydrological setting. Therefore, the information on necessary conditioning factors is only indicative, and has to be checked and detailed on the basis of local data and expertise. As hydrological conditions are most critical for the conservation and restoration of Natura 2000 habitats in the Netherlands, special attention is given to the relation with hydrology. In the Netherlands these relations will be important in the debate between authorities, nature managers and other stakeholders about external measures in the water system.

013 External environmental influences on Natura 2000 sites in the Netherlands

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In order to conserve and restore habitats protected under the Habitats Directive, environmental conditions should meet the demands of habitats. A quick scan analysis was made to determine the extent to which ecological conditions in the designated Natura 2000 sites are sufficient as regards realisation of the nature protection objectives for these areas. On the basis of available literature and information given by local nature managers, an overview was made of known and suspected external environmental threats, with details on the nature of the threat and an indication of the certainty and the impact on the nature targets. The results of this study make it clear that realisation of the Natura 2000 targets is impossible without external measures. Hydrology is the most critical factor in the Netherlands. In more than half of the Natura 2000 sites environmental conditions are negatively influenced by drainage of surrounding agricultural lands. Desiccation, acidification and eutrofication are responsible for a bad conservation status and an ongoing degradation of habitats. For this reason, effective programs for improving environmental conditions at Natura 2000 sites are needed to realise Nature 2000 goals.

014 Critical limits of nitrate for the favourable conservation status of transition mires and quaking bogs (7140), Cratoneurion (7220) and Alkaline fens (7230).

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Denmark has applied the concept of operational conservation criteria to the species and habitats of the Habitats Directive. This implies that for each species and habitat, lists of relevant indicators are produced and for each indicator, a critical limit is defined. When one of these criteria is exceeded, the conservation status is unfavourable. Due to lack of data, the first generation of conservation criteria are loosely defined and often without operational critical limits. Increased availability of quantitative data from the monitoring of annex I habitats has motivated the development of a second generation including critical limits. In this project, we analysed data from the monitoring of rich fens, calcareous springs and transition mires in order to correlate water chemistry with species composition and eventually reach a scientifically motivated criterion for the content of nitrate in the water of these habitat types. We also investigated the use of species data and temperature as alternative indicators of conservation status.

015 Implementation of monitoring of 'Structure & Function' in the Netherlands

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Member states have the obligation to periodically report the conservation status of Natura2000 to Brussels. One of the aspects to be reported is 'structure and function' (S&F). A clear definition of S&F is not provided, and therefore the member states have a certain freedom of interpretation. The aim of our study was to find a workable definition of S&F for the Netherlands. The definition should be such that it yields a clear differentiation between a 'good' and 'bad' state in the Dutch conditions, which should preferably be supported by experts. Moreover the required data should be available from operational monitoring networks, or it should be feasible to acquire these data without excessive additional costs.

As a results of our study it is recommended to judge S&F on the basis of four aspects: (1) vegetation structure, (2) typical species, (3) local abiotic conditions, and (4) size of the habitat. In the Netherlands regional conditions are often unfavourable as a result of high atmospheric deposition, desiccation or habitat fragmentation. In many cases such unfavourable local conditions can be mitigated by management e.g. removal of nitrogen by sod cutting. It is therefore recommended to assess S&F on the basis of local conditions only, and to incorporate the regional conditions in 'future prospects'.

An overview will be given of data sources, and a protocol for the integration of the various aspects of S&F into a single assessment. In a follow-up, detailed assessment protocols will have to be made for each Habitat type.

016 Restoration of woodpastures on former agricultural land in Flanders (N-Belgium)

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Woodpastures (open, grazed woodlands with a mosaic of grassland, shrub and tree patches) are of high biological and cultural value and have become a threatened ecosystem in Europe. Spontaneous tree regeneration in the presence of large herbivores, is an essential process for the restoration of this structurally diverse habitat. In Flanders, the aim to restore woodpastures is a valuable option to preserve biodiversity in the Natura 2000 Network, in particular in floodplains, where agricultural activities have ceased.

We examined the suitability of different vegetation types and their possible role as safe sites for tree regeneration in interaction with grazing and disturbance activities of large introduced herbivores. Moderate trampling disturbance of soils, is important to create sufficient microsites for germination of woody species in closed vegetation types. Local disturbances like flooding, seed availability, distance to seed trees and differences in soil moisture influence this germination pattern and interact with grazing. Subsequently, the development of woodland patches is strongly determined by vegetation structure. The pattern of spiny scrub (often bramble) and unpalatable tall herb patches, developing on productive sites under decreased grazing intensity, reflects future woodland patches, although a temporal decrease in grazing pressure or a temporal absence of large herbivores may be needed for successful outgrowth of established woody species.

A grazing pressure below 0.5-0.6 AU ha⁻¹y⁻¹ allows fast tree establishment when protective vegetation structures are available. In the short term (20-30 years), vegetation development steered by grazing will realise open woodland types, which may include a wide range of habitats.

017 Recovering herb layer vegetations in post-agricultural forests: are forest plants able to recruit after introduction?

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In Western Europe, large areas of forest are recovering from former agricultural land use. Following the afforestation of agricultural land, herb layer species need to re-establish through colonization. Because many forest herbs have a limited dispersal capacity, this colonization process is extremely slow. Reintroducing target species in post-agricultural forest therefore seems a valuable measure to restore forest herb communities. Nonetheless, as nutrients have accumulated during agricultural land use, competitive species will be able to dominate and will probably hamper the recruitment and survival of the introduced species. Therefore, we assessed recruitment and survival of forest herbs in two similar long-term introduction experiments. Species were sown at three different seed densities or planted as adults in 168 plots distributed over 4 forests (including both ancient and post-agricultural sites) in Northern Belgium. In both experiments, competition-free regeneration gaps were created by removing the established vegetation in half of the plots. The results of both introduction experiments indicated moderately successful germination. More seeds generated more recruits, and competition-free gaps clearly promoted germination. However, high mortality during the life stages following germination strongly reduced further recruitment into the adult stage. Additionally, we found that survival of adults was lower in post-agricultural forest as compared to ancient forest sites. In post-agricultural forest, a persistent nutrient availability obviously hampered recruitment and survival through competition, limiting the re-establishment of forest herbs. To conclude, by-passing dispersal constraints through introduction seems insufficient for the re-establishment of forest herbs and measures to reduce competitive dominance turn out to be essential for the restoration of forest herb vegetations.

018 Multispecies approach supporting management practice in the forest of the low Campine. Naturalist volunteer meets professional manager

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The Forest of the Low Campine is an area of almost 5.000 hectares of nature dominated by forests. At the same time it is an unique partnership for sustainable forest management between the Agency for Nature and Forest of the Flemish government and three local municipalities. Already in 2004, the Agency for Nature

and Forest started with a platform for the systematic inventarisation and monitoring of fauna and flora in this region. A unique cooperation between professional managers and local volunteers has been organised with exchange of knowledge, evaluation of management and monitoring of target species and habitats as the most important aims.

In this lecture we give some examples of the organisation and outcome of this survey and monitoring. We focus on some Natura 2000 species as Nightjar, Smooth snake and Woodlark and on some target species of regional importance. Then we illustrate how this information has been used to work out overall visions and management plans at one hand and how target species are useful to evaluate and adapt measures at the other hand. We also discuss how the knowledge of fauna and flora can be used for the purpose of sensibilisation of the public and the local authorities and for educational initiatives.

019 Restoration of wild forested areas in floodplains through application of naturalness concepts

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This presentation discusses the ecological and cultural criteria for promoting naturalness in protected areas. The free development of ecosystems, whatever the human heritages, is an interesting subject for research. From a philosophical point of view, such "wilderness under anthropogenic influence" might be considered as valuable components of biodiversity.

I examine two examples of management in this way, in the context of alluvial forested landscapes. Floodplain forests are listed by the European habitats Directive as being a priority forest habitat type. However, recovering previous, intact ecosystems is often impossible because of flow regulations and aggressivity of a few exotic plants.

Based on floristic records, this presentation examines the spontaneous evolution of two forests of the Rhine and the Moselle upper valleys North-East of France. The hydrological contexts and the history of the forests are quite different, but both develop freely over a few decades. In the Rhine forests, rather ancient (more than two centuries), the non-intervention since two decades have emphasized the losses of hygrophilic species, and the invasion of non alluvial trees following regulations, and the development of a more natural forest architecture with big trees and natural gap dynamics. In the Moselle valley, forests are younger (less than one century), highly diverse, but they are also increasingly invaded aggressive exotics (*Fallopia japonica*, *Impatiens glandulifera*).

The non intervention has emphasized the profound changes that have taken place in our current landscapes since two centuries, and the diverse spontaneous responses of ecosystems. These areas would then provide a reference for future generations and must be protected for this purpose.

020 The importance of the geomorphological footprint in planning landscape restoration; a case study of inland drift sands in the Netherlands

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Landscape-ecological characteristics are closely related to the geomorphological footprint of a landscape and should therefore be an important input in ecology restoration. In this study we examined the role of the geomorphological footprint in planning restoration measures in inland drift sands, which are included in habitat type 2330, inland dunes with open *Corynephorus* and *Agrostis* grasslands. In the Netherlands the total area of inland drift sands covers approximately 82.000 ha. In the year 2002 only 1400 ha were mapped as still active with wind driven sediment transport. However most of the characteristic relief is hidden by forests or levelled as part of agricultural practices. Government funds are available to restore the active sand. Lack of detailed information of the geomorphological structure of drift-sand areas led to ad hoc decisions on the location of restoration measures. In combination with the lack of knowledge of landscape-forming processes, the result of the measures was unpredictable. Sustainable restoration requires profound knowledge of the geomorphological footprint.

In this study we used relief-shaded maps based on data from laser altimetry, and aerial photographs to examine the position of the former drift-sand areas in the landscape, to reconstruct their internal structure, and to evaluate the impact of large-scale restoration works on this structure. The study showed that measures that were planned without taking the geomorphological structure into account resulted in anomalous relief structures and/or a loss of relief. It happened that vegetated dunes, which are formed by accumulation of sediment in the vegetation, were turned into a deflation zone after sod-cutting. It is therefore recommended to start the planning procedure of drift-sand restoration with the reconstruction of the geomorphological structure first and select the potential deflation zones.

021 Understanding distribution patterns of invertebrates within inland drift sands using life-history tactics and feeding guilds

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European inland drift sands (Natura2000 habitat type 2330) and their characteristic flora and fauna species are highly endangered by afforestation, eutrophication and the invasive moss species *Campylopus introflexus*. Understanding species distribution patterns within these ecosystems is necessary to improve restoration and conservation measures. The relative importance of different environmental variables on these distribution patterns are analysed by using life-history tactics and feeding guilds of different fauna groups.

Invertebrates were sampled in 8 Dutch inland drift sand areas covering 5 vegetation types which differ in aeolian dynamics, microclimate and food resources. Traits on development, reproduction, synchronisation and dispersal were used to define life-history tactics for mites, springtails, ants and carabid beetles. Distribution patterns were analysed using multivariate methods.

Within all study areas, similar distribution patterns of species and life history tactics were found. Traits explaining most variance in distribution patterns for all studied invertebrate groups were timing of reproduction and diapause, high dispersal capability and speed of larval development. These traits were correlated with differences in aeolian dynamics. Herbivorous browsers dominated in early succession stages, while in older succession stages feeding guilds were equally distributed, implicating an increasing bottom-up regulation from food resources.

Use of life-history tactics and feeding guilds proves to be a strong tool in analysing mechanisms of species distribution, facilitating comparison of different areas and different invertebrate taxonomic groups. For restoration and conservation of complete invertebrate fauna communities management should focus on the complete gradient of open vegetation with high aeolian dynamics to stable vegetation.

022 *Campylopus introflexus* as a nitrogen deposition dependent ecosystem engineer in inland dunes

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In The Netherlands, most of the inland dunes were active dune systems until about 1850. Due to afforestation and disappearance of traditional land management, its area declined to only about 1% of its original size. Around 1960, the introduction of an exotic moss added a new threat to the remaining inland dune vegetation. Also nitrogen deposition from agriculture increased dramatically.

In this study we tested the hypothesis of a positive relation between abundance of the invasive moss *Campylopus introflexus* and increased nitrogen deposition. We compared five succession stages in two sites along a deposition gradient, sampling data on microbial activity and nutrient availability. Additionally, 250 relevés were made and soil samples were taken to assess the variation in edaphic parameters for each species. The data were analyzed using multivariate statistics.

Microbial C/N ratios and ammonium concentrations in the top soil were highly dependent on nitrogen deposition. Nitrogen mineralization and edaphic characters were similar in *Campylopus* mats and vegetations dominated by cup-lichens. Both early and late succession stages are similar in areas with high and low nitrogen deposition: vegetations dominated by *Corynephorus canescens* and *Polytrichum piliferum* (early) and reindeer moss and *Agrostis/Festuca* species (late). However, in high nitrogen deposition areas, moss mats of *Campylopus* invade young *Polytrichum* mats, resulting in a thick, species poor moss carpet, leaving no space for many small cup-lichens.

We conclude that vegetation types with small cup-lichens are most affected by nitrogen deposition.

023 Restoration of an extensively grazed alluvial landscape – résumé after six years

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In the northwestern German lowland, alluvial habitats often are under intensive agricultural management. As part of a Testing and Development project, which started in the year 2000, it was possible in a formerly heavily fertilized area within the sandy plain of the Hase river (Ems region) to recreate a new alluvial

landscape including modelled dune structures and inoculation with hay from target areas. The whole area of about ca 70 ha was grazed by cattle.

To study the effects in the restored area compared with target areas we established both a grid system with permanent plots as well as a multifactorial field experiment with the factors grazing and inoculation. Soil water quality was studied by means of lysimeter measurements. Additionally we analysed the interaction between the newly established vegetation and wild bee communities, as compared with target areas.

After 6 years the Detrended Correspondence analysis of the vegetation reveals the establishment of site-specific phytodiversity including both threatened species and threatened plant communities. Nevertheless, there are still differences in species composition and abundance compared with the target areas. Water quality corresponds to the conditions of the target areas. Especially wild bee species which depend on sandy habitats benefited in the restored areas.

Processes of establishment, succession and flood-plain dynamics result in a landscape with specific and characteristic community structures of vegetation and wild bees with high nature conservation value. It was possible to restore the threatened Fauna-Flora-Habitat type "Inland dunes with *Corynephorus* and *Agrostis* grassland" successfully.

024 Identifying climate change proof ecological networks and priority adaptation zones

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The suitable climate space of many species is shifting caused by climate change and further shifts are predicted. Whether species will be able to colonize the new climate space depends on species dispersal capacity and the spatial cohesion of suitable habitat. We developed a method to identify where the connectivity between the current distribution and the projected suitable climate envelope after climate change might be too weak and we developed adaptation strategies.

We used bioclimate envelop models, suitable habitat maps and a dispersal model to identify areas where the spatial cohesion of the ecosystem pattern is expected to be too weak. Results showed that the amount of habitat within suitable climate zones in northwest Europe diminished for all studied species and part of this habitat cannot be colonized because of isolation. As a consequence the amount of suitable habitat protected in Natura 2000 sites will decline for the studied species.

We developed several adaptation strategies to facilitate the response of species to follow their suitable climatic conditions: (1) Link isolated habitat that is within a new suitable climate zone to the nearest 'climate-proof network'. (2) Increase colonizing capacity in the overlap zone, the part of the network that remains suitable in successive climatic time frames. (3) Optimize sustainable networks in climate refugia, the part of the species' range where the climate remains stable.

The impacts of climate change on species distributions will require coordinated actions on a European level to create a functionally coherent Natura 2000 network. We recommend the identification and development of international 'climate corridors' to facilitate species expansion.

025 Ecological restoration and climate change: legal challenges

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EU countries are confronted with fundamental ecological changes such as climate change and biodiversity loss. In order to counter the effects of these changes, states will have to work out adaptive management strategies and mitigation measures, such as creating robust nature as a buffer to climate change, working out new coastal defence infrastructure, etc. This creates opportunities for combining ecological restoration projects with safety measures (for instance against flooding). The adaptive management measures will have legal implications on ownership, private user rights etc. This might be further complicated when these measures coincide with protective instruments such as the Birds and Habitats Directives. It is uncertain if and how existing international and national legislation is flexible enough to face adaptive management measures. Most likely some adaptive measures that adversely effect EU protected sites, will demand compensation measures. Authorities will be confronted with these legal issues in the implementation of the different international and European legislations (such as Birds and Habitats Directive, Water Directive, Flood Directive). This presentation wants to assemble and analyse some of the legal problems that may arise when new adaptive management strategies are implemented.

026 Floodplain forests and climate change – current state and future patterns

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Riparian softwood forests are highly endangered habitat types. At the River Elbe, river regulation by dyking and deforestation of riparian forests has caused severe reduction with only remnant stands left. However, because of their important role in terms of ecosystem function and services the need for the restoration of riparian floodplain forests is emphasized e.g. in NATURA 2000 etc.

Characteristic softwood forest species (willows and poplars) are bound to typical hydrological conditions. While adult vegetation might be less vulnerable to variations young life stages may only persist where suitable conditions are met.

Climate change is believed to change hydrological conditions. This in turn might increase the loss of suitable habitats for softwood forest species not only for regeneration stages but also for established vegetation. Therefore, knowledge on the relation of hydrological parameters and presence of softwood forest species is needed.

Aim of this study was to identify ecologically suitable sites for the restoration of riparian floodplain forests based on hydrological parameters using a modelling approach. Results suggest that not only species but also life stages differ in abiotic requirements and interactions of abiotic factors can lead to shifts in the ecological niches of species considering single parameters. In a second part, possible effects of climate change scenarios on the current vegetation state in terms of alterations in vegetation composition were analysed. Results indicate partly fundamental changes of floodplain forest distribution. Findings of current and future patterns are essential for prospective management measures to assure restoration and conservation of floodplain forests.

027 Impact of climatic warming on larval development of *Pelophylax esculentus* (Amphibia, Ranidae) tadpoles from two different habitats, and acclimation ability

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Palaearctic water frogs are very widespread and abundant in Europe, and used many habitats characterized by different biotic and abiotic factors. *Pelophylax klepton esculentus*, hybridogenetic hybrid resulting from the crossing between *P. ridibundus* and *P. lessonae*, present intermediated characteristics, and occurred as well as in forest, cropland, urban environment, meadow. The success and the evolutionary fate of hybridogenetic lineages are explained by both a generalistic heterosis hypothesis and an alternative hypothesis, the habitat segregation hypothesis. Moreover, these amphibians are considered as phylopatric, as its come each year at the same place for reproduction. We compared the acclimation ability of tadpoles originating from two different habitats, breeding in two temperatures selected to mimic the natural condition and the global warming. After a taxonomic identification of frogs collected in June 2007, using a specific allozyme marker (LDH-B lactate deshydrogenase), artificial fertilizations have been done between *P. lessonae* males *P. esculentus* females from a meadow pond or from a pond inside forest,. Then, tadpoles of these six pond were raised in experimental conditions, at twenty or twenty six degrees Celsius, and we observed body size (mass) and time of larval development at 41th stage and at the end of metamorphosis. Statistic analysis were used to compared larval development of forest tadpoles to meadow tadpoles at a natural temperature, but also at a high temperature. The final aim of this work is to evaluate how the density of water frog can be evolved with climate changes.

028 Integrating objectives for the restoration of wetlands in intensively irrigated territories

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Ecosystem restoration relies on a number of criteria and indicators corresponding to different scales of integration. A multipurpose approach was used in the intensively irrigated territory of Monegros (NE Spain) to establish a protocol for the restoration of wetland habitats and bird populations. Water, soil, vegetation, birds, and landscape characteristics were measured in eighteen wetlands. Water analysis showed that a

wetland must have a minimum area of 0.5 ha to improve efficiently water quality (50% nitrogen retention, organic matter accumulation) as water flows through it. Amoeboid or elongated wetlands of area 0.5 ha with a heterogeneous plant cover favor a rich and diverse bird community. At territory scale, at least 3-6% of the land must be used for wetlands in order to remove nitrogen and major dissolved salts (the key components for water quality) from water outflowing irrigated fields. Following these results, a protocol to restore wetlands in intensively irrigated agricultural zones is proposed which proceeds through dichotomy steps in order to select one or multipurpose restoration objectives. The larger the target area is, the more possibilities for wetland restoration arise. At wetland and sub-watershed scale, restoration can easily achieve one objective. At territory scale (a land made of different sub-watersheds and watersheds in the same biogeographic area) wetland restoration can achieve different objectives integrated at ecosystem scale. The application of these results to Monegros zone shows an array of possibilities to restore wetlands at territory scale and the accomplishment of different objectives related to habitat, biodiversity and landscape improvements.

029 Sustainable compensation measures for wetland restoration

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Restoration measures in wetlands must be able to cope with future climate extremes to be successful. Not only because of ecological reasons but also due to the legal obligations that NATURA 2000 habitats and species must be kept in a favourable status.

In an ecohydrological casestudy the environmental impact of the water work "Inheiden" on the Horloff floodplain in Hesse, Germany, is investigated since 1997. The Horloff floodplain is characterized on the one hand by intensive agriculture and settlements in inundation areas and on the other hand by extended nature conservation areas (IBA, NATURA 2000-areas).

For the restoration and protection of the NATURA 2000 areas a "3-columns-modell" of rewetting measures was developed.

First column: Limitation of ground water table decrease in the NATURA 2000 areas by pumping reduction in dry climate periods. Critical water levels and minimum flooding areas for wetlands and species are defined and derived from monitoring-data and literature.

Second column: Increasing of natural flooding of the protection areas by derivation of water from the Horloff river by river bank modifications and/or weirs.

Third column: Artificial flooding of the wetlands with ground water in case of long period draughts by using a water pipeline from the water work.

For wetland restoration of NATURA 2000 areas influenced by ground water exploitation flexible water rights depending on climate conditions are crucial.

030 Ecological restoration with ecoremediation in protected area

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Ecoremediation is the application of natural and co-natural systems and processes for nature and environmental protection and restoration and it sets a basis for ecosystem technologies. Those ecosystems have strong buffer, purification and biodiversity capacities, and they are capable to assist by neutralisation, decomposition and compensation of wasted waters, lands and air. Additional value of ecoremediation is that it revitalizes degraded parts of environment thus new value is given back to the environment. With ecoremediation we can protect important ecosystems from pollution and at the same time ecoremediation enables sustainable development as we are using natural processes to achieve this development. Protection of endangered and rare plant and animal species as well as there habitats is possible only with ecosystem technologies. Because only with them we can achieve or create the environment where this species will live and survive. With these technologies we can select the most suitable combination of ecological factors for every species or for the entire habitat.

With ecoremediation implementation we would like to establish economic and ecologic advantage of ecoremediation use within Natura 2000 habitat types such as rivers, lakes, wetlands etc. The aim of the article is to show the advantages of using ecoremediation in protected areas such as Natura 2000 and to present the best practices of ecoremediation as river revitalization Mala Krka in protected area Goricko, vegetation zones, boundary lines, puddles and pools, wetlands and swamps, ecoremediation as substitutional ecosystems, constructed wetlands as multipurpose ecosystems. Education as a important part of sustainable development is shown on the some practical examples.

031 Nature restoration and management in a coming Nature Park Aamosen, NW-Zealand, Denmark – A multidisciplinary approach

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Nature Park Aamosen in NW-Zealand, Denmark is a project area about 80 km² where three municipalities and Region Zealand Council work on the creation of a continuous chain of wetlands along the next largest river of Zealand. The area has very important archaeological and biological interests, both on national and international scale.

Aamosen has been strongly influenced by peat digging and draining, which today represent serious threats to the conservation values.

Roskilde University has a multidisciplinary project on the conservation and sustainable use of Aamosen, where the major parts area parts of the Danish NATURA2000 network.

This includes

- Investigation of vegetation in earlier times and today through pollen analysis and investigation of ancient seeds
- Evaluation of the potential for reintroduction of Beaver (*Castor fiber*) in the area
- Traces of peat-digging in 1940 'es and -50 'es
- Rising of water level to improve preservation of archaeological sites
- Clearing of regrown lake-shores to improve bird habitats
- Growth possibilities for sustainable tourism in the area in connection with management mentioned above
- Analysis of possibilities for growth in experience economy as alternative to intensive agriculture in the nature park area
- Cooperation with landowners and public bodies on the right management

032 European ecosystems at crossroads: from halting biodiversity loss by 2010 to a renewed restoration agenda

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033 How does surrounding vegetation influence succession in disturbed sites? Consequences for restoration

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Occurrence of desirable (target, including rare and endangered) and undesirable (usually ruderals, aliens, and strong competitors) in the surroundings of disturbed sites is expected to influence the course of succession as well as species composition of target stages. However, there are not many exact studies dealing with this matter. We present results of studies on the role of surrounding vegetation in the course of spontaneous succession in disused gravel-sand pits, various types of quarries, and extracted peatlands. The following conclusions can be drawn: Nearly all (97%) species occurring in a disturbed site also occurred in its surroundings up to 100m from the site. Desirable and undesirable species did not differ in this matter. The closer are patches of (semi-)natural vegetation to a disturbed site, the higher probability is that target vegetation develops. It has the following practical consequences: It is highly reasonable to preserve at least some remnants of (semi-)natural vegetation during the mining or similar activities in the surroundings of a disturbed site. Eradication of undesirable species, especially invasive aliens, is recommended, if possible, at least up to the 100m distance. These principles should be implemented into mining plans and post-mining restoration programs.

034 Early growth dynamics of some frequently hydroseeded species in coal reclamation: the influence of aspect in Mediterranean environments.

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Although it is well known that aspect of a site influences the vegetation dynamics of natural communities, little is known about the role of aspect in the development of vegetation on reclaimed coal mines, particularly in the Mediterranean region. We investigated the effect of aspect (north vs. south) on the establishment and development of various frequently hydroseeded species on the steep slopes of coal reclamation area in Spain. The dynamics of hydroseeded species, soil properties and weather conditions were monitored in three permanent plots of 20 m² on north- and south-facing slopes, every two months during the first year after hydroseeding. Aspect was related to total plant cover during early revegetation, and south-facing slopes had the lowest cover. Aspect also influenced the early dynamics of hydroseeded grasses and legumes establishing on these slopes. Grass cover was greater on the north slope throughout the study, but differences in plant cover between north and south slopes appeared later for the legumes. Aspect also affected the relative contribution of both of grasses and legumes to the total plant cover, with grasses dominant on both northern and southern slopes, except during the summer on the southern slope. These results suggest that in coal mine reclamation areas of Mediterranean climates, differences in the development of hydroseeded species depended on the slope of the coal mine reclamation areas, and this information is of importance to managers in selecting species for use in reclamation.

035 How can earthworms help us with revegetation of disturbed areas?

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Observations on spoil heaps of brown coal mining region Sokolov (Czech republic) showed, that progress in plant succession is highly affected by changes in soil profile. Important is mainly formation of humus layer formed by earthworms' activity.

We have further test effect of earthworms (*Aporrectodea caliginosa*, *Lumbricus rubellus*) on late successional species in two field and two laboratory manipulative experiments. Generally we observed higher productivity of plants in presence of earthworms in laboratory experiments. It was done mostly by higher nutrient availability. In field experiments the response of individual species was more variable.

In revegetation of heavily disturbed areas mainly abiotic condition are considered. We have shown that biotic conditions could be also very important, especially when more natural approaches like spontaneous or directed succession are used.

0036 A geomorphic approach for the ecological restoration of Kkaolin mines at the Upper Tagus Natural Park (Spain)

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The Upper Tagus Natural Park is one of the largest and most valuable protected areas in Spain (Guadalajara Province), and it overlaps with two protected habitats of the Natura 2000 network (a Special Protection Area for Birds and a Site of Community Importance). At the Outlying Protection Zone of the Park, and within the two protected habitats, a series of abandoned kaolin mines affect the aquatic habitats of the area by siltation of the fluvial network, being the main management problem of the protected areas. Active kaolin mines with operations preceding the declaration of the Natural Park (year 2000), although with reclamation plans, have also the potential of affecting the rivers by siltation.

In this work, geomorphic criteria for the eco-hydrological reclamation of both abandoned and active kaolin mines are explained. The proposed landform designs point out that runoff and soil erosion can be reduced to the minimum by building composed concave slopes, whereas the highwalls' geomorphic activity is allowed to be active, being controlled with retention trenches. It is also recommended that the layout of the reconstructed terrain resembles the local original surficial geomorphology. Finally, the construction of systems of flow control and sediment storage is proposed at the basis of the concave slopes (decanting pools, as small ecologically functional wetlands). For their gauging, the methodology of the International Erosion Control Association (IECA) is developed. All that is made in a collaborative framework between Universities (UCM-UAH), the Natural Park managers, and one mining company of the area (CAOBAR S.A.) with environmental responsibility.

037 Innovative legal instrument for ecological restoration

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The Birds and Habitats Directives oblige the member states 1° to take the necessary management measures (art. 6.1. Habitats Directive), and 2° to take compensatory measures for the damage in cases in which negative plans or projects have been allowed because of overriding public interests (art. 6.4. Habitat Directive), both in order to ensure a favourable conservation status of certain species and habitats in the Natura 2000 sites (art. 3.1. Habitats Directive).

It is up to the member states to provide for appropriate policy instruments to fulfill their obligations. Since nature conservation legislation has a long history in all countries, there are a lot of traditional legal instruments available such as expropriation, designation of protected areas and management contracts.

Recently, some innovative legal instruments have been developed, some in legislation adopted in certain member states, some not (yet) adopted but only in draft legislation made by specialists in environmental law. At the Ghent University (Belgium) a project was carried out (promoter: Prof. Dr. Geert Van Hoorick) in order to draft integrated legislation on nature conservation, landscape care, forests, wild flora and fauna, and hunting. This project resulted in a "Preliminary Draft of the Flemish Nature Code".

In my contribution I want to speak about some innovative legal instruments in that preliminary draft, and in Flemish, Dutch and German legislation: direct biotope protection systems, instruments integrating nature and landscape interests in planning and licensing procedures (including compensation), acquiescence obligations to enhance a sound management, and voluntary legal techniques ensuring a long term sound management.

038 Transdisciplinary approach in participative processes to a local scale management of landscape resources

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The aim of present work is to illustrate the current state of a wider project whose general objective is to integrate a number of scientific and methodological approaches and technologies, in order to support local authority and stakeholders, especially those acting in marginal areas, toward a more sustainable management and use of landscape resources. The proposed methodology has been applied in several real case study to test its validity. In present paper the "Comunità Montana delle Alpi Lepontine" (Cmal) case is outlined. In order to achieve the adhesion to the European Charter for the Sustainable Tourism (ECTS) different stakeholders and public bodies, belonging to thirteen municipalities in the Northern Italy have cooperated. The efforts to preserve and boost economy in such peculiarly landscape compel to cope with landscape different aspects -scientific, historical, artistic and economical- from a multidisciplinary holistic point of view. This approach enables a complex scientific image, as a driver, in order to suggest, integrate and effective planning actions for a rational use of natural and cultural landscape resources. This also require a stronger integration and improved sharing of information among such a number of local actors. This could be better performed thanks to state of the art novel information technologies such as the paradigm of Interconnected Geo Semantic Web Communities.

039 View from the ground: the dirty work of restoration on private property

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Many countries share the social and economic challenges of ecological restoration, as well as the difficulty in improving public participation and support. I am a recent immigrant to Belgium from Canada, where I was the owner of a small ecological business that offered private property stewardship services such as invasive plant control and native landscaping. I discovered these challenges could be partially met by showing private property owners the benefits and enjoyment they could derive from being part of restoration and conservation.

Why try to involve private property owners, and why open a business as opposed to an NGO? Ecological research indicates that small naturalized areas are an important component of any conservation strategy. Large parks are important, but individuals and businesses control many ecologically valuable areas such as valley bottoms and coastlines. Also, restorers need to be recognized as dedicated professionals that deserve to make a living doing this important work. The physical act of land restoration is hard and tedious work, and though volunteers are always welcome they often don't have the necessary time or energy.

My experience with Coast Alive indicated that private property owners were interested in the conservation of their surrounding biodiversity, and that it is possible to make a living as a property steward. In the end, encouraging the public to be part of the restoration of ecosystems helps reinforce the change in consciousness that is vital to the future of the planet's ecological systems.

040 Economic effects of raising the water level

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An important measure in nature restoration projects is raising the water level, which reduces agricultural yield, changes the operational management for the farmer and decreases the commercial value of the land.

The implementation of this restoration measure has consequences for ownership and land use, which are adequately compensated.

To determine the changes in ownership and land use, classification plans are drawn up to compare the situation prior to and after completion of the project. First the cultural value of the soil types (soil texture, drainage and profile development) and recoverable value of the parcels are determined. After the measure is realised, a new proposal for the cultural and recoverable value is calculated by means of an accurate assessment of the yield losses that will occur as a result of the water balance changes.

It is customary to award 1000 points to the soil type in the area where the overall suitability for agricultural use is the highest, e.g. the soil most suitable for the predominant cultures in that area.

The classification plans determine the contribution and consolidation for each owner and user. The contribution relates to the situation before, the consolidation concerns the situation after implementation. Compensations are awarded by comparing contribution and consolidation.

The compensations for the farmers or the land users are in proportion to the impact of the measure on the operational management.

041 Bottom-up ecological restoration of habitats: when the spatial and temporal configuration of ecological resources do matter – Lessons from butterflies

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In the literature, there is a much confused use of the terms and concepts of biotope and habitat. Most of the time European researchers and conservationists apply them as synonyms; American scientists only use habitat. Biotopes (or general vegetation types) represent the general structural environmental variation, but not necessarily the functional variation when focusing on particular species or communities. For the latter, we will advocate a resource-based, bottom-up approach for recognizing habitats within and among different biotopes. This conceptual issue has important consequences for conservation and restoration on the ground, particularly in man-modified landscapes where ecological restoration is a major pathway for conservation (including several Natura2000 sites). The configuration of key ecological resources in managed or restored sites may not match desired settings as they are typically found in more dynamic, heterogeneous 'natural' systems. We will illustrate the approach and applications for the case of Belgian heathlands and peatbogs inhabited by a series of threatened or vulnerable butterfly species. Functional habitat maps provide an interesting tool both for evolutionary ecology and for conservation practice. It also allows incorporating thermal aspects of vegetation types and vegetation gradients, which has often been ignored in classical vegetation-based approaches. The significance of thermal profiles of landscapes should receive much more attention in this era of climate change.

042 The GraS-Model (Grassland-Succession-Model) – A simulation model for the succession of grassland biotopes under various management regimes (developed for the Eifel National Park)

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The GraS-Model was developed to support decision making concerning goals and perspectives for the grassland areas of the former military training site Vogelsang in Eifel National Park. The focus of the model is to simulate the development of the landscape under different management regimes, starting from the current situation of biotope type, land use, wildlife, etc.. Besides current maintenance (mowing, grazing by sheep), the impact of additional megaherbivores (wisent, Heck cattle and konik horse) and undisturbed succession is included.

To account for neighbourhood relationships, the model is set up as a cellular automaton. For this purpose, the modelled area (approximately 1500 ha) is divided into 10m x 10m cells in which all processes included take place. The succession is modelled using simple ecological rules, which were extracted from own data analysis based on the coexistence of different succession stages within the Eifel National Park and on the knowledge of former land use. The results of the simulation are displayed in spatially explicit maps using the software ArcGis.

Applying this approach, we are able to predict the development of the landscape in the former military area Vogelsang under different management regimes for up to 100 years.

043 Iteratio: from vegetation map to abiotic patterns and processes

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Recently a method (Iteratio) is developed that relates vegetation maps to maps of abiotic conditions such as pH, trofic levels and groundwater levels in spring and summer as well as upward seepage. With sequential vegetation mapping the method makes it possible to monitor the changes in the area of the N2000 Habitattypes in relation to the changes in the abiotic conditions (structure and function). This makes it possible to plan the nature management that will improve habitat area and -quality. The method will be published this year in Applied Vegetation Science. It contains a new statistical method and a computer application. Using thousands of abiotic measurements (pH, nutrients, groundwater levels etc.) related to vegetation relevés the application provided indicator values and weights for species for different ecosystem types in Holland. There is a strong relation with existing indicator systems in Holland, because it is based on the same kind of measurements. These systems however provide ranges for species or vegetation types. With these ranges it is not easy to make the described maps. Iteratio solves this problem.

To be used the method needs the following input:

a digital vegetation map with a typology that is based on vegetation relevés.

With the iterative statistical method the vegetation relevés get a indication value that can be related to a digital vegetation map. The output can be checked with local abiotic measurements.

The method would be presented as well as its use for some Nature 2000 areas managed by Staatsbosbeheer. This would be raised bogs (the Peelvenen) and Haaksbergerveen and a dune area like Texel of Terschelling.

044 Applying species distribution modelling for the conservation of the threatened saproxylic Stag Beetle (*Lucanus cervus*)

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Despite its size and attractiveness, many *Lucanus cervus* sites remain undetected in NW Europe because of its short flight period and its nocturnal activity. Therefore, present day designated conservation areas for *L. cervus* are probably insufficient for a sustainable conservation of the species. We applied eight species distribution modelling techniques (artificial neural networks, classification tree analysis, generalised additive models, generalised boosting models, generalised linear models, mixture discriminant analysis, multiple adaptive regression splines and random forests) to predict the distribution of *L. cervus* in Belgium using 10 randomly generated calibration and evaluation sets. We used AUC, sensitivity (% correctly predicted presences in the evaluation set) and specificity (% correctly predicted absences in the evaluation set) and Kappa statistics to compare model performances. To avoid the incorporation of only marginally suitable woodland sites into the Natura 2000 network, we, conservatively, considered the species as being present only in grid cells where all 10 randomly generated model sets predicted the species as such.

Model performance was, on average, good allowing to predict the potential distribution of *L. cervus* accurately. According to the predicted distribution using the more robust prevalence threshold, only 5731 ha (11% of the potentially suitable area) is protected under the Natura 2000 scheme in Belgium. Subsequently, we categorised the potentially suitable woodlands into three conservation priority categories based on their surface area and the already designated Natura 2000 area. Including the most suitable *L. cervus* woodlands

previously not included in the Natura 2000 sites within such network would require protecting an area of 15,260 ha. Finally, we discuss the implications of using species distribution modelling for nature policy decisions in designating conservation networks.

045 Transition of a managed forest towards a natural one – A forest history and stand survey study of an oak forest reserve

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Forest reserves, as reference areas, could serve as model sites for restoration of forest wilderness areas. In Hungary, where the cutting system was widely used during the late 19th century and throughout the 20th century, virgin forest remnants disappeared 60-100 years ago. Forest reserves were designated to preserve near-natural forest areas, allowing natural forest development without human interventions. Pannonian-Balkan turkey-oak and sessile-oak forest are the main forest types of the study area – the Várhegy Forest Reserve.

In this study, our aim was to reconstruct the temporal and spatial variation of stand dynamics for the previous 130 years. We gathered and analysed land-use history documents from the past 130 years and compared them to the results of a detailed field survey of forest stands. We discovered four age classes for the main tree species – *Quercus petraea*, *Qu. cerris*, *Qu. pubescens*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior* and *Acer campestre*. The four age classes are: the remaining trees of the old stand prior to the management system, the dominant 120 years old cohorts – mainly oaks, the middle-aged cohorts originating around the World War II., and the young cohorts filling the gaps after the oak-decline of the 1970-80s.

The most important impacts in this area were the change from forest management (cutting system) to abandonment and oak decline. The oak decline generated spontaneous succession, resulting in a more diverse, mixed oak forest.

Our database and case study provide lessons for future climate forest restoration.

046 The production of autochthonous planting stock as a tool for successful ecological restoration of wooded landscape elements

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Many species in the European Birds and Habitats Directive depend on small wooded landscape elements and forests. Native woody plant species are therefore routinely planted to help restore the populations of these species. But, successful establishment and survival in the long run may depend on where the seeds used to grow the planting stock are collected. Research suggests that it is important to use locally adapted seed provenances. There is evidence to suggest a home-site advantage for autochthonous populations and that non-local genotypes may be maladapted to local environmental conditions. Furthermore, intraspecific hybridisation of local and non-local genotypes may have a negative impact on the genetic structures of local populations via mechanisms such as outbreeding depression. There are challenges to identifying appropriate seed sources as small-scale population differentiation makes it difficult to delineate geographically defined seed zones to which seed exchange should be limited. Negative impacts of improper seed choice for nursery planting stock may only be seen after many years, especially for long-lived and slow growing plants. As several European countries face similar problems, the objective here is to outline the conservation measures that are taken in Flanders. Central issue is the production of autochthonous planting stock that should become available to all organisations involved in nature conservation. The steps to achieve this issue will be discussed.

047 A protection plan for Stag beetle (*Lucanus cervus*) based on his landscape requirements and colonisation capacity

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The distribution of the Stag beetle in Belgium is concentrated around the cities of Brussels and Liege and further the species is found mainly in the river valley of the Meuse. Some more isolated locations are scattered mainly in the south of the country.

The ecological needs and landscape requirements of the species are summarised based on studies of the species in Belgium. For the macro landscape approach a model was build that explains the national distribution of the species. Range in elevation in low mountainous area and urbanisation within hills seem to be the most important factors to explain the species distribution. For the micro landscape approach the habitat and relief of the known breeding sites and recent records was studied. The species is found most often in gardens, followed by woody afforested talus and hollow ways and forests. The needed slope can be determined in Belgium as a SW to SE slope of 4° or more. Both analyses suggest that forests had an historic importance for the species.

Based on this the future role urban areas and forests is discussed. The knowledge on landscape requirements and the poor colonisation capacity is used to work out a species protection plan for the population in the Brabant region (surrounding of Brussels) by studying corridors between relict populations individually and large forest in the surrounding area. Based on the delineation of these possible corridors migration and connectivity assumptions are tested.

048 Dead wood accumulation in previously managed oak and beech woodlands in North-West and Central Europe

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An analysis was made of dead wood accumulation in strict forest reserves in lowland Western Europe. Contrary to numerous other studies that focus on dead wood dynamics in natural and near-natural reserves, this study deliberately focuses on dead wood levels and accumulation rates in beech and oak dominated woodlands that were withdrawn from regular management over the last 10 to 150 years.

In the absence of major disturbances, dead wood accumulation is a slow and steady process: more than ½ of the studied sites have an average accumulation rate below 2 m³/ha.year. Windthrow is an important factor, responsible for extreme values that appear to be confined to the beech dominated reserves. In the absence of catastrophic events however, accumulation in beech stands can also be extremely slow, especially in middle-aged beech stands.

Oak-dominated samples are far less influenced by windstorm. Dead wood build-up is a steadily process in these forests, where trees mostly die individually and standing up, only falling down after a few decades. The way dead wood is recruited, from standing trees or windthrow of living trees, does in the long run not influence the average amount of dead wood, nor the ratio of lying dead wood.

In man-made forests left for free development, a dynamic equilibrium as described for Central-European virgin forests may take very long to develop: the unnatural age structure of the stands and windstorm calamities may lead to more fluctuating processes, with pulses of dead wood accumulation and regeneration.

049 Steppe restoration by hay transfers

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The steppe of La Crau is defined as a priority habitat by the EU (NATURA 2000 habitat FR9310064 & FR9301595). This habitat rich in animal and plant species has incurred a lot of damages and today has been reduced to 11,500 hectares, of which 23 were destroyed in 2006 during the construction of an underground pipeline. As reported in previous studies, the steppe vegetation resilience is extremely low. An original experiment in restoration ecology was tested in order to mitigate potential future damages. This ecological restoration experiment was carried out in order to find ways of accelerating steppe vegetation colonization on the buried pipelines. The aim of the study was to adapt and to test the technique of hay transfer already used in Northern Europe to reintroduce steppe species. A factorial experiment was set up at three replicated sites to test the effects of grazing, habitat characteristics and hay transfer.

The first results obtained in 2007 showed a low efficiency of the measures taken to reduce negative impacts during pipeline construction (e.g. remove topsoil with seed bank, stockpile it during construction, spread it back on top at the end) due to construction delays and an increase of species-richness by the use of hay transfer with the reintroduction of typical steppe species. Among these species, we found a lot of Poaceae. Some of them are locally rare, such as *Taeniatherum caput-medusae*. In 2008, these results will be completed with the data obtained during the second year.

050 Restoration of pannonic sandy grassland habitat on abandoned agricultural fields

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The area of the Pannonic inland dunes and sand steppes has considerably decreased in the past century in Hungary due to intensive agricultural production. The socio-economic transition in the 1990s induced the abandonment of cultivation on nutrient-poor soils, resulting in large areas of degraded old fields, especially in the sandy Kiskunság region. The natural regeneration of the grassland vegetation is often hindered by the limited dispersal of the specialist species from the surrounding landscape, thus the old field can remain at an intermediate state dominated by weeds for a long time. Therefore restoration measures should be applied to facilitate the natural secondary succession and to regain some of the former area of these Natura 2000 priority habitat types. Field experiment started in 2002 on three old fields of different ages to test the effectiveness of various treatments (ploughing as a basic treatment, carbon amendment, seeding with target species, mowing and their combinations) in plots of 1 m². Success of the applied restoration methods was evaluated with the comparison of the share of different plant species groups in the 5th year of the experiment. Species groups were created according to regional behaviour (e.g. habitat preference) of species and based on plant traits (e.g. plant height) in relation to the species' role in succession. We found that carbon addition alone had no significant effect on the vegetation composition. Seeding was very successful, and plots with the seeding plus mowing treatment became the most similar to the reference grassland.

051 Successful establishment of the Natura 2000 species *Pulsatilla patens* (L.) Mill. in newly restored calcareous grasslands

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In Europe, *Pulsatilla patens*, a species listed in Annex II of the habitats directive, is strongly endangered due to land use change. In Germany, only one large population has been preserved in a nature reserve north of Munich, but this population also declined from 27'000 individuals in 1991 to 9500 individuals in 2003. Therefore, *Pulsatilla* seeds were propagated and sown on large-scale restoration fields, on which calcareous grasslands had been established after topsoil removal and transfer of seed-containing hay transfer between 1993 and 2002.

The aim of our study was to study the performance of the newly established populations of *Pulsatilla patens* in comparison to the ancient population in the nature reserve. Population size was determined by a GPS-supported mapping and population structure was studied in relation to vegetation characteristics. On three restoration sites of 0.42 to 1.4 ha area, new populations of 6,075, 16,145 and 13,511 *Pulsatilla patens* individuals respectively could be established. Population density varied between 0.96 and 3.84 plants per 1 m². Five years after sowing, many of the newly established plants were flowering and developed even more flowers than the plants in the nature reserve. The number of flowers per plant was positively correlated with the proportion of bare soil. Low competition of other vascular plants also led to highest seed numbers per inflorescence. Our results indicate that re-introduction of *Pulsatilla patens* is most successful on topsoil removal sites in combination with hay transfer.

052 Recreation of semi-natural grasslands: assessing hay transfer and seed-sowing methods

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Semi-natural grasslands have declined considerably both in numbers and area extent in Europe during the last 50-100 years. Therefore, restoration or recreation of semi-natural grasslands may be a way of maintaining this nature type and it's species that are at risk. However, there are few places in the modern landscape where the landscape are managed in such a way that it is kept open except along the roads. To recreate semi-natural grasslands with the desired species composition along new roads may however be challenging. Seed-sowing of preferred species is generally costly and can therefore only be done within a limited area, but diaspore transfer with hay may be cheaper and better. In the present study we examined four different methods to recreate semi-natural grasslands at an experimental site along a new road: seed-

sowing, two ways of hay transfer (hard raking and light raking) and succession on bare soil (reference treatment). The seeds and the hay were taken from nearby semi-natural grasslands, i.e., donor sites. We compared the species composition in the plots at the experimental site with their species composition at the donor sites with Bray-Curtis dissimilarity index. The species composition of the seed-sowing and the two hay transfer treatments significantly changed towards their donor species composition during three years of succession. These three treatments followed the same pattern over time, implying that diaspore transfer with hay, irrespective of way the hay is collected, could be used instead of the more costly method of seed-sowing when recreating semi-natural grasslands.

053 Restoration and vegetation stability

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In many cases expensive restoration procedures end up with poor outcomes that require much effort to rescue, if indeed it is considered worthwhile. The problems are usually down to lack of knowledge of factors affecting the local vegetation and their dynamic aspects. Several examples are given where the outcomes are clearly unlikely to be satisfactory in the long run. Reasons for the problems are suggested and possible remedial action described, with particular emphasis on work with invasive species.

054 Salt marsh restoration and creation: ways to Global Climate Change adaptation and mitigation

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Salt marsh restoration and creation are a necessity since this ecosystem plays many important social, cultural, economic and ecological functions and it has been destroyed or degraded all around the world. In addition, salt marsh creation and restoration may be used to affront the negative consequences of Global Climate Change and to reduce greenhouse gasses emissions. Thus, salt marsh bioengineering may be used to reduce deleterious effects of flooding events after torrential rains or the impacts of storms, sea level rise and hurricanes on coastal areas. On the other hand, the creation and restoration of European salt marshes using native species such as *Spartina maritima* (small cordgrass) may be used as a mitigation strategy. *S. maritima* at the channel banks where the marsh surface is stabilized develops non-successional stands that last for decades. Thus, the restoration of degraded channel banks converts open mudflats into *S. maritima* swards where it reaches in less than four years above-ground matter values higher than 350 g dry weight m⁻² together with bellow-ground biomass of c. 4000 g dry weight m⁻² and sediment organic contents of c. 8 %. These amounts of biomass and necromass represent a dynamic but stable carbon stock of c. 21765 kg C per hectare without evaluating microbial and animal communities and alga. Alternatively, at successional marshes, *S. maritima* facilitates the development of succession, being replaced by other plant taxa such as *Sarcocornia perennis*, *Sarcocornia perennis* x *fruticosa* and *Atriplex portulacoides* that develop higher biomasses than the small cordgrass. The role of other non-native cordgrass species in European estuaries, specially *Spartina anglica* (a allopolyploid hybrid originated from the introduction of the American *Spartina anglica* in Europe), in fighting global warming should be considered carefully since they can play important ecological and economical functions at the same time that they impact negatively on plant and animal biodiversity.

055 Focusing on spatial and temporal scales in dynamic nature management on the Dutch Wadden Sea Islands

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Since about a century ago the nature areas on the Dutch Wadden Sea Islands show gradual but large changes in dominating habitat types. In all vegetation series (halosere, hydrosere, hygrosere and xerosere)

young successional stages are gradually replaced by older stages. Grass and bush encroachment cause decreases in the area of open, low vegetation stands and in the number and area of patches of bare sand or mud. As a consequence small scale biodiversity in dunes and salt marshes, not only of higher plants but also of mosses, lichens and insects, declines. Nowadays some of the most characteristic species, also some of the birds typical for open dunes, even have vanished completely from the islands.

Successional development on the site is a natural process as such. On the Wadden Sea Islands however, vegetation *regression*, periodical 'destruction' of vegetation-covered surfaces caused by dynamical processes such as water erosion or blowing sand, is an equally natural process. The equilibria between building and degrading forces on different spatial and temporal scales determine the patterns in vegetation and habitat types on the islands. The actual balance between old and young successional stages mirrors the dominance of stabilization measures by men during the last century. Since some decades, from an ecological point of view, the reinforcement of natural dynamics has been propagated.

The necessity to implement Natura2000, as well as the expected climatological changes, stress to reorientate on coastal and nature management strategies for the Wadden Sea Islands. In this process the apparent contradiction between natural dynamics and traced N2000-habitats should be met and the effects of stimulating natural dynamics on coastal safety analyzed. A group of ecological consultants and scientific researchers responded to the challenge. As a first step they identified the most important driving forces on different spatial and temporal scales. Next they identified compartments on a 'model island' each controlled by a specific set of more or less dynamic geomorphological and hydraulic/hydrological processes. This appeared to be a sound basis to identify natural sites for (complexes of) N2000-habitats as well as some new management tools to restore natural patterns. Some aspects of the new approach will be presented.

056 Ecological restoration: natural dynamics hindered by a static legal system?

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Ecosystems are dynamic and nature changes, not only because of the effects of climate change, but often because of proposed policy effects, too. E.g., an important policy goal for large parts of the Wadden Sea is, mainly under the Water Framework Directive, to improve water quality. That means that the water will become less nutritious. The effect will be that there will be less mussels and therefore less mussel-consuming birds. However, the Wadden Sea was designated as a Special Protection Zone under the Birds-Directive amongst others just for these mussel consuming birds. Art. 6 Habitatsdirective seems to forbid decline of the living conditions of the designated areas and decline of the number of species an area is designated for. There is an enormous tension between the static character of the legal protection regime of the Birds- and Habitatsdirective and the (desired) dynamic of nature. However, the case law of the European Court of Justice seems to offer some first openings to take the dynamics of nature into account. It will be discussed, what possibilities this case law, especially a decision against Portugal of 13 July 2006, offers and where restrictions remain.

Moreover, the problem could be solved by identifying only very general protection goals when an area is designated, e.g. "a good ecological status which supports the desired development of nature as much as possible". The strong disadvantage of such general criteria is that they hardly seem to be suitable to function as testing criteria for new and existing activities. An intensive dialog between ecological and legal professionals is needed to explore how designation criteria could be formulated that they on the one hand leave room for the dynamics of nature and changes due to policy goals, but on the other hand function as concrete and feasible testing criteria for existing and new activities. As an outcome of such a dialog it could even be possible to formulate proposals for a change of the highly statically art. 6 Habitatsdirective, which may play a role in the evaluation of the Habitatsdirective that takes place at the moment.

057 Wet meadow restoration at lake Mikri Prespa, Greece: results of vegetation monitoring (2002-2007)

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Restoration of wet meadows at Lake Mikri Prespa, in NW Greece, is very important for endangered birds such as Dalmatian pelicans and Pygmy cormorants. To improve the conservation status for these species and enlarge fish spawning grounds, littoral vegetation management aiming at controlling high emergent vegetation on seasonally flooded areas was implemented by applying three treatments, namely water

buffalo grazing and summer cutting with and without aftermath grazing. Their effects were monitored along transects crossing the littoral zone where cover and species composition was recorded in mid July of the years 2002-2007. We found that the cover of the high emergent helophytes, mainly of *Phragmites australis*, was reduced by all three treatments, especially by the ones involving grazing. In 2007, cover values were significantly lower in the two treatments (5.9% and 7.8% with only buffalo grazing and summer cutting with grazing respectively) than in the one involving only summer cutting (22.9%). On the contrary, the cover of wet meadow species such as *Carex pseudocyperus* was increased, but did not differ significantly among the three treatments in 2007 (60.9%, 70.5% and 68.8% respectively). Litter cover was significantly increased in the two treatments that included grazing while bare soil was significantly increased only in the treatment of buffalo grazing (14.7% in 2007). It is concluded that despite their differences in the effectiveness of controlling high emergent helophytes, all three treatments should be combined in an integrated management scheme for wet meadow restoration and maintenance in the littoral zone of Lake Mikri Prespa.

058 Networking of five life-nature projects in Greek Ramsar wetlands: lessons learnt from vegetation management and monitoring activities

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Among various LIFE-Nature projects that were implemented in protected areas of Greece from 1999 to 2007, five of them were dedicated to the Ramsar wetlands of Strofylia-Kotychi, Amvrakikos, Lake Mikri Prespa, River Nestos Delta and Evros Delta – Drana Lagoon, located from the western to the northeastern parts of the country. Through these projects, important conservation measures targeting vegetation-, water- and bird-related threats were successfully put into practice. Additionally, each project included a public awareness and dissemination of results campaign, while a network of the five projects was also maintained from October 2002 to September 2006, for the first time in Greece, with meetings taking place rotationally at the five sites. This networking activity offered the ground for the projects' teams to learn lessons on both administrative and conservation management issues. The former included exchange of know how, establishment of working groups, interaction between conservationists, public authorities and local politicians from different parts of the country, better diffusion of the results of each project, and production of a common final technical report. The latter, with emphasis on Natura 2000 habitat types, included best practices applied in different wetland and forest types, such as tree plantations, restoration of wet meadows and sand dunes, earthworks to improve degraded habitats, implementation of experiments on specific habitat types and monitoring of vegetation at managed sites. It is recommended to perform such beneficial networking activities as a standard action for similar nature conservation projects being implemented within parallel time periods.

059 Twenty years of ecological restoration in lake IJsselmeer. Lessons learned and unintended yields for the water framework directive and Natura 2000

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Lake IJsselmeer is the largest freshwater body in northern-west Europe. And one of the youngest: only in 1932 it was dammed and transformed from salty to fresh water. It developed as a hot spot for water birds, fish and freshwater mussels. In the seventies and eighties, species richness got a severe knock down. This was mainly due to bad water quality and increased dessication of the lake banks. In the late eighties and early nineties several restoration projects were dressed to repair the damage.

Our study reveals the ecological proceeds of nearly twenty of these projects: from mini-pancake isles and artificial subwater reefs to fishways. But goals have changed. Nowadays water system rehabilitation mainly focuses on the Water Framework Directive and Natura 2000. We also evaluated what the measures have contributed to quality-elements and target species from these two directives. What works, what does not? The restoration projects in Lake IJsselmeer have mainly favoured water bird species. These type of measures are useful for several Natura 2000-goals (but not all). Fish and macrophytes, important WFD-elements, profited from measures where the area of shallow water increased. With clear water as a boundary condition. Problems occurred in projects with insufficient flow through and when created structures were destroyed by wave action.

For a significant contribution of restoration measures to water body quality or Natura 2000 goals, upscaling is necessary. Smart combinations of measures within projects, serving multiple goals increases the efficiency of ecological restoration in these areas.

060 Changes in the radioecological and ecotoxicological state of the Lake Druksiai and implication for the lake ecosystem in 1988–2007

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Ignalina Nuclear Power Plant (INPP) is located at Lake Druksiai utilized as cooler. Like Chernobyl NPP, INPP is equipped by RBMK-1500 type reactors. The Unit One was decommissioned in 2005; the Unit Two must be closed in 2009. When both reactors were functioning the lake was impacted not only by a thermal pollution, but also by chemical and radioactive pollution. The aim of this study was to evaluate the influence of waste water (WW) from INPP on radioecological and ecotoxicological state of Lake Druksiai and the state of Natura 2000 habitats. The investigations were performed during 1988–2000 and 2007. The activity of Cs-137, Co-60 and Mn-54 in bottom sediments and plants of WW channels of INPP and biotopes of Lake Druksiai was measured. The toxicity of water and bottom sediments from WW channels of INPP and biotopes of Lake Druksiai on *Lepidium sativum* and *Tradescantia* clone 02 was assessed. The significant decrease of the activity of tested radionuclides in bottom sediments of WW channels of INPP and Lake Druksiai after the Unit One decommissioning was determined. A slight tendency of the decrease of Co-60 and Mn-54 activity was determined in plants of INPP channels; however, Cs-137 activity in them was in the same level during investigated period. The tendency of the radionuclides activity decrease was observed in lake biotope suffered from the direct impact of INPP WW. However, the comparison of phytotoxicity of water and bottom sediments from INPP WW channels and Lake Druksiai before and after Unit One decommissioning indicated no improvement in lake ecotoxicological state at all. It was found that of the 9 Natura 2000 habitats of the Lake Druksiai site only 4 are in a rather good state. The abiotic conditions of the growth of some plant species (from the list of Lithuanian Red Book) worsened during the investigated period and as the results the populations of protected plants decreased.

061 The effects of Chernobyl accident on Turkey

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The accident occurred at the Chernobyl nuclear power plant in Ukraine on 26 April 1986 and caused the deaths of 30 power workers and firemen within a few days or week, brought about the evacuation of about 116,000 people from areas surrounding the reactor during 1986. The accident had wide-ranging effects on hundreds of thousands of people affecting all dimensions of living conditions: environment, health, social, economic, education and even cultural.

The large amount of radioactive materials was released into the atmosphere at the end of the Chernobyl accident. The most important radioisotopes were caesium-137 and iodine-131. Many European countries were affected as a result of the atmospheric transfer of radioactive materials.

After the Chernobyl reactor accident, Eastern Black Sea coast was one of the heavily contaminated regions of Turkey. The radioactive fall-out which occurred two weeks after the Chernobyl accident over the North-east region of Turkey had an impact on the tea plantations along with tobacco and hazelnut plantations. The intervention level of radioactivity taken by the Turkish Atomic Energy Authority was sufficiently drastic only for pregnant women and to children of less than one year of age, but for all population of Turkey. The aim of this study is to investigate human health effects and the physical consequences of the Chernobyl accident on Turkey.

062 Acid rain in Turkey

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Acid rain is a widespread term used to describe all forms of acid precipitation (rain, snow, hail, fog, etc.). "Acid Rain", is the word used to describe rainfall that has a pH level of less than 5.6. The "natural" acidity of rainwater is often taken to be pH 5.6, which is that of pure water in equilibrium with the global atmospheric concentration of CO₂ (330 ppm), and this pH value of 5.6 has been used as the demarcation line for acidic precipitation. The precursors or chemical forerunners of acid rain formation result from both natural sources, such as volcanoes and decaying vegetation, and man-made sources, primarily emissions of sulfur dioxide (SO₂) and nitrogen oxides (NO_x) resulting from fossil fuel combustion. Acid rain is formed when oxides of nitrogen and sulphur combine with moisture in the atmosphere to make nitric and sulfuric acids. The pH scale is used to measure the acidity of acid rain which is determined by the hydrogen ion content (H⁺).

This form of air pollution is currently a subject of great controversy because of its worldwide environmental damages. Acid rain can be carried great distances in the atmosphere, not just between countries but also from continent to continent. The rain sometimes falls many miles from the source of pollution but wherever it falls it can have a serious effect on soil, trees, buildings and water. For the last ten years, this phenomenon has brought destruction to thousands of lakes and streams in the United States, Canada and parts of Europe.

This study is aimed to view acid rain and its effects in different sites of Turkey. The results in the literature have indicated that large amounts of acids are transported to these sites. But the data reflect that alkaline nature of the soil and alkaline particles in the atmosphere neutralize the acidity.

063 Sustainable development of forest ecosystems in industrial regions of Ukraine

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The research is devoted to the assessment of biogenous migration of heavy metals and approbation of the developed theory to bastard acacia's biogeocenosis of city of Dnepropetrovsk and rural areas of the Dnepropetrovsk area. The complex system of quantitative parameters expressed in absolute and relative units of measurements is offered with which help it is possible to estimate intensity of biogenous migration of heavy metals in natural conditions and to reveal those changes, which are a consequence of ability to live of the man. The parameters describing separate parts and biogenous migration as a whole are entered. The method of definition of bioweight of wood on a photo of a tree made in the winter period is developed. Are carried out (spent) nature of research of migration of heavy metals in biogeocenosis of city and countryside. The basic parameters describing processes of synthesis, accumulation and decomposition of organic-mineral substance are determined. The characteristic law of distribution of heavy metals in organic-mineral substance of biogeocenosis is established. The balance average total of the contents of heavy metals in biogeocenosis of city and rural area is designed. The separate and generalized parameters are determined which have allowed to reveal character and degree of changes in biogenous migration of heavy metals occurring under anthropogenic activity influence, to establish the tendencies and regularities. The results of research allow to estimate ecosystem degradation level and to predict of change it in future.

064 Changes of radioecological state in Lithuania after an accident in the Chernobyl NPP

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The subsequences of Chernobyl NPP (CNPP) accident were perceptible in Lithuania. Therefore the aim of present work was to evaluate changes of radioecological state of plants and soil of their habitats during 1993–2007 in Lithuania regions (Ignalina, Varena and Plunge) because of the CNPP accident contaminated with Cs-137, Cs-134 and Sr-90.

During investigated period, decrease in Cs-137 activity in soil was observed only in Plunge region in 2007. Cs-134 activity in soil of all investigated regions was detected only in 1996 and 1997. Sr-90 activity in soil significantly decreased also only in Plunge region over 1996–1997, and later it hardly changed.

Cs-137 activity in plants strongly decreased depending on region: in Ignalina over 1994–1995, Varena over 1993–1994 and Plunge over 1994–1998, however, at later period it changed a little. Cs-134 activity in plants of all investigated regions decreased over 1994–1997 and from 1998–1999 it was under minimal detectable level. Sr-90 activity in plants of Ignalina, Varena and Plunge regions decreased over 1993–1995 and later it changed not much.

Data reveal that after the CNPP accident significant autorehabilitation processes took place in plants of contaminated areas of Lithuania over 1993–1998, while from 1999 these processes apparently slowed down. Autorehabilitation processes rate in plants were different in Lithuanian regions: in Plunge it was slower than in Varena or Ignalina. Differences may be influenced by particular soil characteristics, as well as other ecological conditions. Whereas autorehabilitation processes in the soil were hardly noticeable.

065 Development of Natura 2000 areas in Flanders

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For the development of the Natura 2000 areas in Flanders a wide range of measures and instruments are used.

Development projects such as land development for nature, comprehensive land consolidation and land development can also contribute to the realisation of the Natura 2000 nature values through the implementation of well-balanced, instrument-based measures.

A map provide an overview of current and finished development projects in or around Natura 2000 areas in Flanders. This concerns land consolidation, land development for nature and land development projects as well as non-instrument based development projects, executed for and on demand of third parties.

The map include a table which provides an overview of the surfaces of Natura 2000 areas that overlap projects, grouped per instrument, and the measures that can be used in each of the instruments to achieve the objectives of Natura 2000.

A few striking projects are highlighted: using maps and/or photos the measures and realisations that contribute to the objectives of Natura 2000 and the desired and/or realised targeted species and habitats are described.

066 Approach for the management strategy of Natura 2000 Sites – Habitats directive, in Romania

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The Romanian Natura 2000 Ecological Network covers 17% of the country's surface and includes 108 SPAP and 273 SCIP. From a biogeographical point of view, Romania has the highest number of bioregions in Europe – 5 out of 10: Alpine, Continental, Pannonian, Steppic and Pontic.

The SCIP were created for 90 habitats, 26 mammals, 6 reptiles, 6 amphibians, 27 fish, 57 invertebrates and 46 plant species.

But after the process of designation finished, a lot of topics are requiring improvement, updating, confirmation.

In this context, we started in 2007 (ongoing till 2010) the project "Scientific substantiation of a model for implementing the Natura 2000 legislation in Romania, using the animal species listed in the Habitats Directive 92/43/EEC (Annex II) as a case study". To undergo the research, a nucleus of specialists in different domains was formed (biologists, biospeologists, forestry management specialists, IT and GIS specialists, geographers, engineers), thus ensuring the elaboration and delivery of the scientific and methodological information needed for the long-term conservation of Natura 2000 animal species in Romania.

The project will contribute to the elaboration of the management strategy for Sites – Habitats Directive, as means for guaranteeing long-term conservation of biological diversity, which is of special protective interest both at national and European level.

The paper presents the information, as resulted from the critical analysis of existing data.

067 Actions for conservation, restoration and development of urban biodiversity in the Brussels capital region

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Despite its limited surface (160 km²), high urbanization level and population density, the Brussels Capital Region hosts a wide and unexpected diversity in ecosystems and relative high species richness. This diversity is composed of fragments of natural landscapes, now encapsulated in the urban environment (ancient woodlands, marshes, grasslands, ...) as well as other man-made habitats (landscape parks, old walls, railway verges, derelict land, ...). These habitats, with their associated species diversity, all have their place in the nature conservation context of a large city.

Besides the appropriated management of sites of particular ecological interest such as the forests, nature

reserves and Natura 2000 sites, covering approximately 14 % of Brussels surface, the challenge of Brussels' nature conservation policy is to integrate ecological management into classical green spaces management and to restore degraded habitats to natural sites in the urban areas. Complementary to this "site oriented management" specific actions focused on species are realized (e.g. Stag Beetle *Lucanus cervus*).

Examples are given of ecological management in traditional landscape parks (mowing, keeping dead wood, pond restoration, ...), restoration of marshland in the urban area, transformation of classical urban green space into natural area, ecological management of railway verges, as well as species oriented actions.

A new juridical framework recently has been worked out, initiating a range of new instruments such as action plans and protection plans. Species protection plans are developed to restore populations of Regional Important Species from different taxonomic groups. Species of regional importance appears from the Brussels Information Network, which exists more than 15 years. Species action plans are under preparation to control invasive alien species populations, such as parakeets.

068 Implementing the Natura 2000 network in a city: the case of the Brussels Capital Region

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Despite its limited surface (160 km²), high urbanization level and population density, the Brussels Capital Region hosts a wide and unexpected diversity in ecosystems, consisting of natural landscape fragments, now encapsulated in the urban environment and man-made habitats.

To protect this diversity, Brussels designated 14 % of its surface as Natura 2000 site: 3 coherent network areas, composed of 48 "core" and "connecting" stations, which act as stepping stones in the urban environment.

In 2005-2007, all Natura 2000 sites were revisited and their conservation status assessed. Based on this survey, three conservation objective reports were prepared, which will form the core of the designation decrees. These objectives are further detailed in 48 pragmatic management plans, in their turn further detailed in worksheets for public property and « management contracts » for private owners. Management will either be done by public services, or by private owners who can receive financial compensation.

While most sites are well protected, edge habitats continue to be subjected to a huge urbanization pressure. Appropriate evaluation of plans and projects with potential impact on habitats and species is therefore crucial, as it serves as a tool to prevent further destruction of edge habitats. Even private persons who wish to build homes along the edges of Natura 2000 sites are subjected to appropriate evaluation, which obliges them to think about minimal ecological impact and their personal contribution to biodiversity protection. A practical manual fixing quality standards for the appropriate evaluation is in preparation.

069 A new decision tool to achieve GIS-based conservation strategies for habitats of the European Natura 2000 network

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Since 1992 onwards, "Habitats" Directive 92/43/EEC became a cardinal European law for the protection of biodiversity through the conservation of natural and semi-natural habitats, wild flora and fauna. As a consequence, a continental network of Sites of Community Importance (SCIs) was instituted and now it covers about 17 % of the EU territory. Article 6 of such directive underlines the importance of biodiversity conservation through the realization for SCIs, if needed, of proper management plans, recently increasing in number.

A management plan based on intensive field studies and monitoring activities requires time and financial resources, which however are generally limited. Hence, we offer a rapid, cost-effective and scientifically-based decision tool aimed to achieve GIS-based conservation strategies for habitats of EU interest within SCIs and, in general, within protected areas. As a case study, we considered the priority habitat 6230* species-rich *Nardus* grasslands (under threat due to natural reconversion and intensive cattle grazing), and the habitat 7140 transition mires (interested by pasturing and human disturbance) in a SCI in the Alps; we submitted them to a multicriteria evaluation in which indicators and weights were selected on the basis of the acquired knowledge of the study area. As a result, we were able to: a) quantify the level of existing threats, b) suggest urgent conservation strategies, and c) future monitoring activities.

Our decision model might be transferable to further areas, through the proper adaptation of weights to the intensity and the frequency of acting threats.

070 The Italian 'Map of Nature' project towards the habitats map and their evaluation

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In order to evaluate the state of the natural environment in Italy, The "Carta della Natura" (The Map of Nature) Project was included into the Italian Law 394/91 on Protected Areas, it identify the natural values and the environmental vulnerability of the country. The Map offers synthetic representation of the reality, combining ecosystems factors. The results is a framework of natural value but also anthropogenic pressure and habitats sensibility. The Biotopes or Habitats Map legend derives from CORINE Biotopes hierarchical classification system, at 1:50.000 scale. To warrant uniformity in habitats interpretation, has been structured a reference legend, consisting of 230 items that represent all mapping habitats in Italy with the correct correspondence with Natura 2000 network sites code in order to compare the maps, to highlight the habitats distribution, fragmentation, rarity and the presence of the Directive Habitat's habitats. This approach might highlight possible shortcomings of Natura 2000 in Italian ecosystems. The GIS approach, permit to evaluate environmental quality and vulnerability, through the use of standardized set of indicators related to all components of the territory. The aim is to show habitats, which are both in risk and high ecological value condition. Through the indicators is possible to associate to the habitats their biodiversity components as fauna and flora, but also obtain an assessment of noise-induced on this natural heritage by human activity as the fragmentation caused by roads, the presence of urban centres, industrial areas, quarries, agricultural areas. Map of Nature provide information that may be used to the identification of ecological networks, for environmental impact assessments etc...

071 A coenocline of woody colonizer species in reclaimed surface coal mines in Spain

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In this study, we combined the analysis of a coenocline with HOF modelling of species behaviour (a statistical approach to describe species responses that may result from both environmental conditions and intra- and inter-specific interactions) to describe colonization patterns of woody species on reclaimed coal wastes in northern Spain. We hypothesize that fine-scale variation in abiotic factors along the forest-mine gradient affects colonization pattern of woody species. To understand these factors, we analysed changes in the floristic composition and in the abundance of the main woody colonizers according to the distance from the forest-mine border. Our results showed how the primary coenocline extracted from DCA1 reflected a gradient in environmental conditions influencing the species composition of woody plant communities, from the more shade, moist and dense forest on acid and rich soils to the open, dry and oligotrophic grassland. The colonization pattern of woody species is affected by the fine-scale variation in abiotic factors, such as the increase in pH, P, light, and the decrease in K, N, C/N, organic matter and soil moisture, from the forest to the mine. Most species HOF modelled showed monotone responses with decreasing trends along the environmental gradient from the forest to the mine, being *Quercus petraea* the species clearly dominant in the forest. On the contrary, *Cytisus scoparius* and *Genista florida* colonize intensely the mine area, reaching the maximum abundance around 14 and 11 m of distance to the forest boundary, respectively. We conclude that the composition of woody species in the forest is not a good predictor of the colonizing intensity, not even of the species composition in the

072 An advanced concept for surface coalmine restoration in semiarid lands

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Long experience and commitment have been applied for the reclamation of surface mining zones. However, in many worldwide sites, practical results are quite poor and a lot of the "reclaimed lands" would need a new reclamation project. Application of an insufficient conceptual framework explains the failure of mining reclamation in practice. An advanced reclamation concept based on the hydroecological basin as the restoration unit is being developed in Teruel coalfield (NE Spain). It can be applied in coal and similar surface mining reclamation in dry environments. Constructed basins are composed by gentle slopes with natural vegetation, flat areas for agricultural use and a drainage network with watercourses and natural simulated

wetlands. Landform, soil, plants and hydrology are managed in an integrated fashion to optimize the supply of water and nutrients to plants and to control the erosion. Water circulation through the watershed and water quality in wetlands are improved while sediment is retained in selected sites. Hydrological impact on natural aquatic systems can be like this controlled. Earlier reclamation performances were based on the "spoil" concept, composed by flat platforms, steep slopes, terraces and ditches for overland flow drainage. This design was not ecologically stable since water infiltration is very low and soil erosion strongly limits vegetation establishment. The next step enhanced the platform-bank-ditch model by constructing softer landforms where productive agriculture is carried out and slope banks revegetation is successful. However terraces and ditches remain unstable yielding large amounts of sediments and water towards the natural watercourses. This advanced concept requires great effort in planning and design, and also an interdisciplinary approach. Implementation cost can be higher, but maintenance decreases and the value of restored site is much higher.

073 Hydroseeded and native species on coal reclamation in Mediterranean environments: short-term species responses

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An understanding of the response of established species during the first years of ecosystem development is crucial to the successful of the ecosystem restoration. Particularly, more information about the success of hydroseeded and natives species in terms of establishment and development on reclaimed coal mines in the Mediterranean region is needed. We described the species response curves of various frequently hydroseeded and native species on a coal reclamation area in Spain. The percentage of cover of hydroseeded and native species were monitored in three permanent plots of 20 m² on north- and south-facing slopes, and on a flat area, every two months during 3 years after hydroseeding. There were differences in the response among the hydroseeded species, especially for two annuals (*Avena sativa* and *Secale cereale*) which appeared only during the 2 first years after hydroseeding. Native species showed also differences in their response models, whereas *Trifolium* species showed similar responses, there were some species which only were important during one year. The knowledge of this information is very important for the correct management of those areas and for improve the selection of the species for use in future reclamations.

074 Comparison of seminatural vegetation and soil properties between spoil and natural sites in the Kozani-Ptolemais-Florina basin

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In order to measure the divergence between semi natural ecosystems and spoil ecosystems in the basin studied, different sites were sampled. These include recent spoil deposits (< 1year) deposits, 1-3 years old, deposits 4-8 years old, deposits older than 8 years, and semi natural vegetation.

Parameters studied were: Plant species composition, functional form diversity in each vegetation floor, similarity index concerning angiosperms, soil respiration, soil organic matter content and microbial biomass.

As expected the vegetation layer showed highly divergent results (work still continues)

Soil parameters gave more comparable results, with spoil sites giving higher values.

This is attributed to the carbon enrichment of the spoil sites and the poor quality of natural vegetation sites being developed over Pliocene strata and the alluvial existing elsewhere.

075 Ecological interactions between plant and soil characteristics: Implications for the design of new restoration strategies at the roadside

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Roadsides are commonly difficult to restore because they are often drastically disturbed (all topsoil and biological activity removed), creating multiple plant growth limiting conditions. Soil conditions such as

nutrient content, texture and water content are requirements for the establishments of plants. At the same time, plant traits also impact these characteristics of soil resources. Therefore, combining the frameworks that use traits to predict plant effects on, and plant responses to soil conditions, a successional approach to restoration can be designed to improve the success of restoration efforts. According with this, we designed an experimental set-up on two highways (M-12 and M-13) in Madrid. We considered two types of roadslopes: roadcuts, constructed by excavation, and embankments, by heaping and compacting materials. We selected 9 roadcuts and 6 embankments for the soil and cover sampling using 18 quadrat plots (50 x 50 cm) per roadslope, according to a regular design. All the soil samples were analyzed for pH, soil conductivity, nitrate, soil texture, nitrogen and organic matter, and the vegetation cover was estimated during the spring. We found interactions between the soil conditions and the vegetation cover.

076 Long-term monitoring of sandy dry grassland in a post-mining landscape

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The ecological restoration of highly disturbed ecosystems, such as surface-mined land, presents great opportunities to explore the basic processes that promote and maintain target communities. Knowledge of the mechanisms, rates and pathways of primary succession is crucial for understanding the response of the vegetation to disturbance and to design strategies for ecosystem management.

We will make use of a dataset that results from monitoring the succession of dry grasslands in a post-mining landscape in East Germany. The data have been compiled over more than a decade.

The vegetation consists of various plant communities with varying proportion in time: bare soil, pioneer stages with *Corynephorus canescens*, patches characterized by *Helichrysum arenarium*, successional stages with short lived legumes or *Artemisia campestris* as well as patches dominated by *Calama-grostis epigejos* or by shrubs and trees.

Using a broad range of statistical methods (basic spatial statistics, regression models, Markov models) we evaluated spatial and temporal patterns during succession and its relation to environmental conditions. The results are discussed in terms of whether vegetation shows fluctuations or clear directional trends, convergence or divergence with time as well as the rate of successional change and its implications for the restoration of vegetation structure.

We conclude that even sites with low pH and low nutrient content, such as our study area, can regenerate spontaneously providing habitat conditions for valuable pioneer communities over decades. The development of these sites should not be unnecessarily accelerated by the application of traditional recultivation methods, e.g. the amelioration of nutrient-poor substrates.

077 Effects of different soil tillages and reseeds on soil characteristics and runoff in potential rangelands of Elazığ Province

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The Study was carried out in the years of 1997 and 2001 as a research project in Southeastern Anatolia Forestry Research Institute and completed in 2002.

Aim of the research is to determine the effect of different soil tillage types and reseeds on soil erosion and forage yield. Experimentation applied as split plot experimental design. 3 repetition x 5 various soil tillages (control + 4 tillages) x 2 reseeds (control + reseeding) treatments were used in this study.

The highest forage yield was measured in moldboard and deep soil tillage parcels. But the highest soil loss was determined in the same parcels. To determine the relationships between soil loss and some soil erosion sensitivity indexes; Dispersion Ratio, Colloid Moisture Equivalent and Erosion Ratio were compared. The best result was achieved from the Erosion Ratio Index.

078 Perspectives for rehabilitation of landfills covers

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In Flanders, some landfills are located within the Natura 2000 network. Setting appropriate goals and management actions are necessary in order to achieve sustainable habitat rehabilitation. Landfill technology has evolved over the last decade towards a full packing of wastes including a top cover that prevents water

intrusion. Until recently, mixed forest had been set out as goal vegetation on the landfills. New legislation regarding landfill management opened possibilities for the development of heath vegetation.

Despite their artificial character, these former landfills possess potentials for Nature 2000 habitats. Soil variables, texture, pH, and nutrients determine vegetation development. Hence, the substrate type and management will determine the success of restoring site-specific habitats.

Based on soil variables and plant communities present, the potential zones for restoration of dry heath and species rich *Nardus* grasslands were assigned. A landscape perspective was developed in order to optimize habitat for Nightjar (*Caprimulgus europaeus*) and Wood lark (*Lullula arborea*). Attention has been paid to Natterjack Toad (*Bufo calamita*) as well.

079 Revegetation on two tailings in quarries through hydroseeding: effects of seed priming, sowing rate and liming

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Restoration of industrial sites and degraded landscape is a major conservation focus and implies stand establishment of vegetation. Two trials were performed in quarry tailings where spontaneous colonization by vegetation is low, at Antoing (high pH and poor nutrient content) and at Seilles (acidic pH, poor nutrient content and high Ni and Zn concentrations). Revegetation was performed through hydroseeding with a mix of grass and legume species (*Agrostis tenuis*, *Festuca ovina*, *Festuca rubra*, *Lolium perenne*, *Poa pratensis* and *Trifolium repens*). Factors such as liming, sowing rate and seed priming were tested and vegetation cover was evaluated with double-meters system and Ccover© image discrimination software.

Six months after hydroseeding, 60% and 40% of vegetation cover were observed in Antoing and Seilles, respectively. Liming significantly improved revegetation in Seilles. For both sites, vegetation cover obtained with 250 kg/ha seed was higher than with 150 kg/ha after one month but there were no difference anymore after six months. Vegetation analysis 2 years after hydroseeding in Antoing showed increased proportion in *Festuca*, *Trifolium* and *Poa pratensis*, reduced proportion in *Lolium perenne* and presence of species not initially present on the site (*Dactylis glomerata*, *Lotus corniculatus*, *Medicago lupulina*, *Origanum vulgare*, *Buddleia davidii*). Seed priming showed little effect in Antoing but highly positive effect in Seilles and was analyzed in laboratory through flow cytometry and proteomic approaches. It is concluded that long-term efficiency of primed seeds hydroseeding for revegetation purposes is a direct function of soil properties and should therefore be recommended for specific sites.

080 Life Stropersbos: Habitat restoration of alluvial forests and heath in the "Stropers" area

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The "Stropers" area is part of the habitat directive area "Woods and heaths of sandy Flanders: eastern part". The main designated habitat types are mesotrophic alder swamp forest (a subtype of priority habitat type 91E0*) and European dry heaths (4030).

The main objectives of the proposed actions within the habitat directive area are the protection, the recovery and the development of these habitat types and their related species and the increase of biodiversity in general. As a result of the large diversity of physical and biotic environments, the "Stropers" area presents many possibilities for the recovery and development of all these habitat types.

The proposed hydrological actions will result in adequate groundwater levels and increased groundwater upflow for the expansion of mesotrophic alder swamp forest (91E0*). Forest management actions will result in the recovery and development of heath habitats such as European dry heath (4030), Northern Atlantic wet heaths with *Erica tetralix* (4010), and other related habitats and the increase of old acidophilous oak woods with *Quercus robur*. The increase of forest edges and forest structure diversity will boost insect life and increase the bat population. The formation of grazing units will create a "wastine" or wasteland landscape and the adapted recreation infrastructure will protect sensitive habitats and preserve nature recreation possibilities.

The proposed actions are all part of the LIFE project "Stropersbos", which runs from August 2006 till December 2009.

081 Forest reserve as a model area for future climate forest restoration – A case study

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KlimaFa Ltd., an eco-restoration firm, aims to carry out afforestation projects in abandoned fields and degraded grasslands. These forests are planned to be „climate forests”, with native tree species serving only as carbon sequestration, not as productive forests. The Institute of Ecology and Botany estimates the carbon sequestration for these forests, applying the CO2FIX 3.1 model.

The CO2FIX model was originally developed for use in managed forests. We adapted and parameterised it for near-natural, uneven-aged, mixed forests. On behalf of this adaptation we made a retrospective case study of the Várhegy Forest reserve (Bükk mts, North Hungary), which is a typical Hungarian sessile oak – turkey oak forest (see Mázsza et al, in this conference abstract). Through forest inventory data (from 1880 to 2006) and a detailed survey in 2005, we followed the history and the carbon sequestration of the Várhegy forest with the CO2FIX model. We ran several scenarios to show the difference between the planned forest and what has been realized. We intend to develop a monitoring proposal which is very important to actualize the model for the ongoing processes.

Our calculations will aid in planning to restore near-natural forests and estimating their carbon sequestration.

082 Effects of invasive species on forest restoration in South-East Brazil

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Despite the fact that tropical forests are recognized as one of the biggest biodiversity containers in the world, they have been destroyed in a very alarming way mainly in the regions where the cutting down of native vegetation along with its burning up is a common practice. This research aimed to investigate the effect of invasive species on natural regeneration and on development of some native species in order to subsidize a future forest restoration. During two years the growth and the frost damage of ten reintroduced native species were checked in the area. The richness and abundance of natural regeneration were also evaluated. The first results show that, independently of invasive species, *Gochnatia polymorpha* had a bigger growth and was not affected by the frost. Even if invasive plants have decreased the growth of all reintroduced species, they can be an interesting option to cover the soil and avoid erosion in restoration projects with low budget.

083 Restoration of the riparian forest of Nestos river

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The results of a Life Nature project are presented that aimed at the re-establishment of the native riparian forest vegetation in a part of the protected Nestos Delta, North-eastern Greece. The project was implemented in 2002-2006 by the Forestry Service of Kavala in collaboration with two environmental NGOs and other partners. After a detailed planning study a selected combination of autochthonous hydrophilic species of bushes and trees were planted in an area of 60 ha between the river and its embankments on both sides. During a 2 years monitoring period after the plantation (November 2004 till September 2006) the plots showed very good growth of the various species-clusters. The height of most softwood trees (*Salix* sp., *Populus alba*, *Alnus glutinosa*) and hardwoods (*Ulmus minor*, *Quercus pedunculiflora*) had been doubled. Only the growth figures of *Fraxinus angustifolia* remained low because of the negative impact from wild boar which preferred to feed on the bark of this particular species. Generally the reforestation appeared to be very successful at a percentage that exceeds 85%, thus restoring vital riparian forest habitats.

084 Spontaneous succession in abandoned fields in a landscape scale: repeated sampling after three decades

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Vegetation analyses were repeated in abandoned fields representing now 100-year chronosequence in the Protected Landscape Area of the Bohemian Karst in the Czech Republic. Altogether 58 abandoned fields were sampled in the seventies and sampling was repeated in 2008. The following main results were found: Vegetation succession somewhat differed regarding especially site moisture. But generally, vegetation converged towards shrubby stages which nowadays exhibit no or slow successional change. The participation of woody species was negatively correlated with the site moisture and with the size of fields. In the driest sites, nearly-natural steppe-woodland developed being valuable from the nature conservancy point of view. The dense shrubby stands, developed in mesic sites, represent valuable buffer zones around protected areas and provide habitats for birds and other animals. Spontaneous succession appeared in this case as the best way of restoration in former arable land.

085 The dendroclimatology of *Pinus pinea* L. on mid-Thyrrhenian coasts

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The aim of this study was to investigate the relationship between radial growth and climate of umbrella pine (*Pinus pinea* L.). *Pinus pinea* L. is a mediterranean tree characterized by the "umbrella" crown. It is considered a xerotolerant species. In Italy, the umbrella pine is distributed mainly on the coasts of the Tyrrhenian Sea. The area of study concerned six different sites in Tuscany and Latium, from 41.30° to 43.72° N and from 10.31° to 13.03° E. All sites were situated near the coast, at sea level, and have a Mediterranean climate. Dendrochronological and dendroclimatic analysis have followed standard methods. Trees have been cored at breast height (about 1.3m from the ground) using increment borers. Through the software COFECHA the singles series dating were statistically checked. Standardized site chronology was built for comparison with climatological data, through the software ARSTAN. Climate data has been described by monthly total precipitation, monthly mean maximum temperature and monthly mean minimum temperature. Correlation functions, used to obtain quantitative information about the relationship between radial growth and climate, were calculated with the software DENDROCLIM2002. PCA analysis was performed (SYSTAT) to describe common modes of growth variability. PC1 score chronology was used to calculate correlation functions to describe climatic signal common to these sites.

These analyses were useful for identifying the main climatic signal limiting the *Pinus pinea* growth along the Tyrrhenian coasts and with particular attention to the difference among the study sites in relation to the latitudinal gradient.

086 Relationship between plant traits and resistance to burial by marly sediment

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In marly lands of the French Southern Alps, harsh soil erosion results in sediment movements during intensive rainfall events. Plants can be submitted to sediment burial in their early stages of development and their protective function may be reduced. In a context of land restoration, it is important to know species resistance to environmental disturbances and to be able to predict it, in particular from plant traits (height, biomass, sugar and starch accumulation). However, few studies about woody species tolerance to burial by sediment have been carried out. Seedlings of five woody species were buried in marly sediment at three different depths in pot experiment during eight weeks: no burial (control), partial burial (50% stem height) and complete burial (100% stem height). Height through time, biomass and survival rates were measured to assess species resistance to burial. Results show that among the five species, only one (*Acer campestre*) survived complete burial. All plants survived partial burial, but there were significant differences in height and biomass between buried plants and control, and significant differences between species responses. Three different responses to disturbance were identified: negative (*Hippophae rhamnoides*, *Ononis fruticosa*), neutral (*Robinia pseudo acacia*, *Pinus nigra*) and positive (*Acer campestre*). Results finally suggest that species resistance to burial by marly sediment is related to sugar accumulation in plant stems.

087 Independent monitoring of the implementation of the Expanded Work Programme on forest biodiversity of the Convention on Biological Diversity (CBD POW), 2002-2007, in the Netherlands

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The Netherlands in Europe is a densely populated country with 400 inhabitants per km². Forest cover (using the FAO's definition, which includes plantations) is 360,000 ha, or 10.6% of the country. However, most of it consists of plantations of exotic species. Only 100,000 ha are mixed broadleaved forests. Of these, only 3,000 ha are strictly protected Forest Reserves not to be used for economic purposes. While forest management is very professional and two fifths of the Dutch forests are certified, the Netherlands have lost virtually all their natural forest and forest cover is barely increasing. Whereas the government claims that the implementation of the CBD/POW in the Netherlands does not require any additional policy measures "as the Netherlands already complies with the CBD", the Natuurbalans 2007 states that it is highly unlikely the Netherlands will comply with the commitment of the European Union to halt further biodiversity loss by 2010. Key forest species are still severely threatened. Plantations and secondary forests suffer from nitrate deposition, drought stress and habitat fragmentation. There is an active policy to encourage more mixed and broadleaved forests and to leave more dead wood in the forest, but the degree of human impact on the countryside is still significant, probably amongst the highest in the world. The Natuurbalans also states that establishment of the Dutch Ecological Network,

a cornerstone of national biodiversity conservation policy, according to the Dutch Government, suffers serious delays; and that it might be not be finalized until 2025 or even later. The slow rate of restoration of natural forest is caused by lack of political will, a strong agricultural lobby, and the fact that every square kilometre in the Netherlands is inhabited and mainly privately owned. Water is intensively managed and forests are interrupted by roads and infrastructure. So, restoration is not simply a matter of setting aside an area of wilderness. Three additional cases came up where the Kingdom of the Netherlands ignored CBD requirements:

- One concerns the rules relating to emissions of ammonia around sensitive natural areas. The Netherlands decided to apply a minimal buffer zone, despite the serious negative impacts on forests.
- Another concerns the deforestation of a forested area near a military airfield, where the Netherlands acted against the will of the local population.

It is recommended that the Netherlands should restore its three natural forest types: peat forest, mixed oak forest on sandy soils, and forests alongside rivers. Interconnectivity of the fragmented natural remnants is important. Most of the forest flagship species are extinct. New large wildernesses are needed to provide habitat for these species.

088 The threat of cryptic habitat losses for birds in a traditional landscape in Central Greece

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The Balkan in general and Greece in particular host a varied ornithofauna, both migratory and resident species. The bird species richness matches a wide range of available biotopes, often small scaled in a complex landscape. Though the Greek landscape is shaped by human intervention at a millennial scale, recent years have accelerated landscape change with a loss of landscape elements, even in remote areas. We estimated changes in bird species composition in a characteristic highland agricultural area of 50 km² in Central Greece, which is undergoing major landscape changes. No decadal bird census series for diachronic correlation to landscape condition are available, so we resorted to spatial comparison as a proxy to temporal trends. The study was conducted over three post-migration spring seasons. Firstly, differences were detected in species composition between areas where land use had undergone changes (detected through retrospective remote sensing) and nearby 'control' areas which had remained unchanged over 40 years, thus establishing the possible linkage of bird species to landscape types. Secondly we determined through an ordination study which landscape features have the strongest explanatory potential for species composition. Thirdly, we studied bird occupancy of landscape types and their linkage to landscape attributes in randomly distributed observations. In a final survey we tried to establish through remote sensing to what degree landscape features had changed over more than 4 decades, in order to conjecture how bird populations may have been affected. Even at the small scale of the study area and the proximity of respective landscape types ornithofauna is spatially differentiated, with a net impoverishment in species richness in 'new' landscape types. Previously non-existing, planted forest types did not recruit the original tree-related fauna. Openness

of the landscape and the deciduous vs. evergreen character of the vegetation were the most important landscape features determining species composition. The observed landscape changes must have affected bird populations, in view of their relative faithfulness to particular landscape features, which are being lost over time. If considering bird species with a status of concern to the European Bird Directive (eight annex 1 listed species) we must conclude that this area, though not listed for NATURA2000, is undergoing cryptic but rapid losses in both landscape features and ornithofauna in spite of a general perception of its small-scaled, little affected nature.

089 Reintroduction & effects on their environment of indigenous plants of the Cerrado

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The Cerrado biome (22% of Brazil) is composed of various savannah ecosystems, and is one the most endangered biome of South America. Campos rupestres, one type of Cerrado, are grasslands with scattered small trees and shrubs, found on thin soils with rocky outcrops. The aim was to study the potential of 17 endemic species to regenerate in degraded areas. Plant survival and growth were measured and the influence of planted species was assessed on colonizing understory herbaceous communities. 4.5 years after transplantation, species survival is highly contrasted (e.g. *Lafoensia* 100%, *Actinocephalus* 10%). However, species, such as *Diplusodon hirsutos* and *Actinocephalus* allow other herbaceous species to colonize their understory, which is positive for community development. Although most of *Actinocephalus* individuals are dead 4.5 years after the beginning of the experiment, they actually survived well into the third year, which allowed them time to influence their environment and to produce seeds and a relatively abundant thatch. *Calliandra* and *Chamaecrista* both have a dense canopy and produce a great amount of litter. Although their survival is relatively high, they do not allow other species to colonize. Under *Collaea* and *Lavoisiera*, mosses and lichens colonize well while under three of the four tree species (*Kielmeyera*, *Zeyera* and *Eugenia*) bare ground dominates. To conclude, some species (e.g. *Diplusodon hirsutos*) are particularly indicated to be used in restoration projects. For some others (e.g. *Chamaecrista*), survival is high but plant spacing should be carefully planned so that they are not planted too densely.

090 Restoring of wooded meadows in Estonia: recovery of species diversity via natural processes

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Wooded meadows are the most species-rich habitats in the boreal Europe. In Estonia the area of wooded meadows is 8000 ha, but communities with distinctive structure are preserved only on 4800 ha. Stands without proper management need restoration before the traditional use can restart. Restoring of wooded meadows in Estonia started in 1990s. It comprises removal of invading shrub and trees and re-establishment of sustainable mowing. (Re)introduction of seeds or planting have not been applied, thus the recovery of species relates only to natural processes. We studied such recovery of species richness of herbaceous plants in restored stands. We also described the occupancy status of species in differently managed stands: mown, abandoned and restored wooded meadows.

Small-scale (0.25m²) species-richness did not recover by 10 yrs passing the restoration. In average the total species richness of the restored stands is still much lower than in managed stands, but the difference was statistically insignificant.

Our study revealed 37 management-dependant species. The species lost first due to abandonment are the low-growing herbs, with average height less than 40 cm, preferring infertile soils and dry habitats. One third out of the management dependant species have low occupancy in restored stands. These are light demanding species of infertile habitats.

Conservation managers and policy makers must notice the difference in recovery times of spatial structure, abiotic conditions and species composition. We identified mowing dependant species to be included when assessing habitat's recovery potential or restoration success.

091 Shared concerns across the boarder- practice in restoration and management of species rich semi-natural grasslands in Sweden and Norway

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Agricultural land use changes, followed by regrowth, are threats to biodiversity. In Scandinavia we still have a lot of nature to destroy before the governments will focus on restoration, but- some of us have started developing a practice for the future, combining restoration of valuable areas, management, education and information towards students, school children and the general public. The poster presents two projects owned by the municipalities, Böensaetre in southeastern Norway and EkoPark Strömstad in western Sweden, situated 80 km apart from each other in different environments, with Natura 2000 qualities. Böensaetre comprises two cottar places with species rich meadows and pastures, and volunteers have been mowing the most species rich meadows since 1990, and the University College and schools in the county use it for excursions covering different subjects. The EkoPark Strömstad consists of an information and education centre, a recycling centre, a sewage plant and two nature trails. Along one of the trails there are remnants of old meadows and pastures. From 2004 the nature trail was cleared and later maintained, and the meadow has been kept open by hay making with a mower.

We ask how the two projects mutually can benefit from each other and develop strategies for informing and engaging children and students in management and conservation, the public and the politicians in decision making and restoration/practical management. We plan to make a resource book for teachers and a guide for politicians and decision makers based on the experiences from the projects.

092 Conservation management activities in the breite wood pasture natural reserve (Sighisoara, Romania)

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The breite wood pasture is a natural reserve included in the sighisoara-tarnava-mare sci and spa sites, situated on a 500 m elevation plateau near sighisoara (transylvania). the scattered multi-secular oak trees originated from the thinning of the oak-hornbeam forest (91g0* pannonic woods with *quercus petraea* and *carpinus betulus*) that still surrounds the plateau and from plantings. the opening of the forest conducted to decreased evapotranspiration and permitted the development of 6510 lowland hay meadows (*alopecurus pratensis*, *sanguisorba officinalis*) on the low permeability clayey soil. besides its characteristic vegetation, the breite is also an important habitat for several species of community interest.

starting from the 1970s, 15 drainage ditches were dug on the plateau with the aim of transforming it into agricultural field, affecting especially the mesophilous meadows and amphibians. besides desiccation, natural hornbeam regeneration and the propagation of shrubs had also negative influence on the veteran oaks, oak saplings and several bird species (e.g. *anthus trivialis*). intensive grazing and uncontrolled tourism favored the spread of invasive species (e.g. *solidago canadensis*, *cirsium vulgare*) and of the nitrophilous *urtica dioica*.

in this study we present preliminary results on the management activities that were started in autumn 2007, when 11 major drainage ditches were enclosed and 14 hectares were cleared of hornbeam saplings. the average depth of the drainage ditches increased significantly compared to the previous years (from around 7 to around 18 cm) and four new breeding habitats became available (that were not suitable before 2008) for the reproduction of amphibians.

093 Restoration of former intensively used grasslands towards Arrhenatheretum meadow in Flanders: characteristics of the initial situation

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Semi-natural grasslands have become very rare in the Flanders (North Belgium). Due to intensification of agriculture, many of these vegetation types are replaced by intensive (high input) grasslands. They are also present, often frequently, within the Special Areas for Conservation. For those under nature management, restoration to Natura 2000 grassland habitat should be aimed at. In order to optimize restoration policy and conservation practice, more information about the evolution of these vegetations is necessary. Therefore

we launched a grassland monitoring scheme in 2003. To record vegetation changes permanent quadrates (period 2003-2005) were set up in several grasslands. Here we focus on a subset of quadrates where the main conservation priority is the development of Arrhenatheretum grassland, habitat type 6510 'Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)'. The grasslands in the subset are managed by cutting and/or grazing and occur on various soil conditions. Floristic diversity was determined by estimating the coverage of the plant species in each quadrate. Abiotic variables as plant tissue nutrient content, soil nutrient availability and dry matter production were measured. The relation between plant species diversity and biomass production is examined. With an average of 18 species/ 9m², most grasslands are not that species rich. The above ground production varies between 4-6 ton/ha. This value indicates that high species density can occur but in this study it is only the case in a few grasslands (n = 3). The meadows with highest species diversity have the lowest above ground production and have been restored from former fields, while the grasslands with a higher dry matter production originated from intensively used grasslands. In this subset of examined grasslands, development towards Arrhenatheretum vegetation seems to go easier from former field.

094 On the importance of adequate restoration reference: the example of Pannonic rocky grasslands

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The use of reference is fundamental to monitor and evaluate the success of restoration interventions. As global changes influence ecosystem composition, reference targets also change in time. Therefore the use of historical data provides deeper insights into long-term trends of ecosystem changes and helps determine realistic restoration goals. Large European data sets gathered from the early 20th century on may be used for assessing changes in the natural state of vegetation in searching for restoration potentials.

Pannonic rocky grasslands under the "Rupicolous pannonic grasslands" habitat are among the most important Natura 2000 habitats because of their unique species composition and high frequency of species listed on the Annex II of the Habitat Directive. The aim of our study was to detect long-term plant composition changes of these associations. Phytosociological relevés sampled between 1931 and 1961 served as historical reference to re-sampling between 1991-94. Historical and recent states were compared using Annex II priority species occurrences and social behaviour characteristic of species.

We detected a decrease in priority species' frequencies. Specialist species richness decreased significantly, while natural pioneers, disturbance tolerant and weedy species increased their number. Our results showed a slight but general degradation of Pannonic rocky grasslands. Degradation was caused presumably by partly prevailing driving pressures that may constrain future prospects of restoration trials (e.g. clear-cutting of *Pinus nigra* plantations at such sites).

095 Restoration of species-rich pastures on former arable land by spontaneous colonization and hay transfer

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In the seventies of the last century most of the grasslands in the „Wulfener Bruch“ (Saxony-Anhalt) were meliorated, ploughed and used for intensive cropping. Since 1996 local NGO's have been successful in recovering a biotope-network of species-rich grasslands. Former arable land was bought and immediately grazed by large herbivores (aurochs and Przewalski-horses) without additional feeding. Most of the sites were left for spontaneous succession. In parts of the area vegetation development was accelerated by hay transfer from adjacent species-rich grasslands as well as by sowing of commercial seed mixtures. It is most difficult to restore the original groundwater table, so that up to now only in parts of the former swamp area a suitable water regime is established. Scientific evaluation of the project progress revealed the following results: (1) on former arable land immediate grazing with large herbivores without additional feeding is possible and leads to the successive development of typical grassland communities with low nutrient status and also an successful discharge of phosphorus, (2) seeding of commercial seed mixtures impeded the colonization of native grassland species, (3) integration of old pastures into the grazing system enhanced colonization of native grassland species, (4) transfer of species-rich hay accelerates the colonization rate of grassland species, and (5) best results were obtained on wet sites with more suitable groundwater table. We conclude that grazing with large herbivores proofed to be successful in conversion of former arable land into species-rich grasslands, but rising of the groundwater table is most crucial for the successful development of species-rich grasslands in swamp areas.

096 Degraded sites in the Low Tatras National Park

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In the year 2004 was performed survey of sites influenced by folding of grassland, in locations Pod Keckou (1100 m) and Leniva (1400 m). Low soil fertility and low soil stability at folding site was affirmed. Soil conditions after end of folding vary, but at non folding site after notable withdrawal of potassium is presence of ruderal species still very high. Participation of synantropic species in stand with finished folding is comparatively high. Relation between ruderal species and form of maintenance, naked places and excessive nutrient content. Sites rank with weeds negatively affect adjoining areas by decreasing of species diversity, suppression of species restraining soil erosion, by degradation of feed value of stands and aesthetic value of the habitat. In term of its own being ruderal associations are rather stabil, but on the other side, in wider extensional and functional context of the ecosystem, they cause the unstability.

097 Short-term effects of herbicide treatment on the vegetation of semiarid sandy oldfields invaded by *Asclepias syriaca* L.

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In Hungary, large abandoned agricultural areas have been invaded by the non-indigenous common milkweed (*Asclepias syriaca* L.). This species hinders the regeneration of sandy oldfields to open sand grassland (Pannonic sand steppes - Annex I 6260 habitat type). Glyphosate application is a cost-effective control method that helps avoid soil surface disturbance and subsequent germination of milkweed seeds in the soil. However, it affects non-target plant species negatively, as well.

In our study we tried to explore the effects of the treatment on the non-target vegetation. Glyphosate spraying was applied to three oldfields (Kiskunság National Park) to control vigorous stands of *A. syriaca* in July 2006. In June 2006 and 2007, shoot number of *A. syriaca* and percentage cover of plant species were estimated in 1 m² permanent plots.

Elimination of common milkweed was successful in the short term. Multivariate analysis showed a general shift of species composition following herbicide spraying. The share of summer annual herbs and grasses increased significantly, while perennial grasses and herbs decreased in cover. A significant decrease in the average cover of sand grassland specialist species were detected, while weedy species increased in their abundance. The revealed changes showed that it is an effective way to control common milkweed in the short term. However, it disturbs the underlying vegetation so that it relapses back into an earlier successional stage rich in annual species in the case of the open patch types, while helps to proceed succession when the vegetation has been closed by clonal grasses.

098 Seed production in fens, fen meadows and degraded meadows – the relevance for meadow restoration

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We investigated the seed production in several plant communities and compared their seed output. We examined the relationship between the vegetation composition and the composition of the seed output. We discuss the results in relation to fen meadow restoration.

We found that the seed production of the studied communities is large, variable and in general increasing with disturbance intensity. The estimated mean seed production was c. 40 000 seeds m⁻² in fens, 160 000 in fen meadows and 500 000 seeds m⁻² in degraded meadows. The majority of seeds was produced by just a few species. The similarity between the vegetation composition and the seed production profile was low and did not increase with disturbance intensity.

We found that an increased disturbance enhances seed production at the community level. The composition

of the vegetation is a poor predictor of the seed output. We estimate that the number of seeds transferred with hay is much lower than the seed production in fens and fen meadows.

099 Habitat modifications by Scotch broom invasion of montane grassland ecosystem of Western Ghats in India

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Although the effect of habitat modification on a single species has been described, we describe the effects of invasion of Scotch broom (*Cytisus scoparius* (L) Link.) on the high elevation grassland ecosystem of the Nilgiri hills of India. Native grasses are adapted to low soil nitrogen, as indicated by non-flowering of dominant grasses except when induced by fire or fertilizers. The nitrogen-fixing invader has overwhelmed the grassland and exhibits unique characteristics, including year round flowering and seed dispersal by herbivores. Pellet count data suggests Sambar Cervus unicolor prefer browsing Scotch broom over native vegetation and exotic plantations of wattle (*Acacia* spp.) and pine (*Pinus* spp.). Scotch broom has changed food preferences of Sambar. Pellet analysis suggests sambar acts as a seed vector for at least 1 km from the invading front. Data collected using line transect method indicates greater overall bird richness ($R = 4.36$ and diversity ($H = 2.6$ in invaded patches as against 3.86 and 2.4 respectively for grassland. However, the invasions threaten the endemic, threatened and grassland specialist bird Nilgiri Pipit *Anthus nilghiriensis*, which recorded a density of 36 individuals/km² in the invaded areas as against 163 individuals/km² in grassland. Experiments to determine the effectiveness of control methods (uprooting, cutting at ground level and herbicides) have been initiated. Several life cycle differences between Scotch broom in India and elsewhere, and probable mechanisms of its success are discussed.

100 Restoration of freshwater tidal areas in the Slidrechtse Biesbosch (the Netherlands)

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The delta of the rivers Rhine and Meuse is one of the largest freshwater tidal areas in Europe, but due to land reclamation, dams and other infrastructural works the total area has been reduced. The Slidrechtse Biesbosch (SB) has the highest tidal amplitude (0,6 m) of the Biesbosch. Two farmland polders in the SB offered the opportunity to realise 300 hectares freshwater tidal area in combination with clay winning.

Attention has been paid to conserve morphological and historical values as well as to realise the optimum situation for new freshwater tidal areas. In the eastern polder clay winning was more intensive due to a higher ground level, but in the western polder clay winning has been restricted to the new tidal channels.

After the clay winning the manipulation of the water level was important to control the germination of willows. This was effective in the western polder.

There were several solutions for connecting the polders to the tidal waters. The connexion chosen minimised effects on botanical values in surrounding areas en maximised the tidal amplitude in the polders. The polluted sediments in the tidal waters have to be removed before connecting the polders, reducing the existing tidal flats.

In the meantime in the polders new botanical and ornithological values developed. These values will partly disappear. The realisation of new freshwater tidal areas will cause some losses of existing values but the new tidal areas in the polders will compensate this.

101 Ecological restoration in the Belgian part of the North Sea

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Goods and services provided by marine ecosystems are based on natural processes. Ecological restoration is limited to reducing existing human pressure. 'Pressure reduction' will be an important factor in the 'ecosystems approach' in the European seas. Within the Natura2000-network, different habitat-types have been described that deserve protection. Current presentation provides insights in how habitat-types are described in the EU habitats directive and discusses this for the Belgian Part of the North Sea (BPNS) from

an ecological point of view. Annex I Habitat-type 1110 ('sandbanks which are slightly covered by sea water all the time') is of importance for the BPNS. The interpretation manual provides a broad definition that does not allow defining a 'healthy sandbank system' but indicates that association with several other habitats is possible. Habitat-type 1170 ('reefs') is one of the habitat-types that might occur in the shallow sandbank system of the BPNS. Although biogenic reefs have largely disappeared, reefs build up by tube building polychaetes still exist in the BPNS. Current presentation shows that dense aggregations of *Lanice conchilega* classify as reefs. We therefore advocate to classify the SAC as a sandbank habitat-type (1110), associated with the reef habitat-type (1170). This would also allow for better criteria for the ecological restoration in the area as the reefs represent a higher biological value. Moreover, the impact of fisheries on these systems has been quantified. We speak out for a fishing ban in SACs. This might however lead to difficulties both on political and social level.

102 Habitat restoration by dredging: fact or fiction?

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Preservation of the multi-channel system is one of the main objectives in the Long Term Vision Strategy of the Scheldt estuary. Natural morphological evolutions combined with continuous human interferences may jeopardise this objective.

One of the continuous human activities is the dredging of the navigation channel, to keep the Port of Antwerp accessible. In 2008 the river will also undergo widening and deepening at specific locations along the navigational channel to enable larger ships to reach the port.

In 2002 experts proposed the idea of morphological dredging. The aim was to steer the estuarine morphology by dredging operations, make the estuary ecologically healthier and possibly reduce the quantity of material to be dredged. This strategy is being evaluated in the Walsoorden pilot project.

After a desk study and the use of numerical models, different in situ disposal tests were executed and morphologically and ecologically monitored. So far the morphological monitoring was successful and the ecological monitoring revealed no negative changes. Unfortunately until now no "new ecological valuable areas" were created.

An additional study will map the subtidal habitats at the Walsoorden sandbar, useful for dredging activities. Furthermore, an optimal monitoring and working method for mapping the ecological quality of subtidal zones will be advised.

Further research is necessary on how to embed and optimise this strategy in the future dredging activities, to investigate the possible use of the strategy on other locations and the possibilities for habitat restoration by means of dredging activities.

103 Restoring the functions of the habitat of shifting dunes in a pilot site of the Northern Adriatic coast (Italy)

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In the area of the SCI/SPZ IT4070009 "Ortazzo, Ortazzino, Foce del Torrente Bevano", located in the Northern Adriatic coast (Emilia-Romagna, Italy), a restoration of the habitat 2120 "Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)" was performed. The intervention aimed to restore the main environmental functions of this habitat (sand capture, sediment accumulation and stabilisation). *Ammophila arenaria*, because of its particular structure and morphology, strongly contributes to the accomplishment of these functions: so it was chosen as a key species for the intervention.

Shoots and rhizomes of natural *Ammophila arenaria* populations were collected in 2006 early spring. The plant material was vegetatively propagated and the new individuals obtained were cultivated in nursery during the late spring, summer and the start of autumn 2006. At the end of October 2006, 1500 vigorous shoots of *Ammophila arenaria* along a strip of 300 m x 2 m were planted. Any loss of the *Ammophila arenaria* shoots was scored in the following months. During the 2007 vegetative season a significant increase in number of shoots as well as in height and diameter of tufts occurred; plant cover passed from 3-5% to 20-25% of the total vegetated surface. One year after implantation, clear sand accumulation micro-morphologies appeared in the intervention site, indicating that the main geomorphological functions of the habitat were restored. Other interventions are now in progress in order to improve the plant biodiversity of the reconstructed habitat. The paper will describe the intervention and its results.

104 Nature restoration in Belgian coastal dunes, a state of the art

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As in many European countries, the Belgian coastal zone has been subject to drastic changes, in particular during the past 150 years. Main elements in this process are urbanisation and a general shift in land use. About half of the dune area was lost and remaining dune sites changed significantly. Main trends are fixation of mobile dunes and encroachment of tall grasses, shrubs and trees.

Nature conservation actions focus on restoration of mobile dune, dune grassland (HD priority habitat) and slack vegetation. Pond creation and restoration also receive special attention. Prior to 1996, management focused mainly on important relict populations. A major impulse for large scale actions in the field were the Life nature projects 'ICCI' (1997-2001), 'FEYDRA' (2002-2005) and 'ZENO' (started 2007). The main results are discussed.

1) Scrub and forest clearing (30 and 10 ha respectively) was carried out on several sites and more is planned. Clearing is often essential for restoration success and is generally very effective. Spectacular effects of seed bank recovery were observed.

2) Botanically vulnerable sites are mown. Grazing is used in most sites as maintenance management and is evaluated positively with zoochory as a specific benefit. A negative effect is trampling, mainly of moss dune and pond banks.

3) Several ponds were newly created (67) or restored (38), offering a habitat for a.o. the Habitat Directive annex II species *Triturus cristatus*.

4) Restoration of dune mobility is complex and difficult, but is one of the main challenges for future coastal dune conservation.

105 Fire as a possibility of restoration of the NATURA 2000 Habitats

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On the Lithuanian seacoast, the Curonian Spit is the site of Community importance (LTNER0005). Since December 2000 the Curonian Spit has been included into UNESCO World Heritage List as a valuable cultural landscape.

After the II World War, the fires in the Curonian Spit had local character. The fire on May 4, 2006 was called a "century fire". 235,66 ha of forest have burned away.

Vegetation structure before the fire. The largest area of the burnt territory was occupied by *Pinus mugo* communities. In this territory *P. mugo* was planted to stabilize shifting sands. Recently *P. mugo* stands have already served their purpose. These forests were monodominant, superannuated. The herb layer was thin. Only *Deschampsia flexuosa*, *Melampyrum nemorosum*, *Carex arenaria*, *Corynephorus canescens* grew rarely. Bryophyte layer was comprised of *Pseudoscleropodium purum*.

Post-fire dunes system vegetation management ideas. The accidental fire of 2006 made a possibility to reveal a peculiar relief and recover the NATURA 2000 habitats. Three zones of management were marked out in the burnt territory:

i) zone of open sand areas. It is planned to transform the territory into open landscape with sand vegetation. The management of the following habitats will be carried out: Embryonic shifting dunes (2110); Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) (2120); Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130*); Dry sand heaths with *Calluna* and *Empetrum nigrum* (2320); Decalcified fixed dunes with *Empetrum nigrum* (2140*); Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*) (2170).

ii) natural post-fire succession zone. The burnt *P. mugo* strands remain for natural degradation.

iii) *Pinus sylvestris* forest recovering zone. New, *P. sylvestris* trees have recently been planted. They enlarge the stands of Scotch pine on the southern area of Smiltynė; and make the open, half-open and closed sceneries characteristic of the Spit more impressive.

106 Implementation of flood control areas in the metal contaminated Schelde estuary

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High trace metal concentrations in surface water, suspended matter and river sediments are reported world wide. Although West European water quality is improving gradually, historically polluted sediments may still

pose an environmental risk. Because the nutrient load decreases surface water oxygen levels become higher. The oxygen water concentration can influence soil chemistry and hence metal bioavailability. PVC cores filled with polluted sediments from the Zenne (Belgium) were placed in a climate room. Cores were flooded with water with a 0, low or high aeration treatment. The experiment was followed up for 1 year. The acid volatile sulphide (AVS) concentration was higher in the "0 aeration" treatment (1139 mg kg⁻¹ dry weight) compared to the "low" (56 mg kg⁻¹ dry weight) en "high" (19 mg kg⁻¹ dry weight) aeration treatment. Simultaneously extracted metals (SEM), total and dissolved surface water metals and top soil pore water metal concentrations are increasing with increasing water aeration. This experiment indicates that surface water aeration has a major influence on AVS concentrations in the sediment. AVS is one of the most important sinks for toxic trace metals. Reoxygenation of river water due to amelioration of the water quality can result in AVS dissolve. Historically deposited heavy metals may become more available to macroinvertebrates and may enrich river surface water.

107 The 'perfect' grazing management: how to choose the best suited herbivore?

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Grazing is a commonly used management technique to stop the expansion of invasive species, to enlarge species richness, and/or to create spatial heterogeneity, in order to accomplish an effective and efficient grazing management both the herbivore's needs as well as the manager's needs have to be defined. Several ungulate species are commonly used in nature management (e.g. different breeds of cattle, horses, sheep, donkeys and goat). Several intra- and interspecific dissimilarities in animal morphology and physiology (e.g. gastro-intestinal system, breed hardiness) appear, and important differences in animal nutritional requirements (crude protein, energy, phytomass, water) and habitat selection are found. Therefore not all herbivore species will be equally suited to fulfil management needs.

Because of the considerable variation in biological (e.g. floristic composition), physical (e.g. scrub density, forage yield, water availability) and chemical characteristics (forage quality), not all terrains are equally fit for all herbivores. This reveals the necessity to determine the carrying capacity of the system. Therefore a grazing capacity model (GCM) is being developed. This dynamic model considers crucial variables on both the terrain and the grazer level, such as forage yield, forage quality, palatability of plant species, accessibility of the area, soil erosion vulnerability, animal nutritive requirements, animal behaviour and general habitat health. It predicts the optimal grazer species and density, taking the seasonal variation into account.

In this presentation the outline of the model will be presented together with the results of two case studies in coastal and estuarine Natura 2000 habitats in Flanders (Nature Reserves Westhoek and IJzermonding).

108 The Presidio - 10 years of restoration lessons

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Presidio Trust, USA

The Presidio is a 1500 acre "island" of biodiversity at the edge of the Golden Gate in San Francisco. 14 native plant communities with 15 rare plant species constitute some of the last San Francisco natives in the city. The poster will also review four of the key restoration projects over the last decade in the Presidio with before and after photos and descriptions of techniques. It will focus on three broad habitat types: coastal dunes/dune scrub, serpentine grassland, and riparian vegetation, and identify both successes and failures. The Presidio uses an adaptive management strategy to guide restoration work over the short term at a single site and over the medium term between sites. Planting strategies, public use and perception of restoration, and invasive plant control strategies will be noted. Some of the projects we will discuss are former remediation sites with their own unique sets of constraints and opportunities.

110 Restoration of open pit coal mining deposits – case study from Kolubara lignite basin (Serbia)

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The paper presents the case-study of successful biological recultivation, landscaping, restoration and revitalization of the huge areas of destroyed or degraded landscapes and ecosystems in Kolubara coal basin (Serbia). The lignite deposits interesting for exploitation in this Basin occupy the area of more than 500 km². The rehabilitated area consists of forests – about 75% and agricultural crops – about 25%. Such initial ratios of different ecosystems are justified if we consider the fact that forest ecosystems are of the highest significance for environmental protection and maintenance. A more significant percentage of agricultural ecosystems are planned with the further process of coal exploitation and biological rehabilitation.

The first afforestation of minespoil banks was performed in 1957 by planting predominantly black locusts, but the first project of biological rehabilitation by afforestation based on the previous ecological, phytocoenological and pedological researches of deposol, performed in 1977 (Institute of Forestry, Belgrade). Till 1997, the rehabilitated area was 1,306 hectares.

A relatively high number of species is applied in the afforestation of stock piles not only because of the high variability of the micro-ecological conditions over a small area conditioned by the non-selective deposition of waste, but also due to the tendency to enrich the landscape of the created forest ecosystems whose valorisation should be directed towards the post-exploitation land use as a leisure and recreation zone.

Despite the great difficulties caused by non-selective deposition of overburden and by the absence of previous technical rehabilitation and planned shaping of the spaces in some areas planned for forest-biological rehabilitation, excellent results of successful afforestation and the dynamics of development of different broadleaf and coniferous tree species have been achieved.

Extraordinary anthropogenic forest ecosystems have been created, rich in colours, poly-functional values, enriched by aquatic and meadow-grass ecosystems, which make an excellent base for further spontaneous evolution of rich phyto- and zoo- biodiversity, multiply richer than that existing in the pre-mining period.

111 Ecological restoration of gypsum quarries in Southeast Spain

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Recent studies have highlighted the gypsum outcrops of Spain as the most outstanding for the conservation of gypsiferous flora. Open cast gypsum mining rehabilitation is made difficult because the original soil resource is not retained and local substitute materials, that is, soil-forming materials (SFMs), have to be used as growing media. One severe limitation of SFMs is their poor inherent structure and nutrient content, mainly derived from their low organic matter (OM) content. Concerning this case, the restoration strategy carried out in open cast gypsum on Southeast Spain was mainly based on subsuperficial organic amendment (Municipal solid waste compost) and topsoil replacement. A 5-year field study has been carried out in 2 landfill materials (gypsum fines and sterile material) to evaluate the effect of these materials on the evolution of soil chemical properties and to consider amendment addition. The influence of chemical and physical soil properties on plant community have been studied since rehabilitation success could be conditioned by landfill materials.

The results showed that there is a clear difference between the 2 landfills materials considered. Sterile material is characterized by a higher nutrient and carbonate content and more heterogeneous texture than gypsum fines. Therefore, landfill materials would benefit different life forms hence plant community is dominated by annual species in gypsum fines while shrubs are clearly dominant in sterile material. All this leads us to establish that amendment addition could be considered an efficient tool to enhance ecological restoration.

112 Soil biota in post mining sites bioindication of ecosystem restoration and role in pedogenesis

Frouz J.

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The role of plants in formation of post mining soil is generally accepted, much less is known about the role of soil biota in this process. The aim of this contribution is to bring overview about main factors that determine occurrence of soil biota in post mining soils and about the role of soil biota in soil forming process based on studies conducted in reclaimed and non reclaimed sites in two post mining areas in Czech Republic and Germany. Study is focussed on forest reclamation or naturally revegetated areas covered by woody species as forest reclamation is the most common reclamation practice in both areas.

Major constraints that determine colonization of post mining sites by soil fauna are migration distance, character of substrate, namely substrate toxicity and physical properties, and development of vegetation. Development of vegetation can affect soil biota by quality of litter, in addition spatial organization of vegetation is also very important for soil fauna. Beside immediate vegetation cover long term changes in development

of soil horizons are crucial. Beside vegetation soil biota also contribute to development of soil horizons. Soil microflora play crucial role in litter decomposition and nutrient dynamic in post mining sites. The soil fauna effect soil microstructure, carbon and nutrient storage, soil physical properties and plant growth in post mining sites.

113 Potential of restored landfill sites for biodiversity conservation in the UK and its context to landscape

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Restoring landfill sites to species-rich plant communities or grassland increases opportunities for biodiversity conservation in the UK as there are 2198 landfill sites covering at about 28000 ha. The goal of the present study is to assess the biodiversity of a variety of taxa on restored landfill sites in the East Midlands region of UK. The taxa to be investigated include plants (bryophytes and vascular plants), vertebrates (birds) and invertebrates (molluscs and ground beetles). Standard sampling methods are chosen for different taxa considering a range of ecofunctional characteristics. Cross-taxon congruence in biodiversity α -diversity and β -diversity across different taxonomic groups will be investigated to assess the extent to which these groups of organisms can function as surrogates for each other in biodiversity measures. The potential effects of regional landscape context on assemblages of species on particular restored landfill sites will be studied using GIS.

114 Drivers of change in ecological restoration

Bonn A.
Moors for the Future Partnership, UK

This workshop aims to explore successful drivers for change for ecological restoration. It will be highly interactive and adopts the UK Sustainable Development strategy principles for achieving change:

Engage

Innovative partnerships between different interest groups - government agencies, NGOs, community level organisations, and industries - can form effective ways forward to manage change through ecological restoration across sectorial and geopolitical boundaries. In the short-term, they can achieve change by mobilising substantial resources to fund joint capital investment to implement restoration projects. These can include land management projects at a landscape scale, new buildings or education programmes. Partnerships are often a pre-requisite for successful major grant applications, such as EU LIFE bids.

By engaging and collaboration, partnerships can overcome traditional sectorial thinking and create new opportunities to find innovative solutions to managing change. In the longterm, partnerships can also arrive at institutional change by relationship building, advocacy and capacity building by development of best practice to change attitudes and policies. As ecological restoration is often a long-term process, and ecosystem functioning is only slowly restored, the latter appears of prime importance.

Enable

Sharing of information between restoration projects can promote best practice. Awareness raising with the public can promote acceptance. Addressing multiple benefits of restoration through ecosystem services approach is important for wide acceptance. In addition, multidisciplinary research needs to provide scientific evidence base for informed planning and management of restoration projects. However, effective knowledge exchange between scientists, practitioners and decision makers is crucial to tackle the right questions and to allow learning. Monitoring is pivotal to enable adaptive management throughout the restoration process.

Encourage

Policy and regulation can be strong drivers for ecological restoration, but have also been strong drivers for ecological deterioration. Following the Convention of Biodiversity and Natura 2000 commitments, the public service agreement target to restore Sites of Special Scientific Interest within the UK, for example, has recently been a main driver for peat restoration projects. In addition, the Water Frame Work Directive has been instrumental to form new public – private restoration partnerships between water companies and NGOs and generated project funding. Incentives, such as agri-environment schemes, tax schemes and other innovative finance instruments such as carbon-offsetting through restoration can further foster ecological restoration.

Exemplify

Within the workshop we aim to identify success stories of ecological restoration as examples.

115 Implementation of the Habitats Directive: Identifying major challenges and possible ways of solution considering dynamic approaches

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In its Annexes I and II the Habitats Directive identifies habitat types as well as animal and plant species of European importance. According to the directive these designated habitats and species shall be maintained at or restored to a favourable conservation status, thus indicating a certain static approach. To comply with the aims of the directive and to achieve sustainable conservation, for some of the subjects of protection intensive management measures need to be applied.

This paper focuses on the habitat types listed in Annex I. A set of criteria, considering succession, management demands and endangerment will be applied on the example of the 91 habitat types hosted in Germany to identify those habitat types whose conservation could be challenging under a static regime. Some of these critical habitat types will undergo closer examination e.g. by analyzing good practice examples. Appropriate management options will be presented and discussed for different habitat types. Concluding from the discussion, requirements on management planning will be outlined.

116 Balancing Natura priorities on a National Nature Reserve in Scotland

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Glen Affric, a recently designated National Nature Reserve, is one of the largest areas of Caledonian forest in Scotland. The challenge is to implement management to deliver Natura 2000 objectives across the 9 Annex 1 habitats present, through the development of ecologically functioning landscapes. This case study describes planning and management strategies to meet these objectives.

A range of GIS supported tools have been applied to improve the ecological content and function of the design process. These provide managers with the means to address a landscape scale approach to habitat management and to select species that are ecologically suited to sites. The use of these models has been shown to not only help the spatial delivery of the management objectives but also improve the objectivity, transparency and accountability of the decision making process in relation to habitat factors at the landscape scale.

Policy tends to steer us to focus on patches of designated habitats as islands within the landscape; the reality is that there are few definitive lines on maps or set areas of habitat. Conservation objectives should instead initiate site specific management, allowing for spatial and temporal change and the development of the transitional zones between habitats. This will encourage a wide range of structures and composition types within these habitats.

The development of ecological functionality will enhance connectivity across the landscape from lowlands to uplands. Its delivery will require a range of different management options to maintain, and enhance, the necessary mosaics of habitats and woodland structures.

117 Strengths and weakness of the bureaucratic procedure for a-priori evaluation of restoration projects: two case studies from the Lazio Region

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Recently green house production of cucumber (*Cucumis sativa* L.) has been increased enormously in I.R.Iran and other parts of the world. This study was conducted to investigate the effects of two exogenous plant growth regulators, IAA and GA3, on production, vegetation, and infrastructure of parthenocarp cucumber (*Cucumis sativa*), Holland Royal Star cultivar, in greenhouse conditions. Two concentrations of 100 and 500 ppm of IAA and GA3, alone or in combination, was sprayed every week on the plants from when they have 4 leaves and followed for 24 weeks. Experiments carried out in a 4 complete randomized blocks, each comprising 9 parts: 8 treatments and one for control. Each part included 8 plants in 2 square meters. Vegetative and reproductive factors such height, number of leaves, male and female flowers, and number of fruits was measured every week and the data was analyzed using ANOVA. Study on infrastructure of plants was carried out using conventional methods. Results showed that the combination of 500 ppm IAA and 100 ppm GA3 led to produce significantly more vegetation and female flowers ($p < 0.01$) in which number of fruits

was 2.78 times more than control. Interestingly, significantly ($p < 0.011$) more male flowers appeared when the combination of 100 ppm IAA and 500 ppm GA3 used. The hormone treatments have caused different infrastructural alteration in various parts of the plants such cortical and pith parenchymas, xylem vessels, and structural tissues. The results of this study could be applied in green houses to increase production of cucumber.

118 A tropical forest at the coastal Lomas of Peru: Should we restore a fog oasis or the lost garden of the Incas?

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Scientific interpretation of tropical forests in Central and South America has swung from pristine wilderness to cultural parkland. This fundamental perspective change does not impair the relevance of the restoration efforts to preserve biodiversity and re-establish the supply of environmental goods and services. However, it drastically alters the diagnosis of the key limiting processes. In 2002, a UNDP/GEF project supported the reforestation of the largest and most diverse remnant of the Lomas formation, a globally unique fog-dependent ecosystem found along the Atacama and Peruvian Coastal Desert. In 2006, a FBBVA project supported the reappraisal of the knowledge on the dominant tree species, Tara (*Caesalpinia spinosa* (Mol.) Kuntze), to implement an effective adaptive management of these restoration efforts. We hypothesized, first, that fog oases of the Atiquipa Lomas would have acted as refugia favouring population genetic divergence, and second, that plant recruitment and performance would respond opportunistically to water pulses better than to a sustained irrigation. As results, chloroplast microsatellite diversity in nine populations across Peru suggests a lack of genetic differentiation. Seedlings recruitment within the best preserved patches of forest was extremely sparse, and planted and irrigated individuals exhibited differentially higher growth rates. The historical survey confirms the existence of this forest by the end of the sixteenth century but also proves that Atiquipa was a major settlement on the Inca trail. Preliminary results are coherent with the view of this extraordinary forest as a manufactured landscape and support, so far, the initial reforestation project for conservation and sustainable use.

119 Conservation and reforestation strategies for the habitat 9210* Apennine beech forests with *Taxus* and *Ilex*

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The habitat 9210 * Apennine beech forests with *Taxus* and *Ilex* is the object of this study. Such habitat is in Italy extremely fragmented and constituted by reduced populations of yew and holly. It is linked to the refugia areas during the glaciations and the subsequent interglacial expansions. The aim of this work is to define the ecological characteristics and the factors that influence its regeneration, through the elaboration of climatic, environmental and structural data. Seventy five plots have been sampled in Central Italy and the data have been statistically elaborated. The Mann-Whitney test showed that *Taxus* and *Ilex* occupy two well differentiated ecological niches. In particular, *Taxus* has been proved to be a more microthermic, mesophilous and sciophilous species. Furthermore it grows in beech woods with a more dense, stratified and closed canopy. Five statistical methods (RTA, GAM, SVR, MARS, RLM) have been compared to define the bioclimatic envelope of the two species. RTA, the most efficient model, has been used to produce GIS maps of their current potential distribution. A stepwise multiple regression analysis has been applied to identify the factors influencing the regeneration of the two species: beside climatic effects, *Taxus* regeneration is negatively influenced by soil nitrate concentration (an indirect indicator for grazing pressure), while *Ilex* is negatively influenced by the forest cover measured by *Fagus* basal area. The proposed approach promoted the elaboration and the implementation of specific strategies and actions for the conservation and the reforestation programs for this habitat.

120 Forest restoration in Finland – Monitoring scheme and first results

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The objective of forest restoration in Finland is to speed up the recovery of former commercial forests included in reserves towards a natural-like state. Three main methods are used: increasing the volume of dead wood, burning of forests, and creation of small openings into young monotonous forest stands. The aim is to promote natural forest dynamics and processes as well as to improve living conditions of threatened and rare species. In order to evaluate the effectiveness of these measures monitoring site network has been established where effects of restoration on two focal species groups – beetles and polypores – are monitored along the development of stand structure and changes in tree species composition. The very first results obtained from the monitoring network show that the number of beetle species was higher in study plots where trees were killed compared to the control plots both in pine-dominated and in spruce-dominated stands. The species communities composed largely of phloem feeders and their related species. These are usually good dispersers and thus well able to locate newly formed resources. Burning of forests seems to be the most effective restoration method in terms of creating habitat and resources for red-listed species, although, it is also the most expensive one. With these data it can be concluded, that restoration of forests is beneficial for numbers of declined species in the short-term. Further monitoring is needed, however, to reveal the longer-term effects and effects on different saproxylic organisms, such as polypores, during the long decay succession of trees.

121 Lessons learned from a large scale restoration program in Portland, Oregon: the watershed revegetation program

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Since 1996, the City of Portland's Watershed Revegetation Program (Reveg) has been managing natural areas to improve native plant diversity and structure, and decrease noxious weeds. To date Reveg has planted over 2.5 million trees and shrubs, at over 600 sites totaling over 2,000 acres and 95 miles of streambank, working on both private and public property. Reveg has taken sites with nearly 100 percent noxious weed cover and converted them into young native forests. Monitoring shows 10-year sites average 80% canopy cover and 21% exotic ground cover. Site conditions range from highly urbanized areas to large rural reserves. The Watershed Revegetation Program ensures quality and cost effectiveness by using professional reforestation contractors and acquires 5 to 10 year maintenance agreements with landowners. Plantings are designed to best match natural plant associations, while taking into account maintenance regimes. Seeds are hand collected locally, and bareroot seedlings are planted to maximize diversity and decrease costs. Experiments have been set up to evaluate tree and shrub performance, plant spacing, herbaceous seeding effectiveness, soil amendments, reference plant communities, animal protection devices, herbicide effectiveness, and wildlife usage. And this information is used to improve restoration efforts. Reveg have been challenged with poor soils, landowner communication, animal damage, herbaceous seed establishment and invasive species. Reveg has been successful dealing with these challenges through long-term management and continued funding. The Watershed Revegetation Program serves as a model to efficiently and effectively manage urban natural areas.

122 Mapping biologically important forests – Towards the restoration of a trans-European forest mega-corridor

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The BirdLife European Forest Task Force has been working on mapping the Biologically Important Forests (BIFs) in Europe since 2001. So far 7 countries are being included in the forest mapping project. The mapping programme is aiming at determining the precise location of forest areas with high nature values. The main data sources for mapping are national forestry databases, supplemented by topographic maps, Natura 2000 data and maps, National Red Lists, field checks and others. The BIF mapping results in a GIS-based database organised at three levels and an interactive map service available on Internet.

The analysis of distribution and concentration of BIF will allow to delineate larger forest landscapes that should become targets of special conservation efforts and management restoration techniques.

In future, Natura 2000 network will represent the core areas for biodiversity protection. However, management of forest areas outside Natura 2000 in a suitable manner is needed to secure its coherence and connectivity.

Preservation of all remnants of natural forests and restoration of the ecological connectivity bridging forest biodiversity centres from Fennoscandia to the Balkans is one of the most urgent conservation challenges in the view of the environment affecting mega-trends including growing demand for the forest biomass and climate changes. Design and restoration of a trans-European forest megacorridor according to the BIF distribution will be of critical importance to forest biodiversity preservation as well as a crucial pillar of the Wild Europe initiative aimed to restore European wildlands.

123 Restoration of species-rich mesophilous meadows by hay transfer: which results do we have after four years?

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In the five-years-project „Restoration and creation of species-rich meadows by hay transfer - a contribution to nature conservation in intensively used landscapes“ (supported by the Deutsche Bundesstiftung Umwelt) up to now 21 measures have been carried out, from these 3 in 2004, 14 in 2006 and 4 in 2007 (furthermore a few planned for summer 2008). The restitution areas are situated in SW- (Upper Rhine Valley, Black Forest; with rich or poor mineral soils) and NW-Germany (Weser-Ems-Region, with sand and peat soils); they are abandoned or actual fields or have been managed as intensive or extensive, but species-poor grassland. The donor areas include a wide spectrum of meadow types with great variety of soil types and humidity and nutrient level, as well as floristic composition and structure of the vegetation and the altitude (from 0 to 1200 m s.l.).

Four years after the transfers of 2004 we found on the three recipient areas (former fields) at the Tüllinger Berg (SW-Germany, near Basel) the floristic composition and vegetation structure of a meadow with *Arrhenatheretum salviatsum*, already very similar to the ones of the donor meadows nearby. The species number and cover of weeds and nitrophytic ruderals decrease from one year to the next, while the typical grassland species disperse into and inside the permanent plots and show higher species numbers and densities.

In accordance with the results of BOSSHARD (Switzerland; mainly by seed sowing), on former fields the initial character of a mesophilous meadow is discernable already one year after the transfer, while on some former meadows a clear enrichment of typical meadow species has not taken place after 1-2 years. However, in special cases we do not aim at the enrichment of species on former meadows, but on structural changes (vegetation structure, relative cover of the dominant species; e.g. Belchen-Hohtann). In the preliminary comparison of the variants (with or without former soil opening of the meadows; without hay or application of hay in simple or double layer) we found on former fields no differences of species number and cover of the grassland species between the simple and double hay layer, but clearly to the variant without hay; in former meadows, however, the application of the double layer shows better restoration success.

We resume that problems in restoration measures arised mainly by the small interest of a few farmers or the lack of appropriate donor sites or bad whether conditions in the planned transfer period. We found good results in those measures, where the hay had been transported from a very species-rich donor meadow to a very species-poor restitution area and where the soil management and the consecutive application of hay had been carried out very carefully; additionally is important the time of mowing the donor meadow as well as the time of cutting the restitution area in the months and years after the hay transfer.

124 Grassland restoration in practice – Do we achieve the targets?

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The restoration of mesophile grasslands is area-wise one of the most frequently implemented measures used to counteract environmental impacts in the course of infrastructural projects in Germany.

A comprehensive evaluation of all grassland restoration measures that were implemented between 1992 and 2003 in Saxony-Anhalt offers a valuable insight into the current practice. On most of the 135 sites standardized, not site adapted, herb-poor seed mixtures of allochthonous origin were used. These established

mainly monotone, species-poor, grass-rich grasslands, that do not correspond to grasslands that are typical for the region. Long-term investigations of these species-poor grasslands show little or no development towards the restoration target. Especially varieties of small *Festuca* species impede the colonization of typical species due to their competition characteristics. They are causing a thick litter layer with no niches for establishment. Reaching the restoration target requires extensive and expensive corrective measures (e.g. re-sowing with typical species, more frequent mowing). Establishment methods using site adapted, autochthonous materials (e.g. hay flower seeding, hay mulch seeding, transplanting sods) were expectantly more successful, but highly underrepresented. Only one of these methods was applied onto merely three sites.

Overall, the study has shown, that a) the current practice results in numerous monotone grasslands with a similar species stock, that do not reflect the variability of site conditions, b) grasslands established by standardized seed-mixtures remain species-poor for several years. To restore species-rich mesophile grasslands, it is urgent to change the current practice by using site adapted, autochthonous species for their restoration.

125 Habitat networks for dispersal-limited plant species have to be connected on a small scale

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Xeric and calcareous grasslands are characteristic landscape elements in the German federal state of Brandenburg but they occur in rather small and isolated patches. 137 sites were reported in the Natura 2000 network, covering 3500 ha, i.e. less than 0.12% of the total area. Such fragmentation may cause severe problems for population persistence of affected species via demographic, environmental or genetic stochasticity. Within a meta-population, local extinctions may be buffered if sufficient (re)colonisation events take place at the regional scale.

For the common but declining, perennial plant *Armeria elongata*, a characteristic inhabitant of the mentioned habitat type, we investigated such meta-population dynamics. Within three study regions of 30 km² each, both extinction and colonisation events occurred over two years, indicating meta-population dynamics. In our colonisation experiment with eight regional potentially suitable sites located within 500m distance to an existing source population, sown seeds established at all sites, highlighting that dispersal to suitable sites is critical. Environmental conditions at the site of sowing explained most (42%) of the establishment success, and there was also a significant source population x target site interaction, suggesting genetic differentiation in the response to different target environments.

We conclude that habitats in networks for plant species conservation should be connected at relatively small scale, which appears not be the case for the existing Natura 2000 network. Clearly, conservation management should take species-specific distribution, habitat requirements, and dispersal ability into account to efficiently support regional dynamics.

126 Impacts of changing ratios of reduced to oxidised nitrogen deposition: case studies in acid grassland and fen ecosystems

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Eutrophication is a well known threat to species richness and functioning of many European ecosystems. Increased availability of nitrogen (N) and phosphorus (P) have decreased species number and negatively affected ecosystem processes. One of the main causes of increased N availability is atmospheric deposition of reduced and oxidized N. Currently, there is mounting evidence that relative proportions of reduced and oxidized N are changing in deposition. Over Europe as a whole, the deposition of NO_x has gone down in the period 1980-2005, while the deposition of NH_y stabilised after 1995, resulting in increased NH_y:NO_x ratios. Based on the expected deposition for the coming decades, the relative importance of reduced N will increase even more.

Because the effects of NH_y and NO_x on vegetation and soil processes are markedly different, changes in the NH_y:NO_x ratios are likely to have a great influence on species composition and ecosystem functioning. With evidence accumulating that NH_y toxicity is already causing declines in the abundance of some plant species, a better understanding of the differential effects of NH_y and NO_x is therefore urgently needed.

This paper will present the (preliminary) results of two N-addition field experiments. The first experiment has been conducted in an Irish fen ecosystem. N has been added as NH₄⁺ and or NO₃⁻ to study the effects on vascular plant and bryophytes diversity and abundance.

The second experiment is part of the ESF-funded BEGIN project and here three acid grasslands (in Norway, Wales and France) have been subjected to similar N additions since early 2007. The aim of both experiments is to determine the processes behind biodiversity susceptibility to reduced and oxidized N deposition. In addition, we will investigate how management may be an effective tool in mitigating any negative effects of changed NH_y to NO_x ratios.

127 Liveable and attractive urban rivers - the ecological dimension of the Emscher project in Germany

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The old industrial heart of West-Germany, the Ruhr region, has changed drastically in the last 40 years. The region was well known for its heavy industries and the strong air, soil and water pollution. The recent and strong decline of heavy industry activities offered the possibility to ameliorate the environment substantially and to create a new level of urban life. This includes technical aspects of cleaning, as well as urban biotope management. The most important current project is the ongoing ecological renewal of the Emscher river system. For more than 100 year the main rivers and their tributaries have been used as an open sewer system in the heart of the urban agglomeration. Since there is no more coal mining activity, there are no reasons to continue this environmentally very disturbing system. The state of North-Rhine-Westfalia, together with the region, the cities and the private companies have therefore decided to change the water regime completely. "From sewer to a viable urban river system Emscher" is a current investment programme of 4.3 Billion Euro. Rainwater, storm water and wastewater are collected separately and a whole network of new rivers and new benches is going to be build in the heart of the Ruhr region. The presentation will give an overview of all environmental aspects of this programme and it will report on the experiences of the first 15 years.

128 Global change constraints and opportunities for the restoration of large river floodplains

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Global changes impose constraints but can be incorporated as opportunities for the ecological restoration of floodplains of large rivers. General reductions of water discharge and change of the discharge regime were observed in most European rivers. This impose a reduction of water and dynamics to recreate new sites in floodplains but offers the opportunity to recreate new sites and develop ecological restoration projects by re-connecting and establishing ecological corridors between the rivers and their floodplains. Decreased water quality is a global change affecting large rivers. The ecological restoration of floodplains is an opportunity to contribute to improve water quality by accumulating sediments and removing nutrients, particularly nitrogen. Extensive use of floodplain areas for agriculture lowered biodiversity at landscape scale. It can be an opportunity now to involve farmers and agricultural plans in new activities demanded by society, including reduction of flood risk. It can be also an opportunity to counteract impacts from invasive species while offering alternatives for the conservation of native biodiversity under stress in degraded channels of large rivers. Intensive use of floodplain areas by urban and industrial areas is the most difficult constraint to address as it requires revitalization of social activities for planning the change of land use cover and their restoration at ecosystem scale. Case studies in the Ebro River floodplains illustrate these strategies to plan and implement ecological restoration.

129 Hydromorphological aspects in the restoration of river habitats and species in the context of the common Meuse restoration programme

Van Looy K.

Research Institute for Nature and Forest, Brussels, Belgium

The restoration programme for the Common Meuse aims to restore the river dynamics over a 35 km river stretch. Research on hydromorphological and ecological aspects of the restoration of river habitats and species, will be presented with relevance for large rivers in general.

Knowledge and experiences on pilots for the large restoration project and the way they support to the Natura 2000 targets of conservation and restoration of habitats and species will be shared.

Special emphasis lies on the restoration of river dynamics and how this relates to habitat and species population dynamics, and how to solve the restrictions and constraints of conservation legislation. Further focus will be on how to incorporate the restoration of hydromorphology of large rivers in the targets for conservation status of Natura 2000 and ecological potential of the Water Framework Directive.

Experiences from pilot projects, modelling of the future developments, target setting for habitats and species in this dynamic environment and ecological genetics of species within the river system will be reviewed to illustrate the context of river habitat and species restoration.

130 Nature development and 14 years of vegetation succession in the foreland of the river Waal (the Netherlands)

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1 Nature Conservation and Plant Ecology, Wageningen University, the Netherlands

2 Laboratory of Geo-Information Science and Remote Sensing, Wageningen University, the Netherlands

Nature conservation in the Netherlands changed from strict conservation and protection into nature development by restoring natural processes. In 1992 the World Wildlife Fund announced the plan 'Levende Rivieren (Living Rivers Plan)'. About 200,000 ha of new nature was planned. One of the first nature development projects the 'Millingerwaard', started in 1991 by introduction of grazing by Konik horses, followed in 1992 by Galloway cattle. In 1994 beavers were introduced.

By means of permanent plots and repeated vegetation mapping, we investigated the long term changes in vegetation composition under nature development, especially its effect on dry sandy to loamy grasslands of the Medicagini-Avenetum (Sedo-Cerastion), Bromo-Eryngietum (Artemisietea) and 'fluvial species'. The Medicagini-Avenetum pubescentis strongly declined in the Netherlands and became rather rare and strongly threatened. Restoration of this highly valued community has a high priority in nature development projects along the Dutch rivers.

After 14 years of nature management the surface area of the nitrophilous tall forb communities of the Galio-Urticetea strongly increased, while the Bromo-Eryngietum decreased. The Sedo-Cerastion ruderalized.

On the levee nature development appeared to have no negative or positive effect on the total cover of Medicagini-Avenetum and the fluvial species. However some fluvial species decreased while others strongly increased. On former arable land and pastures these species increased due to in blowing sand. Here *Cirsium arvense* and *Rumex obtusifolius* are replaced by *Calamagrostis epigejos*, which itself is later replaced by the strongly increasing *Rubus caesius*.

Vegetation changes appear to be very dynamic showing both regressive and progressive succession.

18.30 – 19.30 SER Members Meeting

131 Ecological restoration and global climate change

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There are numerous predictions regarding likely global climatic conditions over the next 100 years and beyond and, although the often differ in geographical detail, there is a consensus that we face a warmer planet, increasing occurrence of "extreme events", and considerably altered biophysical conditions over large areas of our terrestrial ecosystem. Fauna and flora are moving away from the equator, further up mountains, and many of them are running out of space and water. Sea level rise threatens island states and coastal ecosystems.

In this context returning ecosystems to “historical” conditions, based on what was known of the composition of ecosystem assemblages prior to direct anthropogenic interventions (such as intense agriculture, redirection and impoundment of surface waters, and extirpation of predatory species) may be difficult if not impossible. What, then, is achievable? We must consider the feasibility and desirability of novel assemblages, and setting metrics independent of particular species, but featuring biodiversity, trophic interactions and valuation (but not necessarily monetization) of the ecosystem goods and services which flow from intact, resistant, resilient and functioning ecosystems, as highlighted in the Millennium Ecosystem Assessment.

This shift in emphasis brings with it significant implications for legislation at local, regional, national and international levels. Much conservation legislation is targeted at particular species in defined geographical location – indeed many sites depend on single species for their protection. What is required is a re-examination of our conservation and restoration planning and protection by incorporating it fully, based on solid scientific theory and evidence and in its socio-economic context, into the planning regime at all of these scales. At the same time, this planning has to take into account the need for flexibility, adaptation and mitigation in the face of our changing biophysical environment.

132 Planning ecological restoration across scales: challenges for the future Opdam P.

Land Use Planning Group, Wageningen University Research, Wageningen, the Netherlands

133 Estuarine restoration ecology along the path of changes

Van Damme S.

University of Antwerp, Department of Biology, Antwerpen, Belgium

Estuaries are dynamic systems where often important economic activities prevail while the high ecological potential is suppressed. Growing awareness of the need for ecological restoration and legal constraints of many kinds have lead to a number of restoration actions. Nevertheless it is seldom clear what measures are needed, as each constraint requires a specific response. The often narrow targets do not always consider interactions on an ecosystem scale, nor their constant evolution. In spite of the current restoration efforts to compensate for past impacts, new adverse effects are expected. Global climate change can amplify tidal action, affect discharge and cause shifts in production and species diversity. Economic growth may require further morphological alterations. All these changes will also bring new constraints and require proper measures. Within the array of expected impacts and societal premises, the quantification of restoration objectives also has to account for ever changing conditions, even on a system scale. One way to deal with the physical and biogeochemical evolution of estuarine systems is to express the goals in terms of ‘ecosystem goods and services’. To avoid the application of arbitrary restoration measures a system based assessment of restoration needs and good knowledge on how processes change with respect to restoration measures, are needed. How is success or failure evaluated? What can we learn from test cases? This session welcomes reviews and innovative studies on how to grasp dynamics in the quantification of restoration needs and on the application and evaluation of multiple restoration practices.

134 Habitat recreation in estuaries - triple-wins for society and ecology giving flood protection, economic benefits and ecological well-being

Van den Bergh E. 1, and Elliott M. 2

1 Institute for Nature and Forest Research (INBO), Brussels, Belgium

2 Institute of Estuarine & Coastal Studies (IECS), University of Hull, Hull, UK

Within Europe, estuarine restoration initiatives will be most successful if they serve both economical or social and ecological purposes: the ability to sustain economic goods and benefits while at the same time delivering ecological goods and services, hence fulfilling ‘The Ecosystem Approach’ sensu stricto. Hence in considering the multiple functions of estuaries, an aim of estuarine environmental management is to maximise joint benefits for natural and social interests. Using case studies from throughout NW Europe and elsewhere, the paper will illustrate that in some cases there have been ‘triple wins’ as benefits for the ecology (i.e. better and increased habitats which may recreate losses from historical land claim), public safety (i.e. protection against flooding and erosion which affects lives and property) and economy (i.e. the reduction in the costs of maintaining flood defences). In addition, habitat restoration or recreation efforts in estuaries are often mitigation or compensation measures for other activities such as port development which could create impacts within the estuary. These cases have allowed us to indicate best-practice for creating and re-creating estuarine wetlands, for deriving and testing environmental objectives aimed at fulfilling national and European legal requirements and for testing indicators of successful management.

135 Managing the impacts of industry on habitats: case study of the Humber estuary, UK

Edwards T.
Humber Industry Nature Conservation Association, UK

The Humber ports and industries are of vital importance to the UK's economy but it is also a Natura 2000 site, particularly on account of birds. The challenge is to meet economic goals while enhancing the environment. The Humber provides practical opportunities to explore the Triple Bottom Line model of sustainable development – projects that provide benefits for the economy, society and environment. Contributing to this goal is the aim of Humber INCA, a 'not for profit' partnership of industry, environmental regulators, municipal government and voluntary nature conservation organisations; it is concerned with integrating business and nature conservation.

The creation of new wetland habitat is a measure used to compensate for some industrial impacts as well as achieving flood risk management objectives. The Immingham Outer Harbour project of Associated British Ports (ABP) involved the loss of 22ha of intertidal mud. Compensation was provided by returning the tide to 55ha of farmland, which had previously been 'claimed' from the estuary. While doing so a number of other impacts were managed, including the translocation of a colony of water voles. The new habitats have value for wildlife, bird watching and as a 'sink' for carbon and nutrients. They contribute to the growing network of tourist sites around the rural parts of the estuary. The concept of habitat banking, including for land beside the estuary used by birds for roosting, is being investigated although there is growing competition for such land for food and energy crops as well as new habitat.

136 Creating and restoring habitat while managing flood risk on the Humber

Winn Ph.
Environment Agency, Anglian, Hull

A system of embankments protect the Humber floodplain from regular inundation. The risks will increase as sea levels rise. In the future the flood embankments protecting population centres and industry will be kept on their existing alignments and raised, but designated habitat will be lost with 'coastal squeeze'. The losses will be offset by realigning a proportion of the embankments and creating new habitat. The initial estimate is that around 700 ha of habitat creation / restoration will be needed over the next 50 years. Two sites are already in place, and a third is on its way.

Where the defences just protect agricultural land, it is unlikely in the future all of these will be maintained or improved at public expense, and some will fail. Landowners are understandably perturbed at what's proposed. Such a 'release' of the system would eventually mean there will be less of a need for new deliberate habitat creation.

As the Humber Strategy is implemented, lessons are being learnt, but many questions are being asked by landowners, policy makers, and politicians. Is it right that valuable habitats are protected, but peoples' land and livelihoods may not be? How well are the completed realignment sites performing, and to what extent will they contribute to meeting WFD objectives as well as creating habitat? Is the habitat creation and restoration programme correctly scaled? Is it acceptable to lose any of the excellent farmland when food prices are rising and there are new concerns about food security?

137 Regeneration of German estuaries: status, measures and perspectives

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The current ecological situation of the inner estuaries of Eider, Elbe, Weser and Ems is heavily stressed. This is shown using the indicators tidal range, forland area, oxygen concentration in the water column and heavy metal concentration in sediments. Compared with a historical situation very strong losses of estuarine habitats and a strong increase of the tidal range are evident. Compared with the situation 20 years ago, there are different developments. On the one hand, improvements can be noted in the heavy metal burden and the oxygen content in Weser and Elbe as a result of measures reducing emissions. On the other hand, there is a dramatic deterioration of the oxygen situation in the inner Ems estuary. A further increase in the tidal range and destruction of foreland still takes place in the estuaries, but on a limited scale. Restoration of estuarine habitats is necessary for all estuaries. Different kinds of measures have been already performed and also monitored; examples of different measures and the ecological consequences will be shown. It becomes obvious, that regeneration of estuarine habitats is possible, but must be adopted to the specific situation along the estuarine salinity and turbidity gradient. However, integrating these measures in overall

management plans is an outstanding challenge, although this process seems to start in the framework of the WFD and FFH.

138 The north mudflat of the Seine estuary: how much surface needs to be restored?

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For the last 30 years, the Seine estuary has been one of the most studied North-eastern Atlantic estuaries in terms of the benthos, fish and bird and is one of the most affected by human activities. The Seine's mudflat plays an important role as a nursery for several commercial fish, such as sole and sea bass. The benthic prey living in the mudflat is also an essential nutritional resource for shorebirds and anatids throughout the year, and for migrant species during especially cold winters. However, the mudflat's surface has decreased dramatically over time due to natural silting up and successive construction projects, such as the latest Normandy Bridge and the new Port 2000: 760 ha in 1978 and < 290 today. This talk analyzes the relationships between the temporal changes of the mudflat surface and the changes in the three biological compartments with respect to abundance, trophic and ecological guilds. Only bird abundance has decreased significantly with the reduction of the mudflat's surface. Both benthos and fish abundances are highly variable, and thus cannot be connected to the evolution of the surface. Mudflat surface has been recreated with success as compensatory measures after the two last constructions. However, the amount of surface that needs to be restored in the future remains debatable. Still, something must be done since, at the current rate of reduction, the lower part of the North mudflat could disappear entirely over the next 20 years if an active restoration policy is not instituted.

139 Experimental restoration sites in the Seine estuary (France): premises to long term restoration plan?

Ducrotoy J-P.

Groupeement d'Intérêt Public Seine-Aval, Rouen, France

The Seine estuary has lost more than 90% of its intertidal areas in about 150 years. Recently, losses due to the extension of harbour facilities in le Havre ("Port 2000") have been compensated by the rehabilitation of a former mud flat and various constructions such as an artificial island for birds. However, the prerequisite to propose a vision of the estuary on the mid-term (25 years) and the long-term (50 years) still prevails. A reference plan needs to be elaborated and proposed to decision-makers. This paper will retrace briefly the morphological and ecological changes which have been inflicted to the estuary over the last century. It will put into light actions which have been successful in improving water quality and introduce the restoration operations which are planned in the next future. The methodology for elaborating a reference plan will be presented and proposals for its realisation and application will be made. The discussion will confront the present management of the estuary to future challenges, including global changes. Such changes will not only include global warming and its consequences (sea level rise, biogeochemical cycles alteration...), but also socio-economic adjustments and a possible geo-political reorganization expected to take place in relation to increase harbour activities and the increasing need for more space dedicated to natural habitats and leisure activities (sports, tourism...). The conclusion will attempt to suggest clear directions and steps to be taken in any future management plan for the estuary.

140 Possibilities for relocating coastal breeders in economical important areas

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Research Institute for Nature and Forest (INBO), Belgium

Breeding habitats of many seabirds are threatened by human activities like recreation, port expansion and coastal defence works. As a result suitable natural breeding habitat for these species has strongly declined and more and more artificial nesting sites are colonised like roof tops, industrial areas and ports. In economically important areas these, mostly legally protected breeding birds are often considered as a problem when

reclamation of the area turns out to become impossible. For such species the creation of new alternative save habitats in less economically important areas may contribute to their sustainable conservation and a solution to the problems. The relocation of coastal breeding birds in the port of Zeebrugge, Belgium, can be regarded as a successful case study. Here port expansion works attracted high numbers and many species of coastal breeding birds. Within 20 years, the area has developed from open sea to a breeding site of major international importance. Peak population figures of 4 species by far exceeded the 1% of the total biogeographical population and the area was of high national importance for almost all other species. Further development of the port urged for alternative breeding sites. After exploring the ecological and economical preconditions it was agreed that the pioneer species (terns and plovers) should be relocated to an artificial peninsula created at the eastern side of the port area, whereas the competing gulls would remain in the western part physically separated by water bodies. The relocation was highly successful and triggered further meta-population studies that may help to successfully compensate for habitat loss in economically important areas.

141 The compatibility of temporary nature with European Nature Conservation Law

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It often occurs that industrial, building and farming lands lie fallow for some time before their final designation is determined. Ecological research has shown that in addition to a detailed area-oriented policy (Natura 2000) the creation of temporary nature on these lands may be essential to the survival of pioneer species (e.g. natterjack toad).

Currently, there seems to be little enthusiasm to make use of temporary nature. The reason is that removing temporary nature at the moment on which the final designation of the lands is determined may lead to administrative dispensation procedures that may drag on for years. For instance, additional dispensations will have to be obtained if certain protected species have in the mean time come to inhabit the site.

From a legal point of view, it appears that temporary nature is difficult to combine with the principles of European nature conservation law (e.g. standstill principle). This study will show that although temporary nature may at first glance not seem to fit in with European nature conservation law, there are nevertheless sufficient possibilities to approach temporary nature in a thematic and systematic manner at the level of an area. Such an approach is possible if creative use is made of the available derogation procedures from the European Bird and Habitat Directives. The conclusion is that a systematic approach (e.g. derogations included in a species protection plan) at the level of an area (e.g. the level of a harbour area) is probably the best approach in practice for temporary.

142 Five years of monitoring and the compensation process for expansion of the Antwerp harbour

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The Port of Antwerp at the left bank of the River Scheldt overlaps with special protection area for birds (SPA). Marshes and mudflats at the river border are special areas of conservation for their habitat (SAC). The digging of the Deurganckdok and Verrebroekdok for harbour expansion destroyed habitats in these areas of special interest. A compensation plan was set up. This involved creation of wetlands, meadow bird area, reed marshes, pioneering situations and tidal marshes. A management commission for the follow up of the compensation projects, gathering all involved parties and stakeholders, was installed. A monitoring scheme to evaluate these compensations was started by the end of 2002. This monitoring did not focus solely on birds and tidal habitat, but also included necessary steering variables such as hydrology and vegetation development. In the meantime most of the compensations works have been realised, but some are still in progress. Five years of data collection allow a first evaluation of the compensation process and assessment of the conservation goals and objectives. Breeding birds do not reach the target numbers yet, but the bird community starts to react positively. In some occasions vegetation development needs more process time to get optimal habitat, in some occasions management will have to be changed to reach the targets. A comprehensive monitoring scheme like this generates the necessary input to evaluate the progress and to formulate eventually suggestions for adaptive management in a sound way.

143 **EcoTRADE – Investigating the suitability of tradable permits for biodiversity conservation in changing landscapes**

Van Teeffelen A.J.A. 1, Opdam P.F.M. 1,2, and Vos C.C. 2

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2 Alterra - Wageningen UR, Landscape centre, Wageningen, the Netherlands

Habitat restoration has been employed in the context of ecological compensation, to offset negative impacts on ecosystems as a result of development projects. Compensation measures are aimed at maintaining the size and quality of ecological networks. These measures are decided on a case-by-case basis, as a response to development. Traditionally, there is a preference to restore the same type of habitat near the location of impact. This practice ignores three main issues however: 1) the current spatial configuration of ecological networks may not be sufficient to maintain species at the long term, given ecosystem dynamics and climate change, 2) conservation budgets are perhaps more effectively spent on restoration of other, scarcer habitat types, and 3) restoration costs and potential differ per location, for which there is scope to achieve conservation targets more cost-efficiently. Furthermore, the current reactive nature of compensation practice does not stimulate a strategic approach to conservation that is flexible in response to ongoing changes.

Market-based policy instruments like tradable permits have characteristics that could them make suitable for cost-effective biodiversity conservation in landscapes subject to economic development. The EcoTRADE project investigates the potential of tradable permits and habitat banking for achieving conservation targets in intensively-used landscapes such as Europe. An international, interdisciplinary team investigates policy, economic and ecological aspects of such instruments. The ecological questions concern the trade-offs in habitat network size, spatial configuration and temporal fluctuations in habitat suitability (resulting of market activity) on species persistence. Also the role of habitat development time is investigated.

144 **Advances in restoring European sites through the review of decades of permitting pressures; Humber Estuary SAC thermal plumes and lamprey investigations**

Rockliff C.

Environment Agency, England

When the Environment Agency, in England and Wales, started work on implementing the requirements of the Habitats Directive, it seemed that it was an almost impossible task. Little was known about the ecological requirements of Species and Habitats of Community Interest and even less about their sensitivity to existing Environment Agency permissions. So we, together with other conservation agencies, embarked on a concentrated program of investigations to increase our knowledge.

Our studies have allowed the Environment Agency to create new policies and deliver environmental changes through restoring European Sites after decades of permitting pressures.

There is much yet to be discovered about the ecological requirements of many of the protected habitat and species, but we have made significant in-roads to several complex issues.

We wish to highlight a number of innovative case studies, that have contributed towards the ecological restoration of protected sites. These include the advances made on the Humber Estuary SAC surrounding thermal plumes and lamprey impacts together with a representative selection of the 400 investigations delivered over the last seven years.

The key lessons learnt have been to work closely with all conservation bodies and approach major industries as early as possible in the investigation cycle.

145 **How to assess liability for ecological damage in international law**

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Ecological disasters like the Amoco Cadiz oil spill (1978) or dumping of toxic waste in Côte d'Ivoire (2006) have an important impact on public awareness. Citizens ask justice to sentence the liable company to repair the damage. Ecological damage leads to economical losses for fishermen, tourism industry and so on. However, other kinds of damages exist. On the one hand the aesthetic, leisure value of the environment is blown, at least for a while. On the other hand, recognition of the intrinsic value of nature leads to consider the value of nature per se apart from human interest to be compensated in case of damage. To repair those damages appear as a major challenge for environmental law because they are much more difficult to assess.

Actually, no market can give a price to those damaged elements.

Recently, this topic was discussed in various international fora. For example, the International Law Commission elaborated « Principles on the allocation of loss in the case of transboundary harm arising out of hazardous activities » (2006) while Parties to the Biological Diversity Convention and its Protocol on biosafety are still discussing this question. In Europe, Directive 2004/35/CE 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage is the new framework.

In that context, it is useful to compare and analyse international Conventions and legislations including liability for ecological damage. It will allow us to better understand how that damage must be assessed in order to restore and compensate. Through definitions of environmental damage, compensable damage, guidelines to assess it, remedial measures and practical cases, we will present international law trends and evolutions on that topic.

We will see that an important way to assess ecological damage per se is to value restoration measures.

146 Restoring species-rich heathlands: finding the right sites with potential for high biodiversity

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In Northwest Europe the heathland landscape is characterised by a variety in vegetation. This variety is related to gradients in soil acidity, nutrient availability and hydrology. During the last decennia, many of the heathlands have degraded. Several of the most threatened species of Europe belong to this ecosystem, especially in the weakly buffered parts of the heathlands. As restoration of the extensive areas is costly, it is important to select sites with high potential to become suitable for the threatened species. The question is how to find such sites. Basically, there are three strategies: sampling, modelling and the use of indicator species. In this presentation we focus on the use of indicator species.

In the Netherlands, detailed information on the distribution of plants and vegetations is available. As plant species are restricted to sites with certain abiotic conditions over a wide range of variables, the distribution of species can be an important source of information on soil and hydrological data. A prerequisite for this is that it is known under what exact conditions species occur. Moreover, key biogeochemical processes for the distribution of species should be known, as otherwise irrelevant indicator values are included in the system. We used an extensive database containing field measurements on all major soil parameters, to determine both the key processes and species indicator values. Next, species indicator values are combined to indicator values per vegetation relevé for all relevé in the study area, which results in maps covering the total Natura 2000 area for all key factors. Finally, suitable sites for restoration are selected by using these maps.

In a case study this method was applied to the Natura 2000 area the Drents Friese Wold.

147 Status of *Juniperus communis* in Flanders and actions needed for its long-term survival

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Common juniper (*Juniperus communis*) is a native coniferous shrub of Flanders (Belgium) whose actual distribution is confined to two large and a number of small relict populations in the Kempen region, where it thrives on acidic, freely-drained soils. Up to the middle of the past century the species occurred frequently on the then vast heathlands. Transformation into agricultural land, afforestation and urbanisation has since resulted in a massive loss of heathland habitat. Furthermore, the abandonment of traditional management practices such as grazing, mowing and burning has severely reduced chances for successful juniper recruitment in the few remaining heathlands. Also in the surrounding regions, juniper is increasingly threatened and hence it is no surprise that 'Juniperus communis formations on heaths or calcareous grasslands (Code 5130)' are listed in the Annex I of the European Habitat Directive.

To gain more insight in the status and population dynamics of this species we compared two inventories which cover all known populations in the Kempen region. The first inventory was made in ~1983 by Burny and the second in 2006 by LIKONA. The inventories made it very clear that the number of populations is decreasing and that the number of individuals and their vitality have strongly diminished. Extrapolations indicate that juniper will be practically extinct within 20 years if nothing is done to stop this trend.

Different management scenarios were tested and a species action plan is currently being made to derive guidelines for conservation, restoration and monitoring of the species in Flanders.

148 **Balancing the interplay of grass and heather vegetation using adjusted fertilization in restoration of heathland vegetation**

Hanslin H.M., and Sæbø A.

Norwegian Institute for Agricultural and Environmental Research, Horticulture and Urban Greening Division, Klepp St., Norway

Following the construction of a pipeline through a coastal heathland (Rogaland, SW Norway), experiments were carried out to find methods for fast and reliable revegetation following disturbance. Fertilization regimes and sowing of target species were tested at two separate sites, where experimental plots were established in dry and moist soils in 2000. Plots were left unfertilized or given a start fertilization of P and K. Half the plots were seeded with *Calluna vulgaris*. Three levels of nitrogen fertilizer were applied, either as a single spring application or split application spring/autumn. Ground cover of vegetation was followed over five years. The effects of treatments changed with time. The first years, treatments and especially N fertilization were important for vegetation establishment (total cover). Fertilization had a positive effect on early development (2-3 years) of grasses, but for both grasses and heather, the effects of fertilization decreased with time. After five years, no residual effects of the initial treatments were found and site characteristics became more important for vegetation development. Grasses established a high ground cover early, while *Calluna* had a lag phase and needed more years to develop a reasonable cover. A pattern developed where plots with much grass had less *Calluna* and opposite. Comparing this relationship between fertilization levels and sites showed the same pattern an early establishment of a high ground cover of grasses prevent establishment of *Calluna* and other heathland vegetation. To avoid total grass dominance, nitrogen fertilization should be restricted to dry sites only.

149 **Restoration of former cornfields on acid sandy soils: sod-cutting, grazing or afforestation?**

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In the Netherlands, many agricultural lands are converted to nature. A main question in these attempts is how to reduce or use excess nutrients. We studied the effect of sod-cutting, grazing and afforestation after 20 years in former cornfields on acid sandy soils. Agricultural soils had higher availability of N and especially P than undisturbed soils, mainly as inorganic P bound to iron-organic matter complexes, showing high long-term desorption. In restoration treatments, quality of soil organic matter improved from organic slurry to more distinctive forms, and microbial mass was higher as well. However, nutrient availability was only reduced by sod-cutting, with an additional biodiversity bonus that soils were now nutrient-poor, but still relatively base-rich. Under grazed conditions, availability of N and P did not decrease, and lower-productive grasslands only showed slightly lower long-term P-desorption than high-productive. In new oak forests, availability of N and P did not decrease either, but here nutrients could be used for rapid growth.

150 **Ecohydrology and advising bog and heath restoration in Campine region, Belgium**

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2 Agentschap voor Natuur en Bos, Antwerp, Belgium

From geohydrological model results, ecohydrology and chemical data, the authors draw conclusions how to restore bog and heath ecosystems, in a partly agricultural area in the Campine region of Mol (Flanders, Belgium). Data are presented on current Natura 2000 habitat in the area. High potential for heath and bog ecosystems is present in the area, as soil is generally poor and sandy and groundwater levels are high (with scattered groundwater discharge zones). The impact of several human factors in the past is modelled in scenarios. Major factors include drainage and eutrophication. In the advised restoration scenario, a potential vegetation pattern is predicted. Groundwater hydrology was modelled with Triwaco; potential vegetation with the Duraveg tool.

151 Long-term restoration of deteriorated heaths and acidic grasslands in the Netherlands: an overview

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Around 1900 species-rich heathlands and acidic grasslands were common in the Dutch Pleistocene areas but they decreased dramatically since then. Major reasons are changes in land use, atmospheric deposition and hydrological changes. The habitats of these communities are nutrient-poor, weakly buffered sandy soils and this makes them very sensitive to acidification, eutrophication and lowering of the water table. Ecological restoration of these degraded nature reserves has therefore got high priority.

Long-term field trials have been set up in deteriorated sites since the early 1990s to counteract the impacts of air pollutants and lowering of the water table. The first aim was to restore former soil conditions, as we feel that rehabilitation of ecosystems should start with recreating appropriate abiotic conditions. Removal of the vegetation and top soil ('sod cutting'), liming and hydrological measures or a combination of measures were used depending on the cause of the degradation. The effectiveness was evaluated by following the soil chemistry and plant composition during a 10-12 years period. In this paper an overview of the experimental restoration measures and the main factors of success or failure are presented. Several (combination of) measures proved to be successful in restoring appropriate soil conditions and a low productive sward. A full recovery of plant diversity was, however, seriously limited when the characteristic species had already disappeared, especially in dry conditions or when it was impossible to increase the soil buffer capacity. Additional measures to counteract the dispersal limitation of many endangered species may be needed.

152 Key issues for the success of forest restoration projects in Natura 2000 sites in Greece

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In this paper key issues regarding forest restoration projects in Natura 2000 sites are presented. The projects were implemented in the Palm Forest of Vai situated in "Voreioanatoliko akro Kritis" and the Riparian Forest of Nestos situated in the "Delta Nestou and Limnothallases Keramotis".

The main objective of both projects was the improvement of the conservation status of priority habitat types and the enhancement of the sites' integrity. That was achieved by re-establishing native vegetation, which was cleared for agriculture and forest plantations from 1950 to 1970. Planting, fencing and irrigation were implemented on both sites, along with communication actions and creation of information infrastructure.

The Vai project was a Life-Nature project. By restoring palm trees over an area of 13.4 ha, the project managed to double the surface of the habitat type "Palm groves of Phoenix" (9370) from 15.6 to 31.7 ha.. Nestos Delta project was funded by EFTA. Its main objective was the restoration of riparian vegetation in an area of 280 ha. Through this action the area covered by "Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*" (91E0) increased from 385 to 467 ha. Consideration of landscape perspectives in the selection of the restored areas resulted in the reduction of forest's fragmentation.

Clear and scientifically sound restoration objectives, thorough study of the soil conditions that had been created after forest destruction and safeguarding of the availability of planting material of local origin were the key issues that led to projects' success.

153 Management recommendations and performances for more effective conservation of the Spanish imperial eagle's (*Aquila adalberti* BREHM, 1861) habitat and populations

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The Spanish imperial eagle (*Aquila Adalberti* BREHM, 1861) is nowadays the predatory bird most threatened in the Iberian Peninsula, as well as one of the most threatened in the world. It is listed in the National Catalogue of Threatened Species as "In danger of Extinction" (Real Decreto 439/1990), also in annexe II of Law 4/1989 of Conservation of Natural Spaces and wild flora and fauna, in annexe I of Birds Directive (79/409/CEE) and

in different agreements of protection at international level (IUCN, Bern, Cites, Bonn). Nowadays there are only 216 pairs and it is limited to the western South quadrant of the Iberian Peninsula.

The present communication will try to show a set of performances and measures of management, which have been carried out in Spain, for improvement and conservation of habitat and populations of Spanish imperial eagle. We want to show also different contributions and information from different specialists and work groups with recognized prestige and experience, which follow the recommendations proposed in the National Strategy for the Conservation of the Spanish imperial eagle. Also particular management experiences carried out in private and public properties, which are included in Natura 2000 network. In these experiences we will comment among other proposals, the compatible forest practices with the conservation of the Spanish imperial eagle's habitat and the improvement of the habitat and the populations of rabbit (*Oryctolagus cuniculus*), main Eagle's prey.

154 Proposals and performances for restoration and conservation of Cantabrian capercaillie (*Tetrao urogallus cantabricus*, Castroviejo 1967) habitat and populations

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The specie *Tetrao urogallus* (Linnaeus 1758) is not globally threatened thank to its wide distribution range and its habitat, most of the time located in remote places. However, it is suffering important declines in its occidental distribution area and in central Europe, where local extinctions are isolating its populations.

From all the subspecies, the Cantabrian one (*Tetrao urogallus cantabricus*) is the most threatened and the one which has worst future perspective in middle term, since its populations begin to be isolated without the possibility of genetic renovation.

Although the Cantabrian capercaillie is protected specie in Spain, its populations have been declining during the last 20 years till dramatic levels. The main causes are deforestation, human activities (stockbreeding mainly) and urban development, combine with some reproduction requirements such as the sound that males in heat need to emit, which requires no human interferences and their type of egg-lying which does not help to get many viable eggs.

One of the few places where the Cantabrian capercaillie can still be seen is "Pinar de Lillo" (in Cantabrian mountain range) which is included in a Site of Community Importance (SCI) and in a Special Protection Area (SPA). In the planning project of this site an inventory and analysis of the mesohabitat and microhabitat, which has the requirements needed for the maintenance and conservation of the specie, have been made. And following the recommendations of the Strategy for the Conservation of the Cantabrian capercaillie in Spain, some specific actions have been defined.

155 Effects of late-season fertilisation on field performance of *Quercus rotundifolia* seedlings

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Restoration of degraded ecosystems frequently demands the re-introduction of plant species whose colonisation ability is hampered or too slow. Planting seedlings, as opposed to seeding, is often recommended when seeds are scarcely available or post-seeding conditions are harsh. However, seedling morpho-functional traits allowing high survival probability and early growth are still under discussion. It has been suggested that seedling quality might depend on site conditions. We forwarded the the following hypotheses concerning the relationships between seedling quality and field performance: (1) seedling nutrient content positively affects seedling rooting capacity and performance, and (2) the magnitude of the effects increases with environmental stress. We have tested these hypotheses by performing field and greenhouse experiments where we have evaluated the response of *Quercus rotundifolia* seedlings showing contrasted nutrient status and similar morphology to a gradient of soil depth and stoniness.

156 Forest edge shape influence in woody species colonization: application in coal wastes restoration

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Spatial variations in physical and biological structures of the floristic communities have taken place in Northern Palencia (Spain) as a consequence of coal mining. In this area reclaimed mines become wounds that are healing within the natural oak forest matrix. This healing process will be strongly determined by interactions between the forest edge and the new herbaceous patch (the mine) and it will be influenced by the shape of this new patch. In this context, it is possible to value the influence of the forest edge shape in forest expansion and in woody species colonization. To that purpose, woody species colonization intensity and browsing traces were measured in three areas affected by coal mining 15 years before sampling, differentiating forest-mine edge shapes in three groups: concave, convex or straight edges. The results obtained suggest that reclaimed coal mines are colonized from the forest edge by relatively not many woody species. Moreover, colonization intensity decreases as distance to the forest edge increases and differs depending on edge shape (being more intense in concave edges than in convex edges). Finally, the highest browsing intensity and frequency is concentrated in the surroundings of the forest edge, but it is higher in convex and not in concave forest edges, as we could think. The presence of livestock, which usually stays away from the forest, is likely responsible for these unexpected results. In conclusion, this study suggests that taking advantage of ecotone location in the landscape and modifying ecotone shape, we could cooperate with nature in its own recovery.

157 Restoration and management of calcareous grasslands: ss there a trade-off between species diversity of cryptogams and vascular plants?

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In calcareous grasslands, vascular plants are usually used as target species for the evaluation of restoration success. Although vascular plants account for most of the plant-species diversity in calcareous grasslands, bryophytes and lichens also form vital parts of plant communities, in terms of species diversity and vegetation cover. We investigated if cryptogams and vascular plants differ in their response to restoration and management measures and how these plant groups interact.

A seeding experiment on topsoil-removal sites showed that even a shallow bryophyte layer can reduce vascular plant germination and establishment of seedlings. On sites without topsoil removal, in contrast, establishment of xerophytic mosses was hampered due to shading by vascular plants. Our results indicate that different restoration and management measures favour certain plant groups, often at the cost of other groups, due to differences in the competitive abilities of plant groups. Topsoil removal changes the edaphic conditions in favour of cryptogams and xerophytic vascular plants.

Xerophytic cryptogam communities, consisting mainly of acrocarpous mosses and epigaeic lichens, can be successfully transferred by raked cryptogam material from species-rich sites. In contrast, the strewing of diaspore-containing hay favours mainly vascular plants and pleurocarpous mosses at the cost of rare acrocarpous mosses.

Our results indicate that species richness of vascular plants characteristic for calcareous grasslands is high in calcareous grasslands restored by transfer of hay or raking material, but still lower than in ancient grasslands. Pleurocarpous mosses were common in all examined areas, whereas acrocarpous mosses and lichens were most abundant on topsoil removal sites.

158 Restoration assessment of calcareous grasslands in Belgium: soil conditions and floristic diversity

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Calcareous grasslands are considered as biodiversity hotspots in Europe due to their high diversity in both plant and animal species. As in many European countries, Belgian calcareous grasslands suffered a high

decline during the past decades. As a consequence, different actions were launched in the country as early as 1990 to restore calcareous grasslands from oak coppices and pine forests. The aim of this study was to provide an evaluation of the restoration success. First, the restoration of soil conditions was studied by comparing soil samples from forests, restored grasslands (3 age classes) and control grasslands (12 sites ; 150 samples). Those analysis revealed a slight nitrogen impoverishment in woodlands that did not persist in restored grasslands. We also observed a slowing down of the soil dynamics (higher C/N and Fe concentration; lower pH) in woodlands and recent restorations, which was partially resorbed in older restorations. As a second step, we assessed the success of restoration in terms of floristic composition. Floristic relevés were taken at the same sites than soil samples (12 sites ; 240 relevés). We found that the older a restoration was, the closer its floristic composition and vegetation structure were from control grasslands. Nevertheless, numerous differences still subsist after 15 years (lower species richness, lower proportion of typical species, higher shrubs and social grasses cover, lower bare soil cover). Moreover a few rare species did not colonise restored grasslands despite the presence of neighbouring seed sources.

159 Restoration of fallow dry grasslands in cooperation with local farmers

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The upper Saale river valley (Saxony-Anhalt) harbours two important Natura2000 sites with sub-pannonic steppic grasslands, semi-natural dry grasslands on calcareous substrates, and siliceous rocks with pioneer vegetation. A more than thousand-year-old tradition of migratory herding of sheep and goats in combination with varying geomorphology and edaphic conditions resulted in attractive mosaics of these habitat types. After the political change in the former GDR sheep breeding became inefficient and declined rapidly, whereas goat breeding decreased already in the middle of the last century. Currently almost all dry grasslands on the scarps of the river valley are encroached. Manual removal of the shrubs on steep slopes is not only expensive but must be repeated in relatively short intervals because of their fast re-growth. Moreover, the lack of grazing led to unwanted dominance of grass species. Therefore a model project with five permanently fenced pastures for goat grazing was started in 2006. In contrast to migratory herding labour costs for this grazing model are much lower and therefore local farmers were willing to resume goat breeding. Already the first grazing period resulted in a successful reduction of woody plants as well as of grasses (predominantly *Brachypodium pinnatum*) and litter layer, whereas herbs benefited from that development. Therefore we conclude that goat grazing within permanently fenced pastures is an effective tool for shrub clearance and enhancing of biodiversity on steep slopes. However, further scientific monitoring is needed to guarantee the successful development of the habitat types and to prevent overgrazing.

160 Ecological restoration of species-rich calcareous grasslands in the Netherlands: perspectives and constraints

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Calcareous grasslands are potentially one of the most species-rich ecosystems in the Netherlands. Due to their high biodiversity, they are integrated in the EU Natura 2000 network and are included in the appendix of the Habitat directive. These grasslands were once abundant as common grazing lands, but in the first half of the twentieth century there was a strong decline in number and surface area due to changing land-use practices.

To enable their long-term conservation, the small patches of calcareous grasslands that are left should be managed carefully. Furthermore, these remnants should be enlarged and, if possible, connected with each other. Therefore, the recreation of species-rich calcareous grassland out of intensively used agricultural grasslands is of main importance. As calcareous grasslands were formerly nutrient limited, the removal of nutrients plays a central role in this process. Here we present a) the results of more than 25 years of cutting with removal of the hay in a permanent plot study in a formerly fertilised grassland, and b) the impacts of sod cutting in combination with hay introduction in a 4-year restoration experiment. It became obvious that long-term cutting of the vegetation is effective to reinstate a typical calcareous grassland vegetation, although the after effects of high P inputs were still present after more than 25 years. After highly intense agricultural use, the restoration of a typical grassland can be best reached using sod cutting of the P-enriched topsoil in combination with the introduction of hay from a species-rich site.

161 What reference ecosystem for semi-natural Mediterranean dry grassland restoration?

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La Crau, located in Southern France, is at present a pseudo-steppe with a high ecological value (NATURA 2000 habitat types 6220). Shrubs and trees are rare on this very constrained ecosystem and restoration in the plain is always aimed towards pseudo-steppe, an alternative ecosystem supposedly resulting from traditional sheep grazing and climate. The original ecosystem is not known, we therefore tested limiting factors which could be at the origin of this absence of natural reforestation by transplanting two tree species (*Pinus halepensis* and *Quercus ilex*) and one scrub species (*Cistus monspeliensis*) of Mediterranean sclerophyllous forests (NATURA 2000 habitat types 9340). The impacts of drought and grazing were tested in a multifactorial in situ experiment. After collection of seeds around the area, seedlings have been cultivated in pots in a nursery for one year before their transplantation in autumn 2006. In three replicated sites, two treatments were applied (i) prevention of sheep grazing on trees by individual enclosures; (ii) irrigation of trees to lower Mediterranean summer drought. In autumn 2007, the first results showed a significant effect of sheep grazing in spring and of drought in summer on tree mortality. *Q. ilex* was significantly more resistant to sheep grazing than *P. halepensis* and *C. monspeliensis* which were more resistant to the drought than *Quercus Ilex*. Thus the absence of natural tree colonisation in the pseudo-steppe area could be explained by the addition of these two limiting factors but our results need to be validated in the next years by taking into account the strong variability of the mean annual rainfall.

162 Differences and similarities in road verge and pasture vegetation – The effect of management

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Semi-natural, dry grasslands like pastures and meadows represent great nature values due to vegetation composition and species richness, but at present they are at great risk throughout Europe due to land use changes. Concurrently to these changes, certain grassland habitats – road verges – increase. Road verge vegetation may resemble semi-natural grassland vegetation given appropriate management regimes. We studied the effect over four years of various management regimes on the vegetation of three road verges and three closely situated grasslands (presently used as pastures) in a small-scale agricultural landscape of western Norway. The road verges regimes included no treatment, mowing once or twice a year with or without hay removal. The pastures were spring- and autumn grazed with or without annual mowing and varying intensity of raking.

Bray-Curtis dissimilarity index indicated that all management regimes led to changes in vegetation composition over the years, and that the annual successional rates were even between regimes. However, we observed no distinct vegetation response patterns to the applied regimes along underlying environmental gradients interpreted by ordination. These two methods reveal different aspects of vegetation change and, hence, they should be used in concert. Our results indicate that the short-time resistance of road verge and pasture vegetation to changes in management regime is rather high.

163 Large river restoration: water framework directive versus stakeholder interests Schabuss M.

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Man induced alterations through impoundment and regulation represent a major threat to river systems world-wide. These impacts affect the "ecological services" of large river systems as drinking water supply, flood protection and biodiversity reserve for the future. Hence, river restoration has become a global issue in terms of geomorphology, hydrology and ecology. River managers are increasingly seeking the cooperation of these sciences to improve degraded waterways within small to large scale river restoration projects.

River restoration programmes have to be coordinated with- and adapted to the interests of the various stakeholders (nature conservation, navigation, flood protection and drinking water supply, etc.) and the planned measures have to accord to the Water Framework Directive. Experiences from current planning processes of large European rivers have shown that through an intensive discussion of the different parties,

mutual solutions and win – win situations can be elaborated through an adaptive combination of stakeholder associated engineering measures (e.g. for inland navigation) with ecological compensatory measures. The conversion of local compromises to an international scale, however, needs an international harmonization of the stakeholder's requirements through an adaptive and innovative approach. Therefore innovations in navigation technology, river engineering and life sciences have to be applied to secure the essential "ecological services" of the large river systems. Transboundary institutions like ICPDR at the Danube provide suitable platforms to evolve such a process. The main aims of the session are to define avenues for an integrated approach and initiate a broader discussion on joint protocols and guidelines for large river management.

164 Large river restoration: concepts & experiences from the Danube Major regulation schemes and the construction of hydropower dams have strongly reduced the ecological integrity and thereby the ecological services of river-floodplain systems

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Over the past 10 years a sound conceptual basis has been developed for understanding functional processes and biodiversity patterns of large rivers. It is well understood that the key factors are the flood-controlled geomorphologic processes which create the characteristic patch dynamics, spatial heterogeneity, the mosaic structure of densely packed ecotones and patterns of successions over a range of scales. The ecological significance of a dynamic habitat equilibrium in floodplains, as expressed in disturbance and succession theory, is a continuous rejuvenescence process. In turn, these provide the habitat diversity and the specific habitat conditions for characteristic floodplain species and result in high levels of local species richness, habitat diversity and between-habitat differences. Regulation schemes and the construction of dams have strongly reduced the ecological integrity and thereby the ecological services of river-floodplain systems. The scenarios, possibilities and constraints for restoration differ strongly according to the geo-morphological setting, the degree of anthropogenic changes, constraints set by stakeholders, public interest and political awareness. In the free-flowing Austrian part of the Danube, three restoration programs were executed between 1997 and 2005. They formed pioneer steps in river-floodplain integration and mitigation of riparian inshore zones. Two comprehensive programs are in the starting phase after 3 years of intensive and integrative planning: 1) the "Integrated River Engineering Project" for the free-flowing, 45 km long section between Vienna and Bratislava and 2) the "Flood Control and Conservation Project" of the urban floodplains at Vienna. These two programs offer a broad range of conditions with regard to the deviation from historical conditions and the envisaged ecological goals.

Restoration requires well-defined objectives. A prerequisite is to refer to the original conditions prior to major engineering as a reference standard.

For their application we propose to follow a hierarchical cause-effect chain: key factors are hydrology and bed-load transport. The resulting geomorphic processes lead to a dynamic equilibrium of habitat composition, turnover and connectivity. This in turn sets the framework for characteristic ecological processes and biodiversity. The success or failure of restoration procedures requires careful evaluation by well-defined interdisciplinary monitoring programs. The present contribution synthesises recent developments in large river restoration and management issues based on experience gained along the Danube.

165 A comprehensive monitoring concept for a large river restoration project on the Austrian Danube Large river restoration: concepts & experiences from the Danube

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This paper outlines the conceptual framework, the principal structure and integrative approach of a monitoring concept developed for the assessment of the "Integrated River Engineering Project" on the Austrian Danube. As fluvial dynamics proved to be the key factor for structural and biological diversity in large river systems, the ecological aim of this large scale restoration project is the promotion of hydro-morphological processes. The implementation of the project over the entire length of approximately 50 river kilometres will be carried out in five successive phases. A long-term monitoring program accompanies and routes the progress of the engineering measures in a stepwise manner through an application of key- abiotic and biotic- indicators. All biotic and abiotic monitoring results of each project step will be integrated and

assessed to adjust the measures of the following phase. Hence, this monitoring concept must not be seen as a final, fixed programme but as a constantly evolving process. Over the past 10 years a sound conceptual basis has been developed for understanding functional processes and biodiversity patterns of large rivers. It is well understood that the key factors are the flood-controlled geomorphologic processes which create the characteristic patch dynamics, spatial heterogeneity, the mosaic structure of densely packed ecotones and patterns of successions over a range of scales. The ecological significance of a dynamic habitat equilibrium in floodplains, as expressed in disturbance and succession theory, is a continuous rejuvenescence process. In turn, these provide the habitat diversity and the specific habitat conditions for characteristic floodplain species and result in high levels of local species richness, habitat diversity and between-habitat differences

166 Considerations to reduce environmental impacts of vessels

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PIANC InCom Working Group 27 has been established to identify, quantify and predict operation-related impacts of inland navigation to minimize and mitigate potential impacts and to provide an environmental sustainable waterway system. The study followed two approaches. The technical "top down" approach covered direct vessel effects such as stranding of fish larvae or detachment of invertebrates due to ship induced water level fluctuation, as well as indirect effects like ship induced turbidity. An impact cascade has been developed providing tolerance thresholds for relevant impacts. The ecological "bottom up" approach covered major properties and requirements of aquatic communities of characteristic water body types. Characteristic groups of aquatic and semi-aquatic organisms have been studied to taxa-specifically derive most relevant impacts. This allowed identifying which kind of impact should be addressed and to which level in a specific waterway.

Both approaches together served as "Ecological Relevance Check" (ERC) to assess ecological risks caused by shipping. ECR helped to identify the most important impacts and their possible mitigation. Detailed knowledge about operation-related physical impacts of inland navigation and how they might affect aquatic biota are substantial prerequisites to assess whether environmental related impacts are significant and which mitigation measures will be appropriate. A check list of adequate mitigation measures is given in the full report. Proper adoption of the mitigation measures suggested will sustain existing uses and improve the ecological quality of the waterways. Thus, the study is a major contribution to maintain and support an environmentally sound inland water transport.

167 Ecological rehabilitation of the large rivers Rhine and Meuse in the Netherlands

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The stretches of large rivers Rhine and Meuse in the Netherlands do not have the good ecological status according to the requirements of the EU Water Framework Directive. The water quality has improved significantly in recent decades. It are much more the morphological and to a lesser extent hydrological adjustments that constrain ecological status and improvement. The morphological changes (embankments, weirs, groynes, riprap) support vital socio-economic functions such as flood protection, navigation, freshwater supply and are thus considered irreversible. Both rivers are therefore classified as heavily modified water bodies. How much room thus this allow for ecological improvement? An overview will be given of ecological side-effects of the hydromorphological modifications, the mitigation and rehabilitation measures which reduce these side-effects and the expected improvement in ecological status (fish, benthic invertebrates, aquatic flora) based on the draft programme of measures. Special emphasis from a catchment perspective will be given to the migratory fish species native to the Rhine and Meuse and listed on the Habitats Directive.

168 Macro-invertebrate sampling in Large Rivers - Implications for assessing the ecological status according to the WFD

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Benthic invertebrates are used to assess the ecological status of running waters according to the Water Framework Directive (WFD; European Union 2000). For the collection of macro-invertebrates a number of

well described methods exist. Sampling in small streams and rivers rarely causes any problems. Difficulties arise - i.e. sampling effort increases - when samples from the gravel bottom of deep rivers have to be collected. Because sampling the river bottom of large rivers is extremely costly and laborious, investigations of the benthic fauna but also official monitoring programs are often restricted to margin habitats.

In our talk we show that the faunal composition of gravel bars and deeper channel sections show pronounced differences demonstrating the necessity of including also the main channel when the benthic biota of large deep gravel-bed rivers are assessed. The underlying reason for this finding is that the driving factors affecting the composition of benthic invertebrate communities differ in channel habitats and near bank habitats.

While deep channel samples allow the detection of the impact of impoundments and ship propellers, near bank samples are suitable in identifying human induced flow alterations.

In conclusion we show the ability of benthic invertebrates to indicate human-induced hydro-morphological changes (e.g. flow alterations, navigation, impoundments) in large rivers and give recommendations for sampling methods and the timing of sampling.

169 Assessment of ecological reference conditions and delineation of environmental objectives for the restoration of the Szigetköz floodplain of the Danube

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The Szigetköz is the right side of the extensive alluvial cone stretching from Rajka to Gönyü (r. km 1850-1794) at the Hungarian-Slovak section of the Danube. Its fluvial system possesses a high natural value concerning its habitat structure and biodiversity. The floodplain has been affected by the operation of the Gabčíkovo hydroelectric power plant since 1992. Despite of several mitigation measures environmental degradation is observable in the impacted river section. Negotiations between Hungary and Slovakia confirmed the necessity of completion of a Strategic Environmental Analysis (SEA) according to the Water Framework Directive and a preceding project was initiated preparing a proposal for the SEA.

The general environmental aim of the restoration of the Szigetköz floodplain is to remodify the landscape dynamics and habitat structure for revitalization of ecological functions as near as possible to the pristine state, accepting irreversible changes and constraints. In the assessment of reference conditions and delineation of the environmental objectives the following cause-effect chain was taken up: 1) hydrological and hydromorphological dynamics, 2) landscape structure, 3) biota, biodiversity and ecological functions. Pre-regulation habitat distribution was revealed in historical analysis which key points were old maps, archive documents and hydrological data series. Past data of fishery and changes of fish fauna indicated some alterations of environmental processes. The environmental objectives determine a quantitative setting of benchmarks associated with a qualitative description of ecological processes of the river system and establish criteria for assessment of scenarios of rehabilitation measures.

170 Socio-economic benefits of ecosystem restoration and nature conservation: empirical evidence that investing in nature pays

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Scientific evidence is mounting that sustainable, multi-functional use of natural ecosystems provides higher net-benefits than the conversion of ecosystems into single-function use (eg. sustainable forestry versus clear-cut or mangrove-conservation versus shrimp-farm development).

Unfortunately, many ecosystems have already been converted and restoring them into a more productive, multi-functional state (in so far that is possible) requires much time, energy and above all: money.

Since most of the benefits of natural ecosystems are still not recognized in conventional economic theory and practice, many people are reluctant to invest in ecosystem conservation and restoration. Curiously, those same people do not seem to have a problem with paying for all the so-called "externalities" caused by ecosystem degradation (including economic and health effects of erosion, water and air-pollution, etc.).

This presentation will provide an overview of the full socio-economic value of natural ecosystems and discuss how to turn at least part of this value into real money based on payments, or other incentive-mechanisms, for conservation, restoration and sustainable use of these ecosystems and their services.

It is argued that if all factors are taken into account properly, in most cases economic benefits generated by sustainable use of ecosystem services (such as water regulation, carbon sequestration, air- and water-purification, natural resources, recreational benefits, aesthetic and spiritual values, etc.) exceed the costs of investing in ecosystem restoration and conservation.

171 The Century of Restoration: Seven global trends that will dramatically increase funding and public support for ecological restoration

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Storm Cunningham's new book, *reWealth!*, was published in May of this year by McGraw-Hill. It has three sections: theory, practice, and stories. All involve integrated approaches to designing, funding, and implementing the restoration of natural resources, and the regeneration of human communities. Seven global trends emerged from this study, all of which will have a profound impact on the ability to design, finance, and implement ecological restoration projects and programs. In this keynote, Storm will reveal the European, African, and North American sources of these insights, and how they will likely affect ecological restoration worldwide. Later in the program, Storm will lead a workshop that reveals specific practices designed to harness the power of these trends.

172 Conservation objectives revisited: how to deal with changing systems and increased knowledge?

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Recently, a set of Conservation Objectives (CO's) has been elaborated for the Schelde estuary. In order to deal with the dynamic nature of the estuarine system, the concept of carrying capacity was applied to quantify system scale habitat needs. As an example it is shown how the concept of carrying capacity was used to determine a CO of 500 ha mudflat on top of the actual area. Ecological modelling of water quality and primary production was a substantial element in this quantification. In the meantime, it has been shown that the Schelde is changing in a way that the recent developments of primary production cannot be fully explained. Factors such as ammonium -, metal - or other forms of intoxication, manganese limitation, physiologic aspects, indicate plausible hypotheses about knowledge that has been omitted in the modelling. The question arises how this new knowledge would affect the outcome of CO quantification. The option of change is imbedded in the framework of the carrying capacity approach, so that the concept proves solid enough to deal with evolution of knowledge as well as changes in the system. It is demonstrated that, although science can always produce a best estimate of conservation needs, policy makers should be aware that, even if expressed in a clear way, numbers can change. But what can the consequences be for the often difficult restoration process with numerous interactions of stakeholders and policy makers?

173 The construction of a salt marsh in the Eastern Scheldt, the Netherlands

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The Eastern Scheldt is a tidal basin in the south-western part of the Netherlands. To prevent the area from flooding, during the 1980s a storm surge barrier was build, which has affected the hydromorfology and ecology of the Eastern Scheldt strongly. The surface area of salt marshes is reducing since the construction. The Dutch government wishes to restore salt marshes in the Eastern Scheldt and has indicated the Schelphoek as a favourable location to start a pilot. Aim of this pilot is to research the possibilities for successful salt marsh restoration in the Eastern Scheldt.

Before alternatives for restoring salt marshes in the Eastern Scheldt were formulated, the hydrodynamics, morphology and ecology of the Schelphoek area were studied. Using this information four alternatives were formulated. These four alternatives were studied in terms of effects on hydrodynamics and ecology, including the expected salt marsh development. Finally, there four alternatives were scored in a multi criteria analyses, which included the acquired salt marsh area, the quality of the salt marsh, effects on benthos and birds, the effects on the mussel cultivation areas in the neighbourhood, and the feasibility including dredging and operational consideration.

The multi criteria analyses showed the restoring a salt marsh in a part of the Schelphoek to be the most profitable option.

The implementation phase of the project is expected to start in the fall of 2008. A monitoring plans has been set up, including bathymetric surveys, flow and turbidity measurements and monitoring of vegetation, benthos and birds.

174 First results of intertidal habitat restoration at Lippenbroek (Belgium), a flood control area with a controlled reduced tide

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Many inter tidal areas, especially in estuaries, suffer from human pressure. They have been claimed for urban, agricultural or industrial expansion; remaining habitat is often degraded by pollution and altered hydrodynamics. Loss of valuable habitat results in loss of associated functions, from energy dissipation and mitigation of floods to recycling, removing and regulating nutrients. When considering restoration, managed realignment is not always an option, due to site characteristics, safety considerations or social acceptance. We present the first results of estuarine restoration in a flood control area with a controlled reduced tide. A well designed sluice system allows semi-diurnal exchange of water with the estuary, introducing a tidal regime similar to natural outerdike marshes. This set-up offers possibilities for tidal marsh restoration in combination with safety measures. It allows the introduction of a wide range of inundation frequencies in a polder with an elevation far below the estuarine mean high water level.

Two years of intensive monitoring on a pilot site demonstrate the potentials of this approach. After two year of implementation, former cropland is evolving towards an estuarine ecosystem. We observed sedimentation-erosion patterns comparable to natural marshes. The vegetation cover shows a succession from pioneer generalist to typical estuarine and wetland species, driven by the installed tidal variation. The same evolution, colonisation by typical estuarine and wetland species, was also observed for zoobenthos, fish and birds. Mass balance studies on the exchanged water volume during several tidal cycles illustrate the potential functions of CRT areas within the estuarine nutrient cycling.

175 Recovery of estuarine tidal mudflat sediments after hypoxia: the structuring role of macrofauna recolonization

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Estuarine tidal flat habitats are worldwide threatened by disturbances, often leading to benthic mortality of marine sediments (e.g. mass mortality during depleted oxygen concentrations as a result of eutrophication). Since macrobenthos plays an essential role in the functioning of tidal flat ecosystems through their bio-engineering capacities, this mortality can have far-reaching consequences. From a restoration point of view, it is therefore important to assess the driving factors of benthic community restoration and the associated effects on ecosystem functions.

To assess biogeochemical, granulometric and benthic community recovery after depleted oxygen bottom water concentrations, hypoxic sediments were created by covering tidal flat sediments along the Westerschelde estuary using plastic sheets.

Macrofauna recovery developed through different succession stages and was structured by tolerance, facilitation and inhibition models: early colonizers had either no effect or a positive effect on subsequent colonizers, while later succession species negatively affected the stable conditions created by the early colonizing tube-builders. Transitions between different stages were related to changes in environmental characteristics and biotic-environmental interactions (e.g. exploitation competition for food).

Nematode community -and biogeochemical recovery were related to macrobenthic succession. Dense polychaete tube aggregations and the development of a fresh diatom bloom, as a result of the low grazing pressure by surface deposit feeding macrofauna during the first stage, stabilized the sediment and thereby enhanced macrobenthic and nematode recruitment success. Bioturbation impact of later succession species increased oxygen input in the sediment, resulting in an enhanced nitrification, denitrification and energy use.

176 Have we witnessed a regime shift in the freshwater tidal reaches of the Schelde estuary?

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As in most estuaries, the freshwater tidal reaches of the Schelde estuary (a stretch of ~70 km) are far less investigated than the brackish and saline parts. Only from the mid 1990s this they were included in long term, systematic monitoring (OMES-project). The data shows that until the late 1990s the freshwater reaches suffered heavily from eutrophication, with average May-Sep oxygen concentrations only reaching 8% from saturation in 1996.

Since then, the situation has been rapidly changing. Average May-Sep oxygen concentrations more than quintupled, reaching 51% of saturation in 2007. From 2006 oversaturated oxygen concentrations are occasionally observed, caused by algal primary production. At the same time, average May-Sep chlorophyll a concentrations increased from 15 µg/l in 1996 to 178 µg/l in 2007. The new occurrence of diatom dominated blooms was accompanied by severe dissolved silica depletion periods of up to 4 months in 2004.

Although part of these changes can be attributed to increasing efforts of waste water treatment leading to a reduction of the load of organic matter and ammonia, the rapid nature is poorly understood. Clearly a pollution threshold has been passed. The resulting transition from a hyper-eutrophied estuary stretch with low algal biomass, dominated by heterotroph processes (high nutrient, low growth), to a situation dominated by autotroph processes (high nutrient, high growth) has characteristics of a regime shift. We hypothesise that inhibition of primary production and algal growth due to anoxia and toxic pollutants a decade ago, has been removed by improvement of water quality.

177 Tidal marsh modelling in the Schelde estuary to determine restoration potential of managed realignments

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The River Scheldt is a macrotidal estuary with a tidal reach up to 160km upstream and a salinity gradient including polyhaline to fresh water habitats. The estuary has been heavily influenced by anthropogenic pressures such as land reclamation, harbour expansion, dredging activities, embankments and urbanisation. As a consequence tidal mudflats and marshes deteriorate or disappear by submersion or erosion.

In the revised SIGMAplan 1400 hectares of managed realignments are planned along the whole salinity gradient to restore and strengthen the ecological functioning in the Scheldt estuary. Restoration sites are located according to the estimated potential for energy dissipation and nutrient (re)cycling. In order to predict development of tidal marsh habitats after implementation of the restoration measures the link between (a)biotic factors and habitat development in the current situation was investigated. Salinity and surface elevation in relation to tidal inundation factors (flooding frequency and duration) are the main key factors that determine the potential for tidal marsh development. Also management and biotic factors such as occurrence of more competitive species influence the present habitat distribution and species presence in tidal marshes of the Scheldt estuary.

Based on the main drivers, a predictive model for potential habitat development and species presence in new restoration areas is made for the different salinity zones and tidal tributaries of the Scheldt estuary. With these models the potentials for tidal marsh development in new de-embankments for the whole Scheldt estuary can be predicted, including Natura- 2000 habitats of the Atlantic salt marshes and meadows (13).

178 Integrated restoration programs: How to maximize long-term monetary and political support for ecological restoration at the community, regional, and national levels

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Storm Cunningham's keynote earlier in this conference revealed seven trends that will provide greatly increased funding and policy support for ecological restoration in the near future. While some benefits will derive automatically, project and program designers who consciously work to tap these trends will enjoy

enhanced support sooner, and to a greater degree. Cunningham's new book, *reWealth!* (McGraw-Hill, May 2008) documents seven "universal" tools designed to harness these trends. By "universal", he means that they are applicable in virtually any political or economic system, in both sparsely-populated rural and densely-populated urban areas, and in both industrial and lesser-developed nations. The insights are new but well-proven, based on his 6-year study of restoration project and regeneration program successes and failures worldwide. In this workshop, you'll discover three universal "renewal rules" for making decisions, and three universal "renewal processes" for creating solutions. You'll also learn of a spectacularly successful, universal "renewal model"—pioneered almost simultaneously in Spain and the U.S.—that effectively organized, sustains, and expands long-term, integrated efforts to revitalize the natural, built, and socioeconomic environments. Finally, this workshop will bring to light a financing tool that is fast gaining popularity—already generating tens of billions of dollars annually for community revitalization—but which has not yet been used to any significant degree for ecological restoration. Combining this tool with the valuation of ecosystem services could radically increase available funding for the regional restoration of ecosystems, commercial fisheries, and watersheds. This 2-hour workshop will be of value to those involved in both policy and practice.

179 Spider assemblages occurring on former agricultural land after top-soil removal in the Northern provinces of the Netherlands

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To restore heathland and low-productive grasslands in the northern provinces of The Netherlands arable land was bought by a nature conservation organisation. The major aim was to enlarge the remaining patches of these two semi-natural habitat types. To lower the nutrient content of these former agricultural lands the top-soil was removed and a low density year round grazing management was installed.

In 2002 seven of these newly created areas were sampled by means of pitfall traps together with the adjoining heathlands and nutrient poor grasslands, the target habitats of the nature restoration project.

The results of this sampling campaign reveal a successful recolonisation of several typical heathland species. However, so-called opportunistic spider species (i.e. species bound to highly dynamic environments) still occur in high abundance. These well-thriving opportunistic species seem to form source populations for the sink populations occurring in the nearby patches of old heathland.

Based on the presence and abundance of typical spiders of heathland and of nutrient poor grasslands on these restored patches recommendations are formulated for future restoration and management measures.

180 Habitat restoration for the endangered *Maculinea alcon* butterfly: effects of sod-cutting and liming on recolonisation

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The Alcon Blue butterfly (*Maculinea alcon*) is one of the flagship species of Northern Atlantic Wet Heaths with *Erica tetralix* (4010). The species is declining throughout Europe. In the Netherlands more than 50% of the populations have been lost since 1990. The main reasons for decline besides habitat loss and fragmentation are decreasing habitat quality through ongoing succession and acidification. Habitat restoration requires a small-scale approach because the butterfly depends both on the presence of the host plant *Gentiana pneumonanthe* during the early larval stages and *Myrmica* host ants during its subsequent development until adult emergence. Host plants need to be present within the activity radius of a few meters of the host ants. The problem for restoration is that host ants require established vegetation, whereas seedling establishment of gentians necessitates bare soil. We conducted a study of small-scale sod-cutting in combination with liming at 11 sites. After two years establishment of gentians was successful in most plots. After five years, flowering gentians were significantly more abundant than in control plots. Oviposition by Alcon Blue on flowering gentians was observed in 70% of the plots. This strongly suggests that small-scale sod-cutting can successfully contribute to the recovery of *M. alcon* populations.

181 Nature in defence: LIFE project DANAH

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LIFE project DANAH is a heath restoration project on military areas in Flanders for which the Ministry of Defence and the Agency for Nature and Forests join forces. DEFENCE and the Agency for Nature and Forests (ANB), a federal government and a regional government fighting together for one goal: **RESTORING NATURE IN MILITARY AREAS.**

Hence DANAH: Defence + ANB = Restoration of nature (**Natuurherstel**) in military areas

Military areas are undoubtedly of the utmost importance for the conservation of wildlife in Flanders. Heath landscapes have become increasingly rare. This unique mix of plants and animals deserves extra attention. Over a surface of close to 10.000 hectares a variety of heath restoration actions are taken, making LIFE project DANAH one of the largest heath restoration projects in Europe. But there is even more...

The situation in Flanders is unique and challenging at the same time. The military domains do not only carry a great military and natural value but also a great potential for the ever evolving society. Due to the fact that open spaces in the densely populated Flanders became ever more rare, the social pressure for recreational use of military domains increases. Merely restoring these habitats won't insure a durable solution nor for nature nor for society. Ignorance of social pressure is no solution.

We believe that the integration of the 3 different forms of land use (military - nature management - recreation) should ensure both good conditions for durable nature conservation and social acceptable solutions.

Combining military values and nature values is a challenge on its own but an obligatory first step to be taken in this process of integration. Only on the basis of these results is it possible to judge the demands for third party terrain use, with respect for military and natural needs. Such a mutual respect of both project partners through integration of military and natural values gives a solid basis to build on. Both partners can communicate to society with one voice. This is essential for durable results. Furthermore, both values should become comparable and the translation of each others jargon is essential. The products should be familiar for the end user.

The next step is the participation of social and governmental stakeholders. In cooperation with society durable solutions should be sought for. This also means a clear translation of the results to the broad public and where possible participation in the search for solutions.

In reality LIFE project DANAH is a very challenging project. Not only because of the project surface, the variety of nature management actions, the challenge to integrate different forms of land-use but mostly because of the pioneers role for nature management in Flanders. Good examples of integration of land-use are rare in a context of military training areas.

Now our project draws to a close, we would like to share our build-up experiences and instruments with a public of specialists and comparable projects with links to society.

What steps have we taken, what plans and commitments are made? Where did we succeed, struggle or even fail?

182 Possible mechanism for spontaneous establishment of *Calluna vulgaris* in a recently abandoned agricultural field

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In Western Europe, arable lands have been abandoned to increase the area of nature, such as *Calluna vulgaris*-dominated heathlands. However, the growth conditions, e.g. nutrient availability and lack of a phenolics-rich organic layer, on ex-arable sandy soils differ markedly from those of heathlands and will favour fast-growing plant species. Succession towards *Calluna*-dominated heathland is expected to take decades, unless intensive restoration management is applied. Here we report a possible mechanism to explain the occurrence of *Calluna* patches (0.7 – 2.0 m dia) in a 10 year abandoned agricultural field within a dominant vegetation of grasses and forbs. All roots sampled from the *Calluna* patches were colonized by ericoid mycorrhizal (ERM) - and other endomycorrhizal fungi. Both nitrogen mineralization of soil organic N and potential nitrogen mineralization (arginine ammonification) were much lower in soil under *Calluna* patches than in the rest of the ex-arable soil, although other soil characteristics did not differ. The nitrogen to phosphorus ratio in *Calluna* shoots was much greater than that in shoots of grasses and forbs, indicating that the latter were more N limited. The results indicate that the association with ERM fungi is probably providing the host with competitive superiority for nitrogen even in a mineral soil in the absence of litter layer. Our results suggest that the conversion from arable land into heathland may be accomplished by the immediate establishment of *Calluna* seedlings and ericoid mycorrhizal inoculum when agricultural activities are stopped. This needs to be tested in controlled experiments.

183 Evaluating experimental grassland and heath restoration on former agricultural fields using plant traits and indicator values

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In ecological restoration plant functional traits can be used to evaluate all kinds of restoration measures. Active seed transport is increasingly applied to overcome the main biotic bottle-neck in restoration: limitation in seed dispersal. We used plant functional traits together with abiotic indicator values to evaluate a hay transfer experiment in order to restore (wet) grasslands and heaths on former agricultural fields.

In 2002 we set up an experiment at three sites in the restoration area Midden Groningen (1850 hectares, The Netherlands). In here we transferred once hay of 10 vegetation types, which were expected to establish given the abiotic conditions, to 640 3 m x 3 m plots. Several Natura 2000 habitat types were included. Transfer success was determined in relation to several abiotic variables: 1) germination conditions (bare soil, top soil removal; open sward, rotorvated once and intact sward, mown once), 2) water regime (no flooding, rainwater flooding and surface water flooding) and 3) soil type (sand, peat and clay).

Results showed that overall transfer success differed much between the vegetation types. This suggest differences in feasibility, but also the need of additional hay transfers. Top soil removal increased transfer success; flooding had almost no effect whilst peat had the highest number of established species. How these results will impact on the plant functional traits and abiotic indicator values we used will be shown and discussed.

184 Impacts of grazing by cattle and rabbits on the restoration of dry heathland on improved farmland

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The restoration of heathland on land that has been converted to improved farmland requires the successful germination and growth of a new ericaceous cover. Grazing by domestic and wild mammals is a key method for managing heathlands but it is important to know at what stage new heathland should be grazed. Fencing is expensive and has other limitations when used in landscape scale restoration or on land with public access. However, it may be necessary if newly establishing heathland is at risk of damage. Conversely, grazers may facilitate the early growth of ericaceous species by preferentially grazing on competing grasses. Here we test the effect of excluding cattle and rabbits from heathland created on improved farmland using soil removal and soil acidification techniques. Development of heathland was most successful when both rabbits and cattle were excluded, particularly when heathland was restored by soil acidification. Exclusion of just cattle, the cheaper fencing option, significantly improved the establishment of heathland only on the soil stripped plots because rabbits grazed young *Calluna vulgaris* growing on soil acidified plots more than that growing on soil stripped plots. We discuss possible reasons for this and practical consequences for restoration of heathlands in grassland-heathland mosaics managed by grazing. We conclude that when heathland is created by soil acidification, success is greatly improved by excluding both cattle and rabbits for a few years until the sward closes. When heathland is created by soil stripping we suggest that the best cost-benefit result is achieved by excluding only cattle.

185 Assessment of conservation and restoration potential of damaged peatbogs in Central Russia

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Peat bogs are one of the most characteristic ecosystems in Central Russian landscape. Because of peat mining and transformation of peat bogs into agricultural land after drainage, suitable habitats for several characteristic species now show a very fragmented pattern. The potentials for viable populations of characteristic species were assessed using a decision support system Landscape Ecological Analysis and Rules for the Configuration of Habitat (LARCH). Two butterfly species (*Coenonympha hero*, *Polyommatus optilete*) and three bird species (*Lanius excubitor*, *Picoides trydactylus* and *Grus grus*) show low potential for viable populations and four butterfly species (*Arichana melanaria*, *Colias palaeno*, *Euphydryas maturna*, *Argynnis laodice*) and one bird species (*Tringa nebularia*) medium potential. For the other seven species (butterflies: *Coenonympha tullia*, *Plebejus idas*, *Boloria euphrosyne*; birds: *Tetrao urogallus*, *T.tetrix*, *Motacilla citreola*,

Larus canus) the potential for viable populations is ensured under almost all conditions. To maintain and increase potential for viable populations of characteristic species of peat bogs both protection and restoration are important measures. To identify sites where restoration will be most effective, all moderately damaged peat bogs are changed to undisturbed. The results of the analysis with LARCH showed a significant increase of the potential for any species, especially butterflies. With these results it is indicated which peat bogs also needed protection.

186 Large scale network and habitat restoration actions for peatbogs and wetlands in Southern Belgium: planning and first results of scientific monitoring

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Since 2002, different Life projects have been launched for the large scale restoration of peat and wet land habitats in Southern Belgium. Working on more than 15.000 ha of various landscape including peatbogs, wet heathland, spruce plantations on peat and alluvial soils, ..., they should normally allow a complete restoration of more than 2.500 ha of habitats and the creation of more than 1.500 ha of natural reserves, i.e. an increase of more 15%.

We will present a first analysis of how ecological network have been restored on local scale and regional scale. Then, we will tackle with a gap analysis what should still be done in high Ardenne. First result of scientific monitoring of the regional diversity will be presented. This will be followed by a large overview of habitat rehabilitation techniques that were implemented and what kind of habitat restoration trajectories are observed on several places.

187 Compendium of UK peatland restoration projects - Experience and lessons learned

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The compendium of UK peat restoration and management projects collated information of over 100 projects in upland and lowland blanket bogs and mires in England, Wales, Scotland and N-Ireland. There were three main methodological components; a questionnaire/database, conference and review of existing literature and knowledge.

The objectives were to

1. Produce a database of past, current and planned peat restoration and management projects.
2. Evaluate the current state of knowledge of peatland restoration management by reviewing current management practice as well as existing and ongoing research into peat restoration and management projects in the UK.
3. Assess the levels of success and failure of current peat restoration and management projects.
4. Assess the motivation, long-term goals and plans behind the projects and any adaptation measures in response to these during the project duration.
5. Identify the technical, logistical, site access, financial and project management difficulties that need to be overcome in the use of successful restoration and management techniques.
6. Collate details on the costs involved in implementing the restoration and management techniques associated with each project.

The process was highly informing and led to a formation of a new peatland network and a strengthening of the knowledge exchange between practitioners as well as between practice and policy.

188 Conservation and restoration of Baltic raised bogs in Pomerania, Poland

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LIFE-Nature funded project (LIFE04NAT/PL/000208 PLBALTBOGS) was implemented by Naturalists Club Poland in 2003-2007, focused on 24 sites in North-Western Poland. The project objective was to preserve or restore favourable conservation status of the active raised bogs and pine and birch bog forests forming the Baltic type raised bog complexes in their major concentration area in Poland.

The following activities were taken under this Project:

- making natural inventory of the relevant sites, including ecological and hydrological survey on them;
- development of the management plans;
- locking water outflow from bogs with use of wooden and earth dams and partial filling of the ditches;
- elimination of birch and pine invasion from the raised bog peatmoss and heath areas that grew on the desiccated bogs;
- elimination of the alien species (spruce) from pine and birch bog forest;
- experimental transplantation of peat mosses into peat post-excavation sites;
- public communication with the local communities and other stakeholders, including meetings, publication materials, and leaflets on bogs, etc.; construction of the tourism-educational infrastructure;

For the some of the project sites, the conservation measures was implemented "in the last minute", stopping almost completed degradation. For some bogs, results of blocking water outflow were almost immediate and evident; for more degraded, afforested sites, results are not so clear and probably significant improving of the conservation status needs much more time. Former recognition of bog's stratigraphy and hydrology was crucial for successful conservation actions planning and implementing.

189 Restoring NATURA 2000 habitats on severely degraded peatlands

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Small patches of protected habitats of fens and fen meadows are often separated by severely degraded meadows. Restoration of degraded fens may help to improve and extend the N2000 habitats and create connections between core areas.

The restoration prospects depend upon the hydrological conditions and the landscape settings of the peatland and its surroundings. Restoring fen meadows on severely degraded peatland is possible and can be achieved by combining the methods of top soil removal, seed transfer and improvement of hydrological conditions.

There are several biotic constraints in restoring the fen meadows on severely degraded peatlands. The past developments in the vegetation cause shifts in the life strategies, trait combinations and seed bank types during degradation. This could have implications on the restoration prospects, as may increase the risk for (negative) legacy effects.

The soil seed bank of severely degraded meadows could provide propagules for a re-development of the target vegetation. However, only persistent seeds of unwanted species are present in the soil, even in deep soil layers.

The seed production, which is much higher in degraded meadows than in fens or fen meadows, might cause problems in restoration, for example due to stochastic effects. A base-line assumption is that a community very similar to a donor meadow will develop after hay transfer. When the similarity between the vegetation composition and the seed composition is low and the number of transferred seeds is small, compared to the influx of non-target seeds, this could not be the case.

Topsoil removal combined with hay transfer gives the best prospects for target vegetation re-development. Hay transfer accelerated the re-establishment of target vegetation, but likely, it has more complex effects than just delivering seeds of target species. The first years of vegetation development and the timing of applying restoration measures might be crucial for success.

190 Raised bogs rehabilitation on the Hautes-Fagnes plateau (East Belgium). An assessment after 15 years of management trials

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Raised bogs are ecosystems of an exceptional biological value that formerly covered ca. 2,000 ha in the Ardenne massif. Today nearly all raised bogs are damaged by the consequences of former marginal peat extraction, drainage and spruce plantation. The (sub)intact parts that are still peat accumulating cover less than 200 ha.

An experimental management program for raised bogs restoration has been implemented since 1993 in the Hautes-Fagnes State Nature Reserve. The following approaches have been tested: (1) trees cutting or milling; (2) elevation of water level by ditch blocking; (3) restoration of inactive areas by sculpting of the peat surface to a level close to the mean perched water mound or by rotovating vegetation and subsoil; (4) renaturation of heavily cut-over bogs by inundation using peat, clay or PVC dams and by re-modelling of peat surface to form lagoons; (5) sheep grazing.

First results of this program are: (1) trees cutting needs to be repeated periodically; (2) ditch blocking doesn't lead neither to rewet large surfaces of peatbogs nor to restore conditions for establishment of bog species, except perhaps very locally; (3) natural colonisation of sculpted peat surface by bog vegetation occurs but is slow; Sphagnum species and ericaceous shrubs may establish from diaspore bank but appropriate human planting gives immediate good results; (4) inundation quickly re-creates fen or transitional mire vegetation; (5) Some bogs species progressively re-appear after grazing.

A large-scale restoration program is currently based on these local results. It concerns four LIFE-Nature projects in the Ardenne massif.

191 Transboundary conservation and restoration efforts to preserve the strongly endangered endemic species *Gentianella bohemica*

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Gentianella bohemica is an endemic species of the bohemian massive with scattered populations in the Czech Republic, Austria, and Germany. It is listed in Annex II and IV of the habitats directive. In Germany, strong efforts to optimize conservation management were made since the 1990ies, but the dramatic population decline could not be stopped. Therefore, an international cooperation was initiated by the Bavarian Environment Agency incorporating research institutes and botanical gardens as well as conservation practitioners and local authorities. Bringing together these different stakeholders proved to be an important clue for first successes in the conservation of this strongly endangered species. Research projects can be quickly adjusted to the needs of species management and recommendations can immediately be put into practice, providing a very critical test for research conclusions.

The cooperation across the borders proved to be essential for the conservation of this species restricted to the border triangle, no country can solve the problems on its own. Currently, first research data are accumulated on the effects of management on germination and seedling establishment in existing and newly restored populations, genetic isolation and fitness, inbreeding and outbreeding, effects of weather conditions on population trends, mycorrhiza, pollination, soil acidification etc.

The cooperation project on *Gentianella bohemica* is an example for putting together different views and achieving more than just the addition of the results. We therefore recommend to researchers, conservation authorities and practitioners to seek closer contact to each other even across borders, especially in projects on conservation and restoration of Natura 2000 habitats and species.

192 Fire – A management possibility for *Mantis religiosa* (Mantodea)?

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Mantis religiosa is widespread in the Mediterranean region and reaches its northwestern distribution border in southwest Germany. One of the strongholds of the endangered species is the Kaiserstuhl region near Freiburg. Open vineyard slopes are typical habitats of this species. Due to abandonment of mowing many

of these open habitats are endangered by succession and shrub encroachment. In 2005 we studied the direct effects of wintery burning of vineyard slopes in the Kaiserstuhl on oothecae of *Mantis religiosa*. Furthermore, recolonisation of the slopes after burning by nymphs and adults were ascertained. Hatching success of nymphs from oothecae on burnt sites was half as high as on fallow slopes. But densities of nymphs, adults and oothecae were higher in the following growing season on most burnt sites through immigration of nymphs and adults. Although wintery burning affects oothecae negatively rotational use of fire should promote *Mantis religiosa* populations due to creation of suitable habitat.

193 Does prescribed fire mean a threat to the rare satyrine butterfly *Hipparchia fagi*? Larval-habitat preferences give the answer

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The ecological effects of fire management, especially regarding arthropods, are poorly investigated. Burning in winter was assumed to pose a threat to butterfly species hibernating as larvae. To assess the impact of prescribed burning in winter on population viability, we analysed larval habitat preferences of the highly endangered, xero-thermophilous butterfly species *Hipparchia fagi* in vineyards of the Kaiserstuhl region in southern Germany. Microhabitat preference analyses for adult larvae and egg-laying females revealed a preference of *H. fagi* for *Bromus erectus*-dominated communities with sparse vegetation cover and a distinct tuft-growth of the host plant *B. erectus* on microclimatically benefited slopes. We explain the clear preference for *B. erectus* by structural vegetation characteristics. The grass tufts offer a suitable climatically buffered living space for the larvae. Concurrently, hot and dry microsites with high solar radiation provide good conditions for egg-deposition and development. As the larval habitat was sparsely vegetated, fire management was not applicable and therefore currently not affecting the populations. We think it is conceivable that *H. fagi*, occurring here at its northern range limit, might expand its larval and oviposition habitat into denser, currently burned *B. erectus*-stands in the course of global warming. A change in habitat preferences would necessitate a re-evaluation of management options.

194 Using small areas covered with stones and grazing exclusion to restore ground-active beetle assemblages in dry grasslands

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The dry grasslands of La Crau (Southern France) have experienced a drastic decline due to intensive agriculture like other dry grasslands of Europe since World War II. Between 1960 and 1985, cereal and melon farming has led to a degradation of the original habitat quality of the pseudo-steppe vegetation (NATURA 2000 habitat types 6220) and to a shift of their original beetle assemblages. With the aim of managing and restoring this valuable ecosystem, we have manipulated ecological factors (intensity of sheep grazing and stone cover) which may play a role in the organization of ground-active beetle assemblages. We collected pitfall trap data from 96 sample points across the study area. Stone cover restoration (which were removed during intensive agricultural practices) of randomized small areas of 2.25 m² associated with two grazing regimes (grazing or no grazing) was tested in order to recreate a high habitat quality in former cultivated fields. After 4 years, the absence of grazing and the restoration of the stone cover on the former cultivated field significantly improved beetle abundance and increased beetle richness. It appears that the restoration of the original 50% stone cover associated with an exclusion of grazing is the more effective way to recreate a high habitat quality for the species richness of ground-active beetles. Our results therefore suggest that removing grazing for a few years and restoring stone cover is a promising method. Various sizes and spatial distributions of the stone cover areas should now be tested.

195 Habitat use by the large copper butterfly *Lycaena dispar* in southern Belgium and implications for conservation

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Lycaena dispar, an Annex II butterfly of the Habitat Directive, has a scattered distribution in Western Europe. The Belgian populations are restricted to the Gaume region, in the southern part of the country, where they are linked to three *Rumex* species growing in grasslands, fallow lands and wetlands. Although these populations showed a recent expansion toward the north, they are potentially threatened through farming management changes or urbanisation (i.e. industry).

A program of habitat restoration has been launched by the regional Forestry Administration (DNF) since 1999 in one of the country's most important Natura 2000 site for this butterfly species (« Vallées de la Vire et du Ton » near Virton, 289 ha).

Poplar plantations were cut, then converted to open grasslands after vegetation and soil chopping. Ponds and ditches were created in some places. These newly created habitats are now managed by light cattle grazing or annual mowing.

Habitat use by *Lycaena dispar* has been studied in 2006 and 2007. The distribution of eggs, caterpillars and adults were assessed by stratified sampling of about 75 ha of open habitats. Densities of eggs and caterpillars were higher in newly restored habitats, followed by lightly grazed grasslands and extensively mown grasslands. They were lowest in intensively grazed grasslands and fallow lands. The population has been estimated at about 2500 eggs/caterpillars on the sampled area in 2006. Adult males preferred extensive mown grasslands. These findings suggest that the program of habitat restoration and management is fruitful for the conservation of this butterfly.

196 Constraints to the restoration of alluvial meadows of river valleys of the *Cnidion dubii* (6440)

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A review on current knowledge and state of the art in restoring alluvial meadows of river valleys of the *Cnidion dubii* will be given. Due to river regulation, construction of levees, drainage and conversion into arable land well developed continental flood-meadows have become very rare. This applies especially to their western range margin whereas in eastern central Europe larger and better preserved remnants still exist. Especially for the control and prevention of harmful floods the restoration of more natural floodplains has become a major topic on the agenda of environmental policy all over Europe. However, in terms of re-establishing desired target communities such as *Cnidion* meadows these measures were often frustratingly unsuccessful even after restoration of more natural flooding regimes and lowering of the soil nutrient status. Most often, these poor results were caused by seed limitation due to soil seed bank depletion and the inefficiency of water dispersal along the usually strongly confined and regulated river systems. Even along riparian corridors that were thought to be particularly favourable for plant migration, the only way to overcome dispersal limitation seems to be the introduction of target species by supplementary measures such as the transfer of plant material from species-rich source stands. In restoration practice such measures proved to be very successful.

For the generally more extensive and better preserved *Cnidion* meadows in eastern central Europe large-scale abandonment is currently the major threat. As in many other semi-natural grasslands, the development of suitable agro-environmental schemes in these countries after transition to EU market economy is of crucial importance.

197 Riparian restoration of headwaters in the bocage of South-Normandy: agricultural and ecological processes influencing vegetation composition

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The "ECOGER" program is a national program in France for management of ecosystems: in our case of study it relies upon the expertise of the Water Agency measures to install feeding troughs and electric fences along the length of brooks, in the Normandie region. The objective is to prevent livestock accessing the channel, thereby reducing soil erosion and the accumulation of suspended solids within the aquatic ecosystem. The salmonid rivers restored are related to the Natura 2000 code 3260. Silt settles in fish spawning grounds, reducing their prevalence. Passive restoration is applied and estimated by the evolution of ligneous and herbaceous communities. A characterisation study of the site was carried out prior to the erection of the fence, permitting the floral evolution to be observed once grazing and trampling were prevented within these zones. Differences were identified in terms of species diversity and the life forms of plants. A very important landscape change is expected. This model of restoration of river banks is discussed in terms of biodiversity changes for target and non-target groups or species.

198 Interacting effects of anoxia and competition during assembly of restored wetland communities - multispecies mesocosm experiment

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Effective establishment is one of biggest obstacles for biodiversity in restored floodplains. We analysed mechanisms of floodplain species pool filtering by soil anoxia, grass canopy and mowing management, by applying autecological juvenile traits to interpret assembly of 34 species in wetland mesocosms during one season. Germination abilities in dark and light, as well as seedling growth parameters were determined in growth-chamber experiments. Germination response to soil moisture was tested in outdoor mesocosms. In a mesocosm experiment, mixtures containing 1000 seeds of each of the same 34 species were sown in 80 containers of 1m² surface, filled with nutrient-rich peat-clay soil. Three factors were applied: (1) soil anoxia vs. aerated soil, (2) presence of grass canopy vs. bare soil when sowing species mixture, (3) mowing applied in the middle of growing season vs. no mowing. Canopy drastically suppressed establishment in mesocosms with pre-sown grass, this effect could be only little lowered by mowing. In non-canopy mesocosms, anoxic treatment resulted in lower total biomass and higher species richness than aerated treatment. There was an interaction between anoxia and mowing, meaning that in the anoxic mesocosms mowing decreased species richness and increased in the aerated mesocosms. Germination and juvenile traits were good predictors of species selection in the mesocosm experiment. The results confirm that anoxia and light competition interact in controlling species establishment and this should be accounted for in restoration and management. Combination of topsoil removal with increasing soil water level seem best options for obtaining high functional diversity in communities.

199 Sedimentation induced eutrophication in large river floodplains –An obstacle to restoration?

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In river floodplains, sediment deposits with a large amount of nutrients cause highly productive conditions. This can be a severe obstacle to the restoration of nutrient limited target communities containing low competitive species. In this study, the nutrient and floristic gradient of floodplain meadows in the Upper Rhine Valley in Germany were examined to assess the prospects for restoration with increasing distance from the main channel. Soil and plant tissue analysis revealed a significant decline in phosphorus concentrations, with increasing distance of our samples from the river Rhine. Extremely high concentrations occurred in close proximity to the main channel with more than 12 mg of CAL-soluble P per 100 g soil. Already at distance of 300m from the main channel P- concentration in the soil dropped to a quarter of this figure. In line with these findings grasslands close to the river showed a floristic depletion with on average less than 12 species 100m² whereas already in a distance of 300 m the average species richness per plot increased up to 27. Endangered and valuable species appeared already at a distance of 400 m to 500 m to the river. Surprisingly strong eutrophication effects induced by sediment deposits proved to be confined to the close proximity of the main channel within a distance of 200 m whereas the restoration prospects at more distant sites in the floodplain are obviously not hampered by recent nutrient input in the course of flooding.

200 Restoration of alluvial meadows by means of plant material transfer – A field manual for practitioners

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Since the late 1990ies projects aiming at the recovery of rare alluvial meadows have been taking place in the city of Riedstadt, which is situated 40 km south-west of Frankfurt in the Holocene floodplain of the northern Upper Rhine. The projects deal with alliances Cnidion (on rich alluvial soils) and Molinion on rare nutrition-low soils, which are the result of former extraction of clay for building purposes. Aiming at species-enrichment, diaspores are transferred with plant material from old species-rich floodplain-meadows onto ex-arable fields and species-poor meadows in large scale.

Based on the experiences from these and other similar projects we want to compile a field manual which

helps practitioners to optimize their restoration work in floodplains.

The manual first will discuss why restoration measures have to be undertaken in alluvial meadows at all. It will give a short overview of the ecology and types of alluvial meadows, their functions in the ecosystem and the cultural landscape.

The manual will name the different possible restoration measures and will try to show, in which case which measure might be appropriate. The main part of the manual will provide a concise - nevertheless complete - overview of the different steps to be undertaken from the very first plan up to the realisation and further management of the restored areas.

A special focus will be laid on practical questions, as e.g. necessary human resources and machinery, time management or budgeting. Furthermore it will give some hints how to promote the restoration measures, to provide knowledge and thus enhance acceptance for the measures among the local population.

201 Do plant material strips really act as colonization initials during flood-meadow restoration?

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Plant material transfer is frequently used during grassland restoration. Often, however, the availability of species-rich donor material is limited so that it is applied in narrow strips that do not cover the entire target site. It is generally assumed that these strips will act as source populations for the target species which will then spread and eventually colonize the entire site. Our aim here is to test this assumption. We conducted our study in the floodplain of the northern Upper Rhine where plant material transfer is applied since the year 2000 within the frame of a large-scale flood meadow restoration project. We chose five plant material strips of 10 m width that had been established in 2000 and 2001 and represent the oldest strips available in the area. On each strip, we established a 2 x 16 m transverse transect starting in the centre of the strip. Each transect was subdivided into eight 2 x 2 m plots, and each plot was subjected to vegetation relevés, seed bank sampling, and seed rain sampling with two different types of seed traps. We can thus observe colonization at the levels of established vegetation, seed bank, and seed rain. This approach allows for the first time to draw realistic conclusions about the extent and duration of the assumed colonization process, which are indispensable for evaluating the long-term success of the project. Furthermore, our results can provide guidance for developing management measures that might further improve the performance of plant material transfer during restoration.

202 Legitimacy for ecological restoration in a multilevel governance context: changes and challenges

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The implementation of Natura 2000 has met with considerable resistance from farmers, fishermen, foresters and other local residents in most EU member states. In response to the rural protest the majority of governments gradually abandoned their centralist, top-down approach and increasingly switched towards methods of participatory and interactive policy making. However, the results of the more participatory and interactive modes of policy-making are far from clear. Some welcome this tendency to incorporate the interests of all stakeholders and the attendant integration of nature objectives in other policy fields, while others lament the 'dilution' of the original nature goals, in the sense that less hectares will be designated as nature areas, and that the type of nature to be realised will shift from deeper to lighter shades of green. The tendency toward new forms of governance is not only questionable with respect to the effectiveness of nature policy but also with respect to its legitimacy. While some applaud this tendency as a triumph of local democracy, others fear the emergence of neo-corporatist politics and the attendant formation of power blocs of special interest groups and social movements that assert themselves as defenders of the public interest without a clear democratic mandate. What are the most important stumbling blocks for successful nature conservation policy at the moment and how can these be overcome?

203 Evaluation of managed realignments in the Schelde estuary

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Since 2002, different Life projects have been launched for the large scale restoration of peat and wet land habitats in Southern Belgium. Working on more than 15.000 ha of various landscape including peatbogs, wet heathland, spruce plantations on peat and alluvial soils, ..., they should normally allow a complete restoration of more than 2.500 ha of habitats and the creation of more than 1.500 ha of natural reserves, i.e. an increase of more 15%.

We will present a first analysis of how ecological network have been restored on local scale and regional scale. Then, we will tackle with a gap analysis what should still be done in high Ardenne. First result of scientific monitoring of the regional diversity will be presented. This will be followed by a large overview of habitat rehabilitation techniques that were implemented and what kind of habitat restoration trajectories are observed on several places.

204 Learning from the past: long-term morphological and hydrodynamical changes in the Scheldt estuary

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The River Scheldt has a macrotidal estuary with a tidal reach up to 160km land inward. The morphological and hydrodynamic characteristics of the estuary were strongly altered by human interventions during the past one and a half century. In turn this affected the area and quality of intertidal and subtidal habitats, mostly a change to the worse.

In the long term vision for the Scheldt estuary, providing more space for the river is considered a key issue to restore a more natural estuarine ecosystem. This will be realized by a combination of managed realignment, controlled reduced tide areas, and development and connection of adjacent wetlands. In the present study we show that this land claim has a strong historical base. Available historical data on tidal regime and bathymetry, old maps and aerial photographs are used to outline the most important changes that occurred along the Sea Scheldt (Belgian part of the Scheldt estuary) and its tidal tributaries since 1850. Land reclamation, harbour expansion, dredging activities, embankments, channelization and land use change all had a profound impact causing a huge loss of water storage area and direct or indirect habitat loss. As hydrodynamic forces strongly increased in the meantime, the remaining tidal marshes, mudflats and shallow subtidal habitats are under increasing erosive pressure. Well-developed gradients from aquatic habitat to high tidal marsh seem hardly sustainable under the present abiotic conditions. Providing more space is indeed one if not the most important restoration measure for these dynamic habitats.

205 Sedimentation and erosion processes drive vegetation development on restored tidal marshes

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The Schelde estuary is subject to many anthropogenic impacts (harbour expansion, dredging activities, embankments, etc.) inducing hydrodynamic pressures and destroying or deteriorating intertidal areas. Some small sites were restored as part of an ecological rehabilitation plan. A monitoring schedule, including physical processes, colonisation by benthic invertebrates, vegetation development and utilisation by water birds and fish was set up for all restored sites. The results will improve our apprehension for restoration of tidal marshes in future plans.

In this paper vegetation developments after restoration in relation to geomorphological processes and sediment characteristics are compared on four sites: Paardeschor, Ketenisseschor, Paddebeek and Heusden.

Sedimentation/erosion was the overall result of slope, intertidal elevation, width, shelter and soil properties. A critical overall slope of 2.5% was calculated. Above this slope erosion was more likely to take place. In sites with net sedimentation the soil developed from sand to fine sand or silt and the organic matter content increased. On locations where erosion and sedimentation alternated, a high variability in texture was observed.

Locations situated high in the tidal frame were colonized most rapidly by macro-algae and higher plants. However, significant differences were observed and not all changes could be linked to tidal elevation. The stability, succession and colonization rate of the vegetation were related to geomorphological processes, depending on the initial condition of the area just after restoration. On marshes with a steep slope erosion

and regressive succession were observed. Areas with a more gentle slope showed continued sedimentation and progressive succession.

206 Spatiotemporal aspects of silica buffering in restored tidal marshes

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Losses of pelagic diatom production, resulting from silica limitation have not only been blamed for toxic algal blooms, but for the reduction in ability of coastal food webs to support higher trophic levels. Recent research has shown the importance of advective seepage water fluxes of dissolved silica (DSi) from freshwater marshes to pelagic waters at moments of riverine Si-limitation. In this study, we investigated the potential impact of recently installed new tidal areas along the Schelde estuary, located in former polder areas and characterised by so-called controlled reduced tidal regimes (CRT). Nine mass-balance studies were conducted in a newly constructed CRT in the freshwater Schelde estuary. During complete tidal cycles both DSi and ASi concentrations were monitored at the entrance culverts as well as in different habitats in the marsh. Despite the shifted spatiotemporal frame in which exchange processes take place compared to reference marshes and the only recent restoration of tidal regime, a swift DSi-delivery capacity was observed. Since silica-accumulating vegetation is not yet present, and difference with reference marshes' deliveries is surprisingly small, we point towards diatomaceous debris and phytoliths as the main silica source. Although further research is needed on the driving forces of different processes involved, restoration of former agricultural areas under CRT-regime provide potential to buffer silica in the estuary.

207 Emscher Landscape Park - the transformation and design of urban landscapes as a basis for sustainable economic and urban development

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The Emscher Landscape Park Project contains a long term vision, a current political programme and a continuous investment programme to redefine and restore urban nature in the heart of the Ruhr region, the former centre of heavy industries in the west of Germany. The urban landscape in and between 20 cities is restructured since the beginning of the 1990s in a new and strategic way. Enormous volumes of Brownfields are no longer seen as a problem but considered as a unique chance to redevelop the cities and their urban nature. More than 300 single projects are included and the construction of the regional park system is planned to proceed for three decades. From rail to trail is one of the practical issues to connect all the projects: former industrial train tracks are reshaped into bike- and footpaths for the daily use of the people. By doing so, the beauty of urban and industrial wilderness appeared as well as the unique potentials for new landscape architecture. The design of urban landscapes is now seen as an investment in the future of the region, reshaping it into an attractive landscape for worth living and working in. All political parties are supporting the Emscher Landscape Park today in all 200 cities. The business people see it as an infrastructure for modern private companies and the cultural and creative scene is working with the cultural basis of Emscher Landscape Park: the industrial heritage. The people of the Ruhr are using the park infrastructure every day and they are asking for more, for more parks and for more services. The lecture will give an overview as well as more detailed informations about several single projects

208 Integration of Nature 2000 and Water Framework Directive in the Netherlands

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In the Netherlands the Water Framework Directive (WFD) is implemented in 4 catchment management plans (CMP). The Natura 2000 sites are "protected areas" where WFD must realize the ecological requirements of Nature 2000 habitats in 2015. Analyses of the first draft CMP's revealed that these plans do not or insufficiently define measures for such an ecological improvement. This will be illustrated by the analyses of these plans and Nature 2000 sites. We identify the following reasons:

- Because only large water bodies are confined in the CMP's nearly all inland wetland habitats of Nature 2000 (and other nature conservation sites) are excluded from water bodies.
- In the goals of the WFD for surface water bodies are defined for one aquatic water type and an average

water condition. Very often the habitats needs more specific and varied abiotic conditions which are not presented to the EU.

- Quality goals set for groundwater bodies are only defined for the deep aquifers and not for regime and hydrochemistry of the phreatic groundwater while these are crucial for wetland habitats.

- Draft versions of CMP's lack serious analyses of the relations of Nature 2000 sites with water related processes in the catchment.

With some examples we illustrate more integration between Natura 2000 and WFD can be achieved when water relations are taken into account on a regional level and on the level of Nature 2000 sites. Such an approach is necessary in order that proposed CMP's will have a significant contribution to the realization of ecological requirements of water depended habitats.

209 Possibilities for adaptive water management and ecological landscape restoration in the Upper Tisza region: case study for understanding the complex decision-making of local farmers

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In this paper, a method to analyse the complex decision-making of local farmers in a socio-economically disadvantaged floodplain area of the Upper Tisza Region is presented. The Bodrogek Region situated in the Hungarian reaches of the Tisza river basin with diverse landscapes and high biodiversity potential. It is facing the problems of high floods, water stagnation and socio-economic degradation at the same time. Based on a recent government decree a water reservoir (flood polder) is going to be built in Cigánd-Tiszakarád for flood protection and water retention purposes accompanied with floodplain revitalisation and floodplain management measures. For the successful implementation of the plans the analysis of the attitude of local farmers and their decision criteria on land use and the provision of appropriate training is essential. In the framework of NeWater project and in cooperation with the local NGO Bokartisz this ongoing research is focusing on the elicitation of knowledge and the articulation of attitudes of local farmers on multifunctional agriculture and floodplain management. Standing on the theoretical bases of adaptive water management this project uses participatory methods with the help of the computer-aided ethnographic knowledge elicitation tools (KnETs) developed by the Stockholm Environmental Institute to elicit local knowledge. (Bharwani, 2006). In this paper the principles of development of the survey and the process of fieldwork is presented. It provides preliminary results as well as exploring the possibilities for land use change, landscape revitalisation and ecological restoration in the Bodrogek Region.

210 Participatory assessment of ecosystem services in Hungary with science-policy collaboration

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Ecological restoration measures may often not reach their original goals due to the attitude and behaviour of local resource users. Participatory assessment (PA) techniques can play a key role in exploring the background of unexpected land use conflicts by eliciting the knowledge and preferences of local resource users. Provision for science-policy collaboration in case of PA exercise can be an essential tool for science-policy integration and could contribute to the appropriate design and efficient implementation of ecological restoration measures. The PA exercise presented in this paper focuses on the elicitation of knowledge and the articulation of values local people attach to ecosystem services of the Homokhátság (Central-Hungary), in order to grasp how ecosystem services contribute to the well-being of local and non-local beneficiaries. The research also aims at studying the impact the assessment exercise has on exploring and managing conflicts emerged between nature conservationists and local resource users. It provides good opportunities for science-policy integration as well by involving policy-makers to the assessment process. The science-policy collaboration (SPC) project draws upon the PA exercise and can be conceptualised as a mutual learning between local, scientific and policy perspectives through science-policy interface. The SPC project uses action research methodology with participatory techniques to involve policy-makers following and commenting the PA exercise and assess science-policy interface throughout the process. We discuss the advantages and the

disadvantages of policy involvement, the expectations and the difficulties faced, and give some reflections on the process. The paper will present the opportunities for science-policy collaboration and their contribution to science-policy integration, adaptive management, conflict resolution by consensus building in detail.

211 One step beyond: creating futures, a relevant ecology

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Often aspirations of what is possible in terms of landscape are very low, mainly because people have lost touch with what is good - dullness and uniformity are the result. It does not have to be like this- there is an alternative route that can be both practical and uplifting. This may trade on creative ways of working and communication as much as landscape technique. It recognises the dynamics of change, rather than the staus quo or standing still. The session considers the important social dynamic which must drive the environment to the foreground in contemporary society. It is about a broader engagement outside academic circles. It is about demonstrating practicalities and using our imagination and creative powers, while employing the best science and proving practical and attractive solutions are possible even in unlikely setting. It is about working with a ripple effect of positive feedback, towards environmental justice and proving that boldness is a virtue.

The session will share some of the lessons from recent creative conservation network and environmental justice meetings over the past two years. It will also directly link to a special creative conservation workshop, later in the conference which will feature a special interactive/agitprop event.

212 Creative conservation. A step Beyond

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Landlife has been working since 1975 developing creative conservation practice and philosophy. Most importantly, Landlife delivers these solutions and approaches on the ground placing ecologically important landscapes close to where people live. In turn, this raises the awareness of the importance of habitats everywhere. This approach won Millennium funding in the UK to build a National Wildflower Centre in Liverpool, which opened in 2000 and has continued to push boundaries in public engagement and sets exemplars for project work. This year Liverpool is European Capital of Culture. As such, it is timely that Landlife is striving to demonstrate the important dimensions that the environment plays in culture. This stimulates a notable and popular following which generates demand for this style of working. Landlife has also staged successive creative conservation networking events in the UK, bringing together individuals and groups who are delivering practical and inspirational work on the ground.

213 The art of questions: Global Warming, ecological re-invention and critical futures thinking

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As more humans live in cities and global warming accelerates beyond 'tipping points', societies continue to be preoccupied with the problems of 'sustainability'. This problem solving seems to concentrate on economic, social, energy, food and carbon issues, but this approach may be part of the biggest problem facing our planet, the Sixth Extinction. In maintaining normative cultural structures, problem based approaches tend to exclude general participation, in favour of expert control. This limiting of perception tends to constrain wider envisioning and risk-taking, while focusing on the symptoms rather than the causes of distressed situations.

If we are to address the issues of resilience, ecological systems collapse, survival and reinvention, perhaps all citizens need to engage in whole systems futures thinking and action? Central to this approach would be our capacity to make effective questions that develop capabilities.

This paper analyses and presents some of the creative questioning approaches used as an ecological arts practice to promote a comprehensive understanding of diversity, interdependence and finite resources. Developed through charrettes, symposia, multi-disciplinary projects and artworks presented in Europe, the USA, China and Taiwan, this other way of learning may offer creative means of turning disasters into opportunities. In other words, how might ecological restoration be understood and practiced as a popular lifestyle? And, how might this lifestyle promote biodiversity through climate change?

214 Ecology in unlikely places: A relevant ecology

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The Eden Project is unrivalled as an agent of positive change, bringing immense ecological diversity from nothing, in what was until 2000 an abandoned Cornish China Clay Pit. This is now a centre of ecological excellence and inspiration, with over 1.4 million visitors a year since its opening in 2000. It has engaged millions in an imaginative and positive way, in what were considered complicated environmental messages. The Eden Project works at all levels from the very local to the international with a brand and spirit of ecological restoration that involves art and science to equal degrees. As such has touched the public attention to an unprecedented degree in the United Kingdom.

Tony will speak on the challenges of the current times to make ecology relevant to society in a way that inspires a change for the better and does not just keep putting future actions off to a slightly later date. The Eden project has also been focus for two creative conservation network events, One Step Beyond (2006) and the Great Creative Conservation Bazaar (2007).

215 Raised bog studies and monitoring of the management actions

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Raised bog studies were studied in the especially protected nature areas in Latvia - Cena Mire, Stikli Mires and Klani Mires Nature Reserves. The sites are nationally and internationally important and include intact raised bog vegetation. The marginal parts of the sites are influenced by drainage and peat extraction.

In the study sites restoration of the hydrological regime was carried out by building of dams on the drainage ditches. In Cena Mire - in the September and October, 2007 but in May/June, 2007 the action was continued in Stikli Mires and Klani Mire. In total, 351 dams were built on the drainage ditches both by the excavator and the hand work. The aim of the building of dams was to raise the water level and to allow the start of the regeneration of degraded raised bog habitats.

Since 2005, habitat and hydrological monitoring is carried out in the sites. The results in 2007/2008 show that after building of dams on the drainage ditches, the water level raise.

Our experience in building of dams on the drainage ditches shows that better results can be achieved by building peat dams with an excavator, and only in exceptional cases using hand work. Also the size of the dams should be large enough to ensure the flooding of the surrounding raised bog area near the dam. The conclusion can be drawn that the raised bog restoration by building of dams on the drainage ditches was carried out successfully as the water level in the degraded area raise and reached that of the intact raised bog area.

216 Spontaneous vegetation in harvested peatlands: a multi-site approach

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In the Czech Republic, central Europe, peat has been intensively harvested in bogs dominated by *Pinus rotundata* Link (in NATURA 2000 classified as 91DO, Bog woodland, a priority habitat). Two main kinds of peat extraction can be distinguished with different impact on the ecosystem and post-disturbance succession: (i) manual block-cut mining, practised in the past, and (ii) industrial harvesting (milling), having been practised in the past 50 years.

The main question asked: Is regeneration of bog vegetation and peat-forming process possible through spontaneous succession and under which circumstances? The vegetation survey of spontaneous sites was done in all available milled (11) and on selected block-cut (7) peatlands. Cover of plant and moss species and site characteristics (age of successional stage, groundwater table, pH, thickness and some chemical characteristics of remaining peat deposits, and site climatic conditions) were recorded.

In the block-cut peatlands succession lead to vegetation comparable to that of undisturbed raised bogs or transitional mires. The milled peatlands have usually developed towards birch-pine woodland without regenerating peat-forming process. Only occasionally, some bog species, including bog mosses, occurred, but even in these sites the regeneration was very slow. If remaining peat deposits were thin and groundwater high, the species composition more resembled fen than bog vegetation. Generally, regeneration of milled peatland was much probable in sites with higher groundwater table, in higher altitude and in vicinity of original bog vegetation. These findings should be considered in restoration programs.

217 Formations of the mire plant cover on an abandoned cranberry-field (Raessaare bog, SW-Estonia)

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Our aim was to understand how is the formation of mire plant cover structure (with special emphasise to Sphagnum) driven by hydrological conditions and underlying peat character on earlier cranberry-field (9.5 ha) established in 1968 and abandoned in late 1980-ties. Plant species were identified for ground vegetation and percent cover for each species was estimated on hundred 1 x 1 m plots. Tree layer coverage and tree ring measurements were provided near the plots. Data on water table depth, water electrical conductivity and pH was collected at the date of sampling. Depth to water level was measured biweekly during one year in 12 piezometer stations. Tree invasion (Scots pine and common birch) started from more drained part, close to main ditches. Tree growth increased as dams on ditches disintegrated in late 1980-ties. *S. angustifolium* as a pioneer peat moss species is distributed on sites with higher mean annual water level on *Sphagnum peat*. Invasion of *S. fuscum* is strictly related with distribution of *Calluna*. *S. magellanicum* can establish more open sites with more stable and high water level. The expansion of *Calluna vulgaris*, *S. angustifolium* and *S. magellanicum* to more forested sites is restricted by abundant tree litter on soil surface. Sites with high surface water on Carex peat are still covered with fen vegetation. Some patches with *Oxycoccus palustris* (40% cover) can still be found. We concluded that for accelerating the expansion of Sphagnum cover over the site even more important than rising up the water level is to decrease the tree canopy density. The corresponding experiment is initiated with monitoring period of seven years.

218 Optimizing nature management by using the PROMME-checklist: from trial-and-error to knowledge based nature management

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The success rate of restoration projects grows with increasing insight in ecosystem functioning as well as experience in carrying out restoration projects. Several problems and pitfalls in nature management seriously hamper the process of increasing success. If information on certain key processes in ecosystem functioning and biodiversity is lacking, unexpected negative effects may occur in restoration projects. E.g., if insufficient knowledge is available about local conditions or important biogeochemical processes affecting nutrient availability, rewetting a peatland can result in further degradation of the area.

To help optimising conservation and restoration measures and to minimize the occurrence of unforeseen negative (side-)effects in ongoing and future nature conservation and restoration projects, the experience of European managers of nature reserves and the latest scientific knowledge of different disciplines was exchanged and integrated in the framework of an international LIFE-Nature Co-op project, focussing on raised bogs and coastal dunes. Steps necessary to perform successful nature conservation and restoration projects were discussed with 130 site managers and scientists from 13 European countries. Based on common sense and experience a checklist with six essential steps was made to help avoiding the most common ecological pitfalls: the PROMME-concept. Use of this checklist will help site managers to deal with ecological knowledge at the proper moments in the process of planning and taking conservation and restoration measures. More detailed background information is available in the freely accessible decision support tool at: www.barger.science.ru.nl/life.

219 Combining restoration and agriculture in semi-natural grasslands: benefits and constraints

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In the field of grassland restoration large advances have been made in the re-establishment of endangered plant communities by developing various techniques that reduce abiotic constraints and allow for species enrichment (e.g. transfer of plant material). However, the long-term survival of both remnant and recreated semi-natural grasslands in Europe depends on an adequate and continuous management, i.e. cutting or grazing schemes. Especially at large scale, this will only be accomplished if the management regime meets both ecological as well as agricultural demands. With this in mind, in this session we intend to discuss the

specific benefits of agricultural use for ecological habitat development and – vice versa – the benefits of restorative management for agricultural production. Potential benefits of agricultural land use for conservation and restoration of semi-natural grasslands include the continuous removal of nutrients, diaspore transport and creation of gaps for recruitment through livestock or haymaking machinery. Furthermore, production of high-quality fodder that can be used in livestock husbandry and production of high-quality animal products are possible benefits for agriculture. In productive, species-rich grasslands, phytomass may be readily incorporated into fodder systems; however, in less-productive grasslands animal welfare and agro-economical benefits may be critically restricted.

We call for contributions from restoration science elucidating benefits and constraints in the relationship between restoration and agricultural management.

220 Combining restoration and traditional grazing in a semi-natural Mediterranean grassland

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The steppe of La Crau is a semi-natural grassland (NATURA 2000 habitat FR9310064 & FR9301595), which has been grazed by sheep for 3,000 years. This ecosystem has been greatly damaged in the past 50 years and various restoration experiments have been carried out since 2002. As traditional grazing is the only vegetation management advocated to ensure the durability of the steppe, this disturbance regime was taken into account in all experiments. Results showed that 1) grazing reduced the biomass of two dominant perennial plant species (*Brachypodium* & *Thymus*), reintroduced on abandoned fields, and negatively affected *Thymus* survival; 2) grazing and low stone cover reduced colonisation by ground-beetle species. For both plant reintroduction and beetle colonisation, it appears that the ideal combination of treatments would be to exclude or reduce grazing during the first year and to restore the original 50% stone cover. 3) On the other hand, grazing was shown not to have a significant influence on the vegetation composition or structure in degraded plots which received steppe hay. This hay transfer allowed the increase of species richness on recently degraded grasslands and to reintroduce many interesting species of Poaceae. 4) A more recent experiment was implemented on 1.5 hectares: three species were sowed in fall 2007, the two perennials and *Trifolium subterraneum*, to cover ground to potentially avoid colonization by ruderal species. The effect of grazing is tested. First results will be presented.

221 Plant species composition and diversity in a calcareous wooded meadow - the significance of management continuity

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The aim of the research was to analyze the variation in plant species composition and richness and to study the key mechanisms of maintaining the plant diversity at Laelatu calcareous wooded meadow in Estonia. In particular, we asked: i) what is the contribution of management continuity during the last 30-40 years to variations in species diversity and composition of a calcareous wooded meadow plant community? ii) is tree cover related to species diversity and composition of the herbaceous layer? iii) what are the effects of local soil gradients on species diversity?

We assessed plant community composition in 150 1x1 m plots, located at sites with different management history. Light and soil conditions and relative altitude were measured at each plot. DCA was used to analyze variation in species composition and general linear mixed models to analyze the effects of management and environmental parameters on diversity.

Management continuity, was the primary determinant of plant community composition, followed by light conditions and soil parameters. Species richness depended positively on management continuity. Diversity started to decline under the tree canopy where 50% or less irradiation reached the level of herbaceous layer. We did not find significant effects of soil conditions on small-scale diversity. Our results imply that management continuity, together with the cover of tree layer, are the most important determinants of diversity. Despite grassland stands with different management history are located side by side, the regeneration of diversity and composition of plant communities after restoring regular management practices is a slow process.

222 **Grazing in nutrient-poor sand grassland: how to combine preservation of site-typical plant diversity and adequate livestock nutrition?**

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Several field studies provide evidence that sheep grazing is an adequate management tool to preserve the specific phytodiversity of threatened inland sand grassland. In nutrient-poor ecosystems, however, livestock nutrition often is suboptimal with regard to animal welfare and agro-economical benefits. Within a running research project we therefore test the prediction that a grazing regime comprising alternation between nutrient-poor (sand grassland) and nutrient-rich ecosystems (mainly former fens) allows habitat conservation and restoration as well as the improvement of animal nutrition. Few changes and long walking distances from high- to low-nutrient systems enable habitats of the same type to be connected by seed dispersal and minimize nutrient transfers. Data on standing crop, livestock diet and phytodiversity were obtained along the route of a roaming sheep flock over a 5-month period/a (since 2006) in central Germany.

Our results give evidence that the alternating grazing regime as compared to a sand grassland-only grazing regime can improve animal nutrition (e.g. higher supply of P and N), suggesting that economic and nature conservation aims can be optimised in parallel. However, nutritional value within the former fen complex depends largely on successional stage. Whereas older, grass-dominated former fields provide adequate livestock fodder, younger fallow fields (herb-dominated) provide an oversupply of, e.g., N; this burdens animal metabolism. Therefore, younger fallow fields need to be agriculturally improved (e.g. by sowing or mulching) to become adequate grazing areas.

223 **Integrating species-rich flood meadows into farming systems - Prospects and imitators**

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As a response to large scale losses of species-rich flood meadows along the northern Upper Rhine, the re-creation of species-rich flood meadows via the transfer of seed-rich plant material started in the late 1990s. This measure proved to be very effective and efficient even at large scale. However, the long term conservation of both remnant stands as well as these newly created species-rich flood meadows depends on a continuous non-intensive management.

To keep this management economical, it is important to assess the prospects for incorporating these flood meadows into farming systems. But conflicts arise due to different interests of farmers and nature conservationists. We therefore need more knowledge about alternative managing regimes of species-rich flood-meadows, e.g. with regard to timing and frequency of the harvest, acceptable for both groups. To this end we sampled biomass of species-rich and species-poor meadows four times from April to June during two years, sorted the biomass into grasses, herbs, sedges and legumes, and determined energy and nutrient content.

We expect non-intensively managed flood meadows to show higher yield compared to species-poor grassland. In addition species-rich flood meadows may show a lower inter- and intra-annual variability in biomass quality and quantity.

We will present the latest results of our study and will discuss the prospects and limits for the large scale conservation of species-rich grassland through agricultural management.

224 **Integrated restoration of the ain river and its floodplain: principles, tools, and first results obtained in the framework of the European program life "Basse vallée de l'Ain"**

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The ain river is an oligo-mesotrophic river with coarse bed load and relatively high slope, which benefited from a life european program from 2002 to 2006. concerning aquatic habitats, the objectives of Scientifics and managers was to slow down the vertical degradation of the river due to hydro-electric dams, and to restore several wetlands that became progressively less and less connected to the aquifers and the river.

both objectives were grouped in a single restoration project that leads to the supply of coarse sediment to the river and the rejuvenation of selected wetlands. the methodology used is described, and more particularly: 1) which methodology we used for the selection of wetlands potentially submitted to restoration, which results we expected in terms of ecological benefits and self maintenance, and why; 2) how we aimed to limit potential invasions; 3) how we evaluate the potential benefits in terms of bed load supply to the river of the different options of wetland restoration. 6 wetlands were restored and the coarse material was supplied to the river. The first results of this global project are described and discussed.

225 River restoration in the Grand Duchy of Luxembourg

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1. Introduction: Support of Ministry of the Interior (the Water Framework Directive) and Ministry of the Environment (Directive Natura 2000).
2. Purposes: Ecological and hydraulic improvement of the state of the current channeled riverbed (riprap, concrete, underpass and wall of protection) in urban, industrial and agricultural areas. Ecological, hydrological, water quality and landscape objectives.
3. Methods: Using of the past and current reference values (old maps, paintings, photos, postcards, aerial photos, state and property boundaries, floods, etc.).
Restoration actions (lateral enlargement of the channel or displacement in its natural bed, restoration of hydraulics annexes and meanders).
Socio-economic solutions for ecological restoration by change of traditional agricultural policy (extensive), agro-environmental (biodiversity) contracts, beef production (Highland, Galloway, etc.) and its distribution to local restaurants with public awareness.
4. Results: Project examples of the restoration in urban, industrial, agricultural and natural areas.
5. Conclusions: Hydraulic effects (flood hazards) are bigger for small catchments areas! River restoration can be economically rewarding by changing land-use patterns and socio-economic setting! Price to pay for non respecting ecological restoration policy.

226 Ecological restoration of a lowland stream with populations of Bullhead (*Cottus gobio*/ *perifretum*) and Spined Loach (*Cobitis taenia*) in Flanders, Belgium

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In 2006 a reach of 1,300 m of the normalized stream, the Witte Nete, was diverted because of sand mining activities. Populations of both Bullhead (*Cottus gobio/perifretum*) and Spined loach (*Cobitis taenia*) are present in the Witte Nete. The downstream reach of the stream is part of the Nature 2000 network. Apart of the restoration of the meandering with a sinuosity of 1.2, sediment and reed rhizomes from the former reach were used to restore the new stretch. The ecological restoration of the Witte Nete is being evaluated in five surveys over a three-year period (2006-2008) and compared with down- en upstream reference transects. The morphology, macrophytes, invertebrate and fish community are monitored both in spring and autumn. The results show a rapid colonization of the new reach, especially zones with introduced sediment and reed rhizomes. Bank erosion and sedimentation of sand bars has started. The new reach differs from the reference transects in the presence of shallow zones along the banks and a higher variability in water velocity. Water - and marsh plant communities dominated the new reach after two years. The macro-invertebrate fauna was re-established to a normal level after one year. The fish community shows to the same diversity as the reference transects. Both Bullhead and Spined loach spontaneously colonized the new reach in less than six months. But population densities of Bullhead and Eel in the restored reach are still lower than in the reference zone.

227 Corridors for snails: the robustness for genetic interchange. The case of *Vertigo moulinsiana* in central Belgium

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Vertigo moulinsiana is a typical species from the wet forests and tall herb vegetations in the valleys of the Dyle and Lasne, central Belgium. The species typically occupies habitats that are situated in the (formally) active alluvial plain of both rivers.

It is known that the snail shows a strong relation with wet and calcareous habitats, which it finds in the alluvial plain. The study focuses on the structure of the meta population within the alluvial plain. Analysis of the genetically structure of the populations indicates familial relations in the meta population. These relations are correlated with characteristics within the alluvial plain and give conclusions about the migration of the species between different habitat patches.

228 Framework for peatland restoration activities in Finnish Natura 2000 conservation areas

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Not all peatlands in Natura 2000 conservation areas in Finland are in pristine condition. Restoration of water dynamics is an important tool for improving the ecological quality of conservation areas. Since the 1990's approximately 15 000 ha of Finnish peatlands drained for forestry have been restored, mainly in state-owned conservation areas. Almost as much restoration work is still required. Metsähallitus (Natural Heritage Services) is responsible for restoration work in state-owned conservation areas.

Drainage changes several fundamental ecosystem properties of peatland, e.g. the water table level, the aeration of surface peat, acidity and microbial activity. These changes are reflected in the species composition and vegetation dynamics. The main goal for restoring peatlands is to restore a peat-accumulating ecosystem to maintain viable populations of characteristic species.

The framework for peatland restoration includes planning, implementation and monitoring. Constant exchange of feedback between these activities is a way to develop restoration methods and to ensure that possible problems will be detected and solved.

The most common peatland restoration methods used in Finland are filling in ditches and building dams with excavators. Tree stands are cut from originally open mires. Spontaneous vegetation succession after restoration is probable, since there are usually relict populations of the original mire plant species left.

The national monitoring plan for restored mires includes methods for monitoring and principles for the monitoring network. Short-term results show that restored sites have re-wetted and peat producing plant species have recovered. The ecosystem recovery is a slower and more complicated process. The long-term results are being monitored.

229 Potential gains of restoring active blanket bog in Wales

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The LIFE Nature funded Active Blanket Bog in Wales project aims to significantly improve areas of blanket bog in two Special Areas of Conservation (SACs) in Wales. The project is focusing on practical restoration work that tackles the key threats facing this internationally important habitat: ditch blocking, removing non-native plant species and advocating best-practice by land managers. The project is monitoring the impacts of the restoration work upon peatland hydrology, water quality, run-off rates and plant species composition on structure. Although research cannot be funded by the project, the experimental design established at the project site on the RSPB reserve at Lake Vynrwy with 5 treatment-control catchment pairs has provided an excellent research platform. This has attracted significant research interest from UKPopNet

that includes examining the impact of the ditch blocking work and climate change upon greenhouse gas flux. The Vrnwy site provides an excellent opportunity to quantify a number of potential gains from such large scale land management and their synthesis into an Ecosystem Service package. Preliminary results are due in November 2008 and final results in 2010.

230 Monitoring and restoration of Mutnanska pila bog

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Mutnanska pila bog is one of the well preserved active raised bogs with a mosaic of alkaline fens, transition mires and quaking bogs in Slovakia, but it is threatened by succession and decreasing underground water level. The area has been protected since 1979. In 2004, it was listed as a candidate Special Areas of Conservation as "Bogs of Biela Orava" along with two other bogs in the Biela Orava catchment. Research was focused on the monitoring of habitats and the hydrological regime after restoration of the area in 2002-2003. Restoration was realized within the project "Conservation and Sustainable Use of Peat lands in Slovakia". On the basis of ecological study, some management measures for improving the hydrological regime were done, such as building barriers on brooklets, cutting trees, and mowing. The effect of these measures was monitored in 2007. Monitoring was based on vegetation sampling and the monitoring of the hydrological regime at eleven monitoring plots which were established in 2001. The increasing of the underground water level was shown only locally, and the vegetation restoration on brooklets was quite successful. Generally, the species composition and the overall hydrological regime have not shown significant changes. By cutting trees the microclimate has changed slightly, which can effect dehydrating of bogs. Succession of *Molinia caerulea* and juveniles and self-seeding of *Pinus sylvestris*, *Populus tremula* still continues and threatens habitats of active raised bogs and mires.

This work was supported by the Slovak Research and Development Agency under the contract No. LPP-0135-06.

231 Some ecosystem dynamics provided by reintroduced beaver (*Castor fiber*)

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The beaver (*C. fiber*) was reintroduced in Denmark in 1999. In total 18 animals were moved from Germany to the upper part of river Flynder - in the north western part of Jutland. In April 2007 the population had increased to 90 individuals. The area of introduction, Klosterheden State Forest District, contains big forest with a lot of small valleys overgrown with *Salix cinerea*/*S. aurita* and *Myrica gale* besides areas with open grassland, some of which have formerly been cultivated.

The vegetation of some of the valleys was described before the introduction in 1999 and characterised to vegetation types. After eight seasons with beaver activity, the vegetation was surveyed again in eight valleys with active beavers. Furthermore, different types of ecosystem dynamics were registered.

The beaver has changed the landscape in different ways. The changes are evaluated to be positive or negative in relation to set aims: Recreation of the former wetland landscape in a nutrient poor Jutland landscape. Some of the changes will be presented and discussed in relation to ecosystem dynamics and set aims. Positive changes were revitalization of dry meadows into wetlands with new sphagnum growth, creation of bare soil for low growing pioneer species and of new shallow waterways with running water. Positive was also cut down of shading bushes in combination with raised water table. Here a new succession of the field layer vegetation was initiated. Negative is a change of the vegetation into a more nutrient rich one along the dams and ponds and drowning of nutrient poor and valuable vegetation.

232 Addition of wood in streams: experiences from a lowland stream restoration project

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Addition of wood in streams is a common low-budget alternative to complex restoration projects. Although increasingly used to increase hydromorphological and ecological status of streams and rivers, only few European projects have been monitored and few descriptions of ecological effects of wood addition exist to date.

As part of a stream habitat restoration experiment, woody debris was introduced on a small-scale in a Dutch lowland stream. Using a before-after-control-impact (BACI) designed experiment, investigating both an experimental and a control section, we examined restoration-induced changes in stream substrate patterns and aquatic macroinvertebrate community composition.

After wood addition, substrate heterogeneity increased and shifts in macroinvertebrate community composition were observed. No differences between number of taxa, families and macroinvertebrate abundance recorded in the control and the restored section were observed. However, changes in feeding and habit groups provided support for community functional changes due to wood addition, in favour of some WFD macroinvertebrate indicator species.

These findings suggest that re-introducing wood is an appropriate restoration technique to improve the hydromorphological and ecological status of Dutch lowland streams. Additional work is needed to confirm these findings, focusing on the addition of more wood over larger spatial scales.

233 River restoration of the 'Kleine Nete' between Herentals en Kasterlee (Flanders – Belgium)

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The river Kleine Nete, located in Flanders (Belgium) has been the subject of several adaptation campaigns, from which the straightening in the seventies was the most excessive. This resulted in a considerable decline in ecological and recreational value of the area and has caused serious water shortages in the public nature reserve "Olens Broek". This nature reserve is part of a Special Protection Area (EU-Habitat BE 2100026 'valley of the Kleine Nete'). The river Kleine Nete is mentioned as the habitat 3260 'Watercourse of plain to montane level with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation'. Within the framework of the implementation of the European Water Framework Directive, a variety of measures was suggested to restore the multifunctional use of rivers, often by creating more natural conditions in the river system.

Different scenarios for restoration are evaluated by an iterative process of surface water, groundwater and hydro-ecological models in which the maximum nature objectives are realised without causing negative impacts on agriculture and habitation.

The surface water model explains the effects of meandering on the water levels, water storage and floods in the area. These results are used as input for the ground water model in which the groundwater depths, groundwater flows and seepage areas are evaluated. The hydro-ecological model NICHE Vlaanderen uses the results of both surface and groundwater models to predict the potential vegetation types.

The integration of these 3 models makes it possible to examine if the conservation objectives of the Special Protection Area (EU-Habitat) can be reached.

234 The need of multiple communities monitoring to study river's conservation status

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Since the Habitat Directive came into force, Member States must evaluate the conservation status of habitat types and species of community interest. Consequently, they started to perform several monitoring and survey methodologies over the last decades.

In this context, we studied the EU 3260 habitat type "Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation". Our aim was to assess the impact of one human pressure on streams: the channelization. We tried to determine which biological indices (e.g. richness, diversity, normalized French biological indices) and communities (e.g. birds, plants, invertebrates) are the more sensible to channelization and could thus be used as suitable indicators for the conservation status assessment.

We monitored four streams similar in term of geomorphologic and chemical characteristics. Seventeen reaches (stations) were investigated with at least one reach hardly channelized per stream. Bird-, aquatic plant- and invertebrate communities were monitored in spring, summer and autumn 2006. We hypothesized that each community was related to one spatial scale: birds and landscape, plants and pool/riffle sequence, invertebrates and substrate types.

The results suggest (1) a gradient of conservation status values between streams and between reaches, and (2) a difference in seasonality between control and impacted reaches. Most of community indices indicated

that the conservation status was worst in channelized reaches than in controls. We also observed changes within the three community compositions: some taxa were mostly found in controls and some others mostly found in impacted reaches. Bird, plant and invertebrate communities showed similar and complementary trends. Some data from those communities' surveys should thus be combined in order to exhibit the best understanding of the impact of channelization on river habitats' conservation status.

Our first results outlined the necessity to use several different communities within an integrated index in order to take into account different habitats' hierarchical level in the EU 3260 habitat type's conservation status assessment.

235 Polders; an alternative for floodplains?

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As the primary habitat found in floodplains has almost disappeared, in the Netherlands polders form alternative (secondary) habitat. Polders are used by many Natura 2000 species for which natural habitat lies in riverfloodplains. The best known example is the godwit from which the major part of the western European population breeds in Dutch polders. Less known is that also Natura 2000 species as weatherfish, bitterling, moorfrog, crested newt, natterjack toad, green hawker and ramshorn snail are relative widespread within polders. These species all have different requirements with respect to connectivity with the main channels, water quality and succession stage. Based on previous projects carried out by the authors minimum habitat areas are given for the species mentioned and proposals have been made for design of habitat and management in polders. This measures are aimed at the long-term existence of these species in polders. It is concluded that polders can replace floodplains as habitat for a lot of species.

236 Conservation and restoration of the protected habitats of endangered fish species in the largest non-navigable watercourses in Flanders (Belgium)

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The poster shows the presence of the 5 species of fish listed in the Annex II of the habitat Directive and their protected habitats in the larger non-navigable rivers, managed by the Flemish Environment Agency. For every fish species the habitat requirements and pressures are given as well as the measures that are needed for the conservation and rehabilitation of their habitats. Examples of projects and measures that have been realised are presented. Also projects and measures in preparation and projects that still need to be added in the management plan are discussed.

237 River lamprey (*Lampetra fluviatilis*) and its need for connectivity

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River lamprey, a diadromous fish species listed in Annex II of the Habitats Directive occurs and breeds in Flanders (Belgium). Its inland penetration into the tidal (estuarine) and non-tidal part of the River Scheldt and its tributaries is monitored in recent years. The impact of several migration barriers on their upstream migration is discussed. Special emphasis is placed on the impact of the first tidal (km 160) and second non-tidal (km 170) lock-weir complex in the River Scheldt and on the use of a nature-like fish bypass channel in the tributary River Zwalm. Erratic free flowing conditions at the tidal weir offered limited opportunities for the lampreys to migrate into the non-tidal part of the river. Upstream migration over the second barrier is almost completely blocked. Nevertheless some River lampreys cleared both obstacles and migrated into the River Zwalm where they passed a nature-like fish bypass.

It is concluded that several locks and weirs in the River Scheldt catchment have a clear barrier-effect. Fish passage facilities are urgently needed to restore longitudinal exchange processes that are crucial for several diadromous fish species. The rehabilitation actions by the different water managers should include the building of fish migration facilities, improved wastewater treatment and habitat restoration programs.

238 Restoring river/floodplain interconnection to preserve riparian vegetation in the Danube floodplain between Neuburg and Ingolstadt (Bavaria/Germany)

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The Upper Danube was embanked and straightened in the 19th century and nowadays runs in dikes without any contact with its floodplain except during very high floods. Additionally, in the 1970s hydropower stations in form of large dams were built, negatively influencing the river continuity and the ground-water level of the floodplain. The goal of the river restoration project is to bring back new dynamics to the floodplain (water, groundwater and morphological features), which is the key process to improve environmental conditions for floodplain habitats and species.

The project "Restoration of riparian areas on the Danube floodplain between Neuburg and Ingolstadt (Germany)" takes place in a research area of 2.100 hectares of ancient floodplain forest. In spite of the changed conditions, a high biodiversity, mainly consisting of species of the hardwood floodplain forest, was conserved in this area. The project consists of three measures: 1) a permanent flow of water (up to 5 m³/s) bypassing the dam of the upper power station. The new river will develop in the floodplain, partly following old oxbows, but partly eroding its way naturally; 2) controlled floodings (up to 30 m³/s) of parts of the floodplain during peak discharge of the Danube (600-1100 m³/s; statistically one to three times a year); 3) temporary drainage of the floodplain in summer, when the groundwater level used to be constantly high due to the dams.

The project started in October 2006, in autumn 2009 the first water will be running through the floodplain forest.

239 The Aueninstitut (Floodplain Institute) Neuburg, tasks and methods

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The Aueninstitut (Floodplain Institute) Neuburg documents the hydrological, morphological and biological changes in the area of the project "Restoration of riparian areas on the Danube floodplain between Neuburg and Ingolstadt (Germany)". The main goal of these studies is to detect the best water donation for the aims of this restoration project and to govern the flooding regime. Furthermore, basic knowledge, which can be used for similar projects in the future, will be compiled.

The hydrological and geomorphological research questions consider flooding effects on sediment movement, correlations between grain size and flow conditions, soil moisture in the floodplain forest and the significance of natural floods for the shaping of river morphology. These questions will be answered by different measurement methods such as traditional mapping and modern laserscanning.

The effect of river restoration on the vegetation will be monitored by two different sampling designs. In the riparian habitats next to the new river, where the changes will be intense, 15 permanent transects with a relevés size of 1m² will be installed across the new river channel. In the hardwood forest, in contrast, about 120 stratified permanent plots for vegetation relevés of 200 m² were selected to identify the long-term effects of the increased water dynamics. Seven combinations of the parameters "height above water level", "distance from the new river" and "probability of flooding" in 6 sectors cause the high number of relevés. In 2008, permanent plot investigations will start with the collection of baseline data before the new flooding regime will start in 2009.

240 Life Nature 2002-2007: protection of the habitats of the freshwater Pearl Mussel in Belgium. Final results

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The purpose of this Life project is the long term conservation of the habitats used by the very endangered pearl mussels (*M. margaritifera*) populations. In the past, Pearl Mussel were common in a large part of the Belgian massif of the Ardennes and of the Eifel. Now, these populations have drastically decreased. Six Natura 2000 sites from the Semois and Moselle hydrographic bassins are concerned by the Life.

First action was locating and studying the ecological conditions of the mussels populations. Second action was

drawing maps of major problems ($n = 600$). Then, management measures were established: building fences (76km), watering places ($n = 119$) and runways for cattle crossing were installed ($n = 10$) ; withdrawing the coniferous trees from the bottom of valley (100ha) in order to restore a network of humid meadows and of deciduous riverine forest ; creating a protective status for the most sensitive lands (164ha of purchased land).

Pearl mussel is an "umbrella species" : the positive consequences of these actions complete in protecting the pearl mussel but above all in restoring our rivers, the habitats in the valley and their catchment as well as the aquatic and terrest species. Nevertheless, restoring habitats within the only Natura 2000 sites will not be sufficient if the pollution sources are not controlled. Action area must be extended to the entire watersheds. It is still long to go to restore populations and that future will clarify wether or not the adjustments will reach their goals. The Walloon Region, Natagora and the PNHFE will strive for additional means to guarantee the monitoring of the persistent problems and the mussels populations.

241 Stepping stones for biodiversity

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Recently green house production of cucumber (*Cucumis sativa* L.) has been increased enormously in I.R.Iran and other parts of the world. This study was conducted to investigate the effects of two exogenous plant growth regulators, IAA and GA3, on production, vegetation, and infrastructure of parthenocarp cucumber (*Cucumis sativa*), Holland Royal Star cultivar, in greenhouse conditions. Two concentrations of 100 and 500 ppm of IAA and GA3, alone or in combination, was sprayed every week on the plants from when they have 4 leaves and followed for 24 weeks. Experiments carried out in a 4 complete randomized blocks, each comprising 9 parts: 8 treatments and one for control. Each part included 8 plants in 2 square meters. Vegetative and reproductive factors such height, number of leaves, male and female flowers, and number of fruits was measured every week and the data was analyzed using ANOVA. Study on infrastructure of plants was carried out using conventional methods. Results showed that the combination of 500 ppm IAA and 100 ppm GA3 led to produce significantly more vegetation and female flowers ($p < 0.01$) in which number of fruits was 2.78 times more than control. Interestingly, significantly ($p < 0.011$) more male flowers appeared when the combination of 100 ppm IAA and 500 ppm GA3 used. The hormone treatments have caused different infrastructural alteration in various parts of the plants such cortical and pith parenchymas, xylem vessels, and structural tissues. The results of this study could be applied in green houses to increase production of cucumber.

242 Improvement of nature quality in a Danish Natura 2000-area: Mølleådal

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The Natura 2000-area Mølleådal (River Mølleå Valley and the deer park Dyrehaven) lies 15 km north of the City of Copenhagen. The valley covers 3,000 ha and comprises of large lakes, natural woods, mires and fens which offer suitable biotopes for rare plants and animals. The area is one of the most species-rich habitats in the Copenhagen area in relation to vascular plants, and several rare species of insects, mollusks, amphibians and birds live there.

River Mølleå Valley and Dyrehaven offer great recreational possibilities and is used by appr. 1.5 million citizens of Copenhagen and surroundings for leisure, picnics, horse riding, water sport activities, nature studies and jogging.

The Natura 2000 area is designated to protect species and habitat types such as: 7140 Transition mires and quaking bogs, 7220 * Petrifying springs with tufa formation, 7230 Alkaline fens and 91E0 * Alluvial forests. One of the major threats is the (natural?) overgrowing of the species-rich habitat types. The overgrowing is accelerated by alteration in hydrology and atmospheric deposition of nitrogen together with former drainage in the forestry.

The project is carried out in 2007 - 2008 as one of the first national initiatives to restore and protect a Danish Natura 2000 area to obtain a favorable conservation status. A plan for restoration with re-afforestation, use of traditional hay harvest, grazing, optimizing the hydrological conditions and promote recreation with considerations to the natural values has been designed by COWI and The Danish National Forest Agency. The plan costs appr. 450.000 euro to realize, and will also benefits the cultural landscapes in the valley.

243 Ecological changes in Manyas bird paradise

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Manyas Lake, known as the Bird Paradise, is a unique refuge and breeding ground for migratory waterbirds. It was awarded by "Class A Wetland Diploma" by European Council in 1976 and the given diploma was renewed four times. It lies in the Marmara region in northwestern Turkey. Manyas Lake is not only a habitat for migratory waterbirds with its rich fauna and flora but also resort for many visitors. But ecologic decomposition was occurred in Manyas Lake by industrial improvement and global pollution.

The objective of this work is to define the ecological changes and their effect on wildlife in this lake. For this purpose, physical, chemical and biological properties of the lake was investigated and changes of this properties and effects of changes were pointed out. Especially differentiation on ecologic dynamic and the damage on wildlife were presented. Considering the results of this work, it was determined that species and number of waterbirds decreased because of industrial and agricultural treatments and other factors.

244 Fen restoration in the Northern part of Turnhout

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Land Development for Nature (LDN) projects find their juridical basis in the Nature Decree of 21/10/97. These project types are mainly directed towards an optimal development of appropriate areas by nature conservation, restoration, management and development. LDN is integrated within the context of the Life project 'Large-Scale Habitat Restoration in Turnhouts Vennengebied' (Life 06 NAT/B/000084).

Turnhouts Vennengebied is one of the most important heath and fen areas in Flanders. It is wide-known for fens like Zwart Water (with *Lobelia dortmanna*), as well as for the large meadow bird populations.

In 1996 a large area of 2800 ha was designated as an SPA under the Habitat Directive. 10 types of habitats (fens, heaths, Alnus wood, Nardetalia grasslands and sand dune grasslands with *Corynephorus* and *Agrostis*) were listed for this area, with *Luronium natans* in addition. This species is still sparsely present in fens around Turnhout. Moreover, *Leucorhinia pectoralis* reappeared in the region a few years ago.

Recently, an expert study on fen restoration has been concentrating on (a)biotic shifts in selected fens over the years, measuring specific quality-parameters of groundwater, surfacewater and soil layers, and updating data on vegetations and aquafauna. All these data, provided evidence for a variety of measures to be taken to recover fens and heaths in sustainable ways. Measure such as creating buffer zones, deforestation, sod-cutting fen shorelines and adjacent former farmland, removing sludge and degenerated peat, liming infiltration zones were considered and assessed, together with local water level management and archaeological value.

245 Partial ecological restoration of the natural lake "Het vinne"

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Where: Zoutleeuw, special protection area "forests and calcareous heaths of Haspengouw", great crested newt as reported habitat species.

Who: Flemish Land Agency and Agency for Nature and Forests in cooperation with the province Flemish Brabant.

History: The Vinne depression is presumed to be created through glacial formation. The lake that developed later was fed with water from the Kleine Gete and surrounding streams and with ground and rain water. It was drained in 1850 to plant poplars.

Restoration?: Ecohydrological research showed that it was possible to partially restore this lake. The original watercourses do not flow in the lake. The social context was of overriding importance to obtain the necessary means and public support.

Measures: Poplar plantations were cut, branchwood and stems as well as mulch were locally removed. Locally debris banks were dug off. The water quality was increased through water purification. Pasture grids and recreation infrastructure were constructed. In 2004 the pumps were stopped. 18 months later the lake was filled.

Results: The whole transformation from closed landscape to open lake is spectacular. Het Vinne is one of the top areas in Belgium for marsh birds such as great bittern, whiskered tern, black-necked grebe, little

bittern. The presence of Norfolk hawk, emerald damselfly, large gold grasshopper, large marsh grasshopper, *Utricularia australis* and little green sedge is also extraordinary.

Problems: Stems in the lake and reed areas were not removed. Consequently these zones provide lots of breeding opportunities for the large number of gulls in the lake, resulting in a considerable nutrient supply.

Conclusions: The results of the lake restoration are spectacular for Flanders. It is important to thoroughly consider the conditions and not give in on ecological priorities (water depth, tree stem removal) to avoid problems. The change of management must be properly assisted. Nature remains unpredictable. The large number of visitors proves the need for this type of high quality nature areas for recreation.

246 Impact of wetland restoration on plant genetic diversity

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The ecological benefits of wetland restoration are usually assessed by community diversity, restoration of groups of interest, or of given functions (eg carbon sink), but rarely through the genetic diversity of populations, if these populations are not a conservation issue. This project aimed to assess such ecological benefit. Indeed, genetic diversity plays an important role in biodiversity conservation because it is a key factor for species ability to evolve and adapt to environmental changes. Aquatic plant species are able to reproduce both sexually and clonally, and the relative importance of these two reproductive ways depends on environmental conditions. So such disturbances should greatly influence genetic diversity of populations. The present study aimed to analyse several parameters of genetic diversity for an aquatic plant species that could reproduce both sexually and vegetatively, *Berula erecta* (Apiaceae), in several wetlands of the Ain floodplain restored between 2005 and 2007. As the restoration was a physical disturbance supposed to favor clonal reproduction and dispersal of clonal propagules, the tested hypothesis was that restoration should reduce intrapopulation clonal diversity and interpopulation genetic differentiation. For testing this hypothesis, clonal and genetic diversity of restored vs. unrestored analogous sites was measured using microsatellite molecular markers. These codominant and highly polymorphic markers represent an efficient tool for clonal species that are expected to exhibit low genotypic diversity, but potentially high heterozygosity. The benefit of restoration in terms of genetic diversity and the validity of the biological material for assessing such benefit are discussed.

247 Restoration of gamebird habitats in state-owned land in Finland

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Numerous natural wetlands in boreal forests have been hydrologically altered by human action. These areas include peatlands used for peat production, drained bogs and mires, and constructed, but afterwards abandoned fish farming ponds. Many of these sites can be restored using innovative land use planning and active measures, and designed for brood habitats of gamebirds.

A two-year project aiming for restoration, rehabilitation or re-creation of wetlands in boreal commercial forests for brood habitats of waterfowl and grouse species was started in Finland last year. During the project, appropriate targets for a novel kind of gamebird habitat improvement have been mapped, and suitable procedures for those planned and carried out. The project sites, totally ca. 60, are located in various parts of Finland. All the project sites are situated on State-owned land administered by Metsähallitus. The sites and actions will be selected so that other possible significant natural features and/or wildlife of the areas will not be deteriorated.

During the project, dozens of needlessly drained bogs and mires are restored as brood habitats for grouse species, e.g. willow grouse (*Lagopus lagopus*) and Bean goose (*Anser fabalis*). The most important measures in bog restoration are restoring hydrology and removing excess trees that have grown since the area was drained. New wetlands especially for waterfowl are constructed on abandoned peat production or fish farming sites, and on places where the natural conditions for this are favourable. Open-water wetlands will be mainly constructed by damming the water to form an area of 1 - 30 hectares.

248 "The chemical time bomb; can surface water oxygenation enhance sediment metal availability?"

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High trace metal concentrations in surface water, suspended matter and river sediments are reported world wide. Although West European water quality is improving gradually, historically polluted sediments may still pose an environmental risk. Because the nutrient load decreases surface water oxygen levels become higher. The oxygen water concentration can influence soil chemistry and hence metal bioavailability.

PVC cores filled with polluted sediments from the Zenne (Belgium) were placed in a climate room. Cores were flooded with water with a 0, low or high aeration treatment. The experiment was followed up for 1 year.

The acid volatile sulphide (AVS) concentration was higher in the "0 aeration" treatment (1139 mg kg⁻¹ dry weight) compared to the "low" (56 mg kg⁻¹ dry weight) en "high" (19 mg kg⁻¹ dry weight) aeration treatment. Simultaneously extracted metals (SEM), total and dissolved surface water metals and top soil pore water metal concentrations are increasing with increasing water aeration.

This experiment indicates that surface water aeration has a major influence on AVS concentrations in the sediment. AVS is one of the most important sinks for toxic trace metals. Reoxygenation of river water due to amelioration of the water quality can result in AVS dissolve. Historically deposited heavy metals may become more available to macroinvertebrates and may enrich river surface water.

249 Prediction of Annex I habitats in Danish wetlands

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The habitats protected by the Habitat Directive (Annex I classes) are a subset of the European habitats described in the CORINE Biotopes Manual (Anon. 1991). Annex I protects 10 types of Danish wetland habitats, whereas 16 remaining types fall outside protection.

The objective of this study is to develop a supervised classification model for all semi-natural and natural wetland plant communities described in the CORINE Biotopes Manual using available monitoring data from Danish wetlands. The target is a statistical and standardised interpretation of the selected habitat types protected by the Habitat Directive that is readily applicable to the management and conservation of natural habitats in Denmark.

250 Monitoring wetlands along the 'Western-Greek Bird Migration Route'. Spatio-temporal change detection using remote sensing and GIS in Logarou Lagoon, Western Greece: a pilot study

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The population of long-distance migratory birds is declining worldwide mainly because of loss of suitable stopover-sites. Wetlands are important stopover-sites for birds offering them energy along their journey. The geographical position of Greece makes it an important transit zone for migratory birds. Along the western coast of Greece numerous wetlands support the 'Western-Greek Migration Route', as defined in this research. During the 20th century, the majority of Greek wetlands were degraded and lost by drainage and development. Further loss and/or deterioration of wetlands along the 'Western-Greek Migration Route' can result in a critical lack of suitable stopover sites for migrating birds.

In this research, a monitoring method was designed to perform a post-classification change detection in wetland area, using remote sensing and GIS, with surface area of habitat types as an indicator. A monitoring and a classification schedule were created using MedWet guidelines. Logarou lagoon was selected as a study area to perform a pilot study. The cost- and labor-effectiveness, the reliability and the feasibility of the method were of interest. Two types of imagery material were used: aerial and satellite images. Habitat maps were created for the study area based on aerial photographs of 1945 and 1985. Then, the areas of each habitat type were compared. From 1945 to 1985, changes had occurred in all classes (expansion of agriculture, road building and construction of an aquaculture plant). Three Landsat images (1977, MSS; 1989, TM and

2000, ETM+) were selected from 'NASA's Global Orthorectified Landsat Data Set'. Each image was classified separately using a Hybrid unsupervised-supervised method. Finally, a post-classification comparison was performed using raster GIS-based matrix analyses for the paired maps: 1977-1989, 1989-2000 and 1977-2000. The results of the change detection show that Logarou lagoon is a very dynamic system, where habitats easily convert from one class into another. The most important human induced change between 1977 and 2000, was the construction of an aquaculture plant (about 420 ha) in a marsh area (about 800 ha) that probably affected the fauna and flora.

The pilot study proves that the methodology developed to monitor wetlands is cost- and labor-effective, reliable and feasible for detecting changes in wetland area. Therefore, it could be used to investigate all wetlands in Greece. In a next phase, the biological relevance of these changes needs to be examined with the main question 'What changes in wetland habitats are important for migrating water birds?'

251 A preliminary analysis of the legislation regarding the western Greek section of the wetland bird migration routes and its implementation

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Greece has exceptional biological diversity. Its position on the Balkan peninsula and its subdivision because of mountain chains has made it into a biogeographical refuge. Situated deep into the Mediterranean, it is a bridgehead from and towards Africa, while its connection to the Balkan and the European mainland has made it into a migratory wetland bird route, or a bundle of routes. The roughly North-South oriented coastline of its Western shores extending into Albania and along the Dalmatian coast provides a link between wintering and breeding areas for migratory birds. This coastline is dotted with wetland complexes hosting resident and migratory wetland birds. According to the last Natura2000 barometer (December 2007), the implementation of the Bird and Habitat Directives by Greece is incomplete in designating the list of SPAs and in protecting SCIs.

We performed a study on the implementation of nature protection measures in the Amvrakikos Gulf wetland, an ecosystem of major interest for its biodiversity and an important habitat for birds (Maragou and Mantziou, 2000) and Red List species (Ministry of Environment, Greece 2007). Moreover, the site is internationally recognized and legally protected (RAMSAR site, Barcelona Convention, EU-SPA, SCI, National park still pending). Privileged witnesses were interviewed (EU Directorate General of Environment, the Ministry of the Environment, the Hellenic Ornithological Society (an NGO), the Greek Centre for Wetlands (EKBY), researchers, managers, local inhabitants) in an exploratory fashion. Literature was reviewed, Greek legislation was screened and the results were SWOT analysed. 'On paper', the Amvrakikos Gulf is a well protected wetland. The data showed, however, that Greece lacks in political will, in coordination of authorities, in the efficiency of institutional structure, in environmental education, in spite of efforts of individual politicians, scientists and citizens. SWOT analysis supports the hypothesis that first, the operational legislation regarding the protection of wetlands in Greece is not sufficient and secondly, the one existing is not implemented, causing misuse of wetland biotopes, breaking wetland connectivity. It details the global evaluation expressed in the Natura2000 barometer on basis of the case of a biologically very important wetland area.

252 Response of macrophytes to restoration from eutrophication in the shallow softwater lake Kraenepoel (Belgium)

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During the last decades, efforts were made to restore at least 200 standing shallow waters in the Flemish part of Belgium. Often, reduction of external nutrient loading proved insufficient to induce a reversal from turbid to clear water, indicating that additional measures are usually needed. The restoration project of Lake Kraenepoel is one of the most extensive ones ever carried out in Flanders. Since its creation in the Middle-Ages, this 22 ha lake was managed for traditional pisciculture. Regular water-level drawdown (\pm every 5 years) for harvesting fish prevented foddering and accumulation of organic matter from leading to ecological degradation. However, since World War II, supply of nutrient-rich surface water, polluted atmospheric deposition and cessation of water-level drawdown accelerated the eutrophication process. Consequently, the regionally exceptional softwater vegetation with priority species such as *Lobelia dortmanna* and *Luronium natans* declined. Restoration started in 2000 within the frame of a LIFE project and included

phased implementation of complementary measures. Changes in the vegetation were recorded by means of complete surveys and transect relevés. Abiotic conditions for the specific flora improved considerably and a marked increase in aquatic macrophyte abundance and structural diversity occurred. Yet, former species composition was only partially restored. Species with a viable seed bank and relic populations that persisted until restoration (*Elatine hexandra*, *Eleocharis acicularis*, *Hypericum elodes*) were most successful. The quality of available surface water is insufficient to allow its use as a source of buffering capacity, whilst atmospheric N-deposition, accumulation of leaf litter and large numbers of exotic geese remain items of concern. Regular drawdown can mitigate some of their effects.

253 Multi attributes project evaluation of ecological restoration: An economic experiment in Kushiro wetland, Japan

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In Japan, Law for the Promotion of Nature Restoration (LPNR) was enforced on January 1, 2003. The LPNR stipulates that the party conducting the nature restoration project should form a Nature Restoration Committee (NRC) with local governments, governmental agencies, and other parties who intend to participate in the project, including local residents and nonprofit organizations. As of March 2007, the numbers of NRC was eighteen. The Kushiro Wetland Nature Restoration Committee, which is one of them, finalized its overall plan in March 2005. As of March 2008, five nature restoration projects were decided to be implemented.

Economic evaluation, based on a questionnaire survey involving the general public, provides valuable insight to conduct restoration projects efficiently. The questionnaire survey for a multi-attributes project requires a researcher to provide a considerable amount of information about the project to the respondents. However, respondents may face difficulties in understanding the project because of their unfamiliarity with it and the complexity of scientific knowledge.

We analyze how public preferences are influenced by the discussion meeting that the respondents can ask questions and share information. Our main findings revealed that discussion meetings can significantly influence participants' preferences and can contribute to reducing the diversity of preferences.

A questionnaire survey generally requires several thousands respondents. However, the evaluation of a multi-attributes project based on unformed public preferences may involve incorrect judgments regarding whether or not the projects are to be implemented.

254 Visitors' profile and their perceptions of the aesthetic forest Kouri of Almyros, Greece

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In Greece there are 151 Special Protection Areas (SPA) and 239 Sites of Community Importance (SCI) which belong to the Natura 2000 Network. These areas cover the 19,1 % of the terrestrial and the 5,5% of the marine surface of the country. Among them, there is significantly a lot which are known only to few people who live close to them. In the present research, an almost unknown protected area, the Aesthetic Forest Kouri of Almyros, was chosen to find out its environmental effects to the community and its visitors' profile. This Aesthetic Forest, member of the Natura 2000 Network, is a unique lowland mixed forest of oak in the Southeast Europe, which offers many environmental benefits to the local community. The Contingent Valuation Method was used in order to estimate the value that the visitors place on it. A sample of the visitors was chosen and they were asked through a questionnaire for their willingness to pay (WTP) an entrance fee to enter in the area as a means to finance it. By using the two-step cluster analysis an attempt was made to specify groups with same characteristics that visit this area. The results show that the Kouri Forest is almost unknown outside the local community, but the latter seems to find extremely beneficial the presence of the former. The groups extracted can help the local authorities to take measures in order to make this protected area known to the whole country.

255 Legal issues and landscape restoration in the South of Brazil

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Changes in environmental law, and their increased constraints do not guarantee a better protection for areas of especial interest for ecological conservation. The Brazilian case it's a very interesting situation to be addressed. Where changes in specific topics of the law which are expected to improve environment protection have no practical results. For the application of the Brazilian Forest Code, the most important national law, the country is divided in three different regions which are Amazonian (northwest region), Cerrado (central region) and Southern region. For these regions there are different degrees of natural vegetation protection which corresponds to 80% natural cover at any farm located at Amazonian region, 35% at Cerrado region and 20% in the south region. About 500,000 acres in a Southern State must be restored to fulfill the environmental law demands. The landscape from this region has characteristic Subtropical forest and natural grasslands which forms a mosaic with agriculture, pastures, tree plantation and wetland patches. Among the most promising alternatives already tested, are the nucleation techniques which are being used to restore areas which were used for agriculture or tree plantation. The most used techniques are the improvement of the connections among forest and grasslands fragments considering landscapes and ecosystems particularities, reforestation with native plants and top soil transportation with a especial attention to soil seed bank richness. The most successful experiences occur on private properties, with especial attention to farms used for tree plantation.

256 Multiple benefits of land reclamation. The importance of local acceptance in addition to ecological success

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Reclamation of degraded areas is normally aimed at restoring ecosystem functions and structure. Most of the time only ecological parameters are used to measure the success of reclamation projects, but due to multiple benefits of ecosystem service for the society, it's also important to measure factors like social or economics values. As reclamation programs always need the support and acknowledgment of society, factors like the aesthetics's value may also be important for their acceptance and success. In this study we assessed the short term success of a reclamation program by measuring some ecological parameters and also the effects of changing the areas' visual appearance by asking locals about their perception. Reclamation treatments resulted in profound changes in the vegetation cover after five years, although the vegetation was still in early stages of succession and the soil parameters had not changed much. On the other hand, participants asked to rank photographs of the reclaimed sites favored photographs of treatments with vegetation they perceived as "natural" over photographs of control plots with sparse vegetation cover or reclamation by an introduced species. This implies that peoples attitude towards reclamation can depend very much on the methods used. Although ecological success is the most important criteria, locals and other stakeholders should be involved in defining goals of reclamation projects if they are to acquire common support of the wider society.

257 Analyzing aspects of the local society in the protected area of Axios-Loudias-Aliakmonas estuaries (Greece)

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The protected area of Axios, Loudias, and Aliakmonas estuaries (Natura 2000 Sites), in northern Greece, belongs in three Prefectures and 10 Municipalities. Its exact boundaries are not defined yet, as full enactment of protection is still missing. We assessed local people's knowledge of the designation of the protected area, their perceptions about environmental stresses being imposed on it, their interest to increase their knowledge and awareness, as well as their willingness to contribute to the protection of the area. Results show that one in four respondents is not aware of the protection status. The great majority of respondents believe that there are negative impacts on the natural environment of the protected area from industrial wastes, pesticides, fertilizers, and hunting. Less than half believe that there are impacts from sand extraction (44%), whereas one in three from the expansion of mussel culture and grazing (as it is currently conducted). Only a small part of the respondents (26%) are aware of the existence of an Informational Centre, half of those

have visited it, and only one in four has attended a relevant information/awareness event. The great majority of respondents expressed their interest in getting more information about the area and their willingness to devote time or pay a little amount of money for protection. Considering positive answers for information and contribution in time or money for the protection of the area as an indication of pro-environmental attitude, we believe that despite the existing conflicts, there is ground for protection in practice.

258 The impact of small scale instruction projects in Turkey's health, safety and environmental policy statement

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Turkey policy is to minimize the negative impact of small scale instruction projects on the environment, to deliver projects that meet people's highest expectations and to ensure the safety and health of our most valuable resource. Training is important to improve person's understanding of the law and give them the authority to act responsibly. Turkey target a "Zero Accident" work place by eliminating risks and expect all employees to participate in the process. The government take environmental protection and pollution minimization into consideration at every stage of work. Turkey Government can proceed with its professions, knowing that all appropriate health, safety and environmental measures have been taken. Environmental management issues are governed or guided by a number of 'standards', including: those required with environmental policy, contained in Turkish legislation; specified in international standards and guidelines. The main impact of surface mining operations on biodiversity is from disturbance to habitats, vegetation removal and land clearance. High dust levels generated in mining operations may affect both aquatic and terrestrial ecosystems. Also, contamination of surface watercourses may occur from leaching. This can affect fish and other aquatic fauna and flora. The impact of quarrying on biodiversity can be reduced by: minimising the amount of land uptake required to undertake the operation, and the amount of vegetation required to be removed; leaving a buffer zone between the workings and sensitive habitats and wildlife corridors; treatment and control of stormwater run-off prior to discharge into any surface watercourse monitoring of the ecology of the site.

259 The perspectives for restoration of protected areas of Borneo

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Timber logging was the first major large-scale land-use change in peat forests of Borneo and Sumatra since the invention of slash & burn practices. Logging roads are pathways of deforestation, leading to changes in humidity, increased tree mortality at their edges, increased litter/fuel loads for fires, thus increasing susceptibility to fire along these roads, and in the end to changes in forest structure. Roads are also pathways of fragmentation along which land-use changes start and where fire is often used as a management tool for land preparation and also for clearance of new agricultural land. Fire is spreading easily into neighbouring forests when out of control. Degradation of peat forests by fire will continue unless future fires can be prevented or drained peat soils can be restored as wetlands. But further drainage of peat forest and conversion of forest to agricultural land is intended for political and economic reason.

Regions with widespread logging, previous fires and the use of fire as a tool for land management are at higher risks for disastrous fires, resulting in complete deforestation and even more serious haze-health disasters. Neither drainage, nor forest fires or forest degradation distinguish between protect and non-protected areas. Also drainage of local peat areas for plantations is impacting the hydrology of remote areas, further degrading the original biodiversity.

The two most important measures, hydrology of peat soils and fires, for restoration of protected areas, limitation of damage and prevention possibilities are described and an outlook will be sketched for protected areas.

260 The GreenKeys eLearning Module: a tool for enhance participation in green cities planning and management

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GreenKeys (Urban Green as a Key for Sustainable Cities) is an INTERREG III B CADSES dedicated to addressing the growing demands of providing healthy living conditions in urban areas by promoting the

development of urban green spaces as a key for making cities more liveable.

Into Greenkeys Toolbox, a Module has been developed, dedicated to decision makers with the aim to increase the sensibility in planning and managing urban green spaces. This Module, called eLearning Module, has been realized to start up a fast consulting process for public stakeholders (Pilot Projects) in a public participation process for increasing sensibility to urban green spaces problem.

261 Planning and implementation of corridor areas in Flanders

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The Flemish provinces have indicated corridor areas and areas with ecological infrastructure in their spatial structure plans. These are juridically defined as areas that are important for the migration of fauna and flora between areas of the Flemish Ecological Network or areas with concentrations of small landscape elements. Furthermore, they are important areas for enhancing ecosystem resilience and the mitigation of climate change impact. The provinces want to realise ecological corridors here by implementing stimulating measures. To support the demarcation processes and the implementation of these areas, INBO carried out an evidence-based review of the fragmentation problem. Ambition and scale levels of corridor areas in Flanders were determined and an attempt was made to distil rules of thumb for functional design of connecting areas. The methodology pleads for the design of sufficiently robust, multipurpose habitat networks which incorporate several landscape functions. In line with EU recommendations on Article 10 of the Habitats Directive (92/93/EEC) we proposed to define clear conservation objectives, to give high priority to corridor areas supporting the coherence of the Natura2000 network and to set focus on functional connectivity (species-specific) based on best available ecological knowledge. The presented method joins the characteristics of habitat quality and spatial consistency for a group of policy-relevant species into eco-profiles for corridor areas. These profiles were symbolised by a flagship species characterising the group and representing the network message. The working method is applied by the provinces in the layout of ecological visions on corridor areas. In light of this study a discussion forum has also been created with representatives of the provinces and regional civil servants. The provinces report on the progress of pilot projects and discuss sticking points and possible solutions here. More on Flemish corridor areas on [www.inbo.be/policy/Flemish Ecological Network](http://www.inbo.be/policy/Flemish%20Ecological%20Network).

262 SELNAT project: How to make Natura 2000 work properly? – Socio-economic, legal & ecological management

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In Belgium, the delineation of Special Protection Areas (SPA) and Special Areas of Conservation (SAC) has been done. At present many questions arise concerning the management of these areas. The multiple use of the space generates conflicts of interest. The SELNAT-project aims to answer the question "How to make Natura 2000 work properly?", taking into account socio-economic, legal and ecological management aspects. This project aims to achieve more insight in a sustainable management of Natura 2000 sites.

In a first part of the study, the legal framework, the ecological status and the socio-economic frame have been described. The main legal, economic, social and ecological bottlenecks for the Natura 2000 network implementation in Belgium have been highlighted. In a next phase, guidelines for the elaboration of a 'good management plan' for the Natura 2000 network will be developed at the local scale taking into account the principles of the Ecosystem approach. The fundamental question in this part is which instruments are needed at what time in the implementation process to reach the ecological targets taking into account economic, legal and social considerations. In a first step we evaluated the feasibility and effectiveness of these instruments by means of a literature review and a survey among experts of the field. In a second step we'll try to develop a management plan for two case study areas, a Flemish site and a Walloon site. At the end of the project, recommendations for policy makers about the improvement of these instruments will be formulated.

263 Stakeholder participation: How are Natura2000 sites managed in the EU member states?

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Management of Natura2000 sites involves close cooperation of multiple stakeholders, because of the multifunctional character of these sites. The stakeholders need to fulfil two objectives:

- Conservation of species and habitats
- Respect of the local socio-economic and cultural context

Under the authority of DG Environment of the European Commission, a consortium of INBO (BE), Alterra (NL) and CEH (UK) studies how the EU member states implement Natura2000. The consortium analyses the designation process and the integrated management plans of Natura2000 sites, as well as it selects the best practices on management and the effective involvement of all stakeholders and produces a website for the presentation and exchange of these experiences.

The poster presents the comparative analysis we apply to the integrated management procedures and actual practice in the EU member states, and some examples of good practice, in nature reserves. It presents criteria that are essential for effective and successful stakeholder participation and achievement of the two aforementioned objectives. Eventually the study leads to a small selection of best practices throughout the European Union, as guidance to other Natura2000 sites.

We ask you to provide us with information on 'your' nature reserve –not necessarily a Natura2000 site–, region or country with regard to the

- Possibilities and effectiveness of stakeholder participation
- Management procedures you need to comply to

264 Status, habitat characteristics and prospects of *Leucorrhinia pectoralis*, an Annex II and IV species, in Flanders (Belgium)

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The Yellow-spotted Whiteface (*Leucorrhinia pectoralis*) is a very rare species in Western Europe and is declining in many countries. In Flanders the species is only known from 23 localities since 1980 and is considered as 'critical endangered' on the Red List. In the eighties several populations occurred, with up to 60 adult individuals seen on one day on a single site, and with a total of nine sites. Although *L. pectoralis* has been seen at 14 localities since 2000, two of them the same as in the eighties, no actual populations are present. For the period 1990-1999 data are missing.

Leucorrhinia pectoralis is a characteristic species for fenlands but inhabits also mesotrophic pools on sandy soil, where populations are small and unstable. In any case the habitat is characterised by well-structured aquatic and riparian vegetation and the water is relatively shallow. This is important for the larvae which are day active and forage visual for prey. Therefore they need sufficient coverage and structure, formed by roots and leaves in the pond to hide for predation by fish.

We examine the habitat characteristics of all locations where the species occurred since 2000 and compare this with the known habitat preferences and assess the conservation status of *L. pectoralis* in Flanders. We also look for the most promising Special Areas of Conservation where the species should be able to establish stable populations.

265 A holistic approach for the conservation of the endangered plant priority species of community interest *Arabis Kennedyae* Meikle in Cyprus

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A holistic approach adopted for the conservation of *Arabis kennedyae* is presented. *Arabis kennedyae* is a priority plant species of Annex II, Directive 92/43/EEC. It is an annual herb, endemic to Cyprus classified as Endangered in the "Red Data Book of Cyprus". It has been found in three locations (3 subpopulations), which are included in proposed Natura 2000 sites of Cyprus.

Monitoring and reintroduction activities are implemented as part the LIFE-NATURE-2004 project "Conservation Management in NATURA 2000 sites of Cyprus", including mapping of the current subpopulations and searching for new subpopulations. Other activities include the estimation of the Relative Reproductive Success of the species and the investigation of seed germination ecophysiology.

The project also focuses on species reintroduction. Taking into consideration the variance of the habitat of the three subpopulations, it was decided the expansion of the larger subpopulation at neighboring sites with similar habitat and the re-establishment of the area of an extinct (4th) subpopulation.

Another project titled "Conservation Biology of priority plant species of Annex II Directive 92/43/EEC", which is funded by the Research Promotion Foundation of Cyprus, incorporates (among others actions), the investigation of the "genetic diversity of the three subpopulations of *Arabis kennedyae*".

The results of the genetic analysis of *Arabis kennedyae* will allow seed collection from the appropriate subpopulation for ex situ and in situ conservation purposes.

The results of the aforementioned activities will contribute to the elaboration of an integrated and effective management plan that it will lead to the conservation of this endangered species.

266 Survey of amphibian mitigation measures: Success or failure of substitute spawning ponds

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In a context of world decline of biodiversity, amphibians are more vulnerable than all other vertebrates. Many parameters could be incriminated, but in Europe, habitat destruction and fragmentation are main causes. Habitat fragmentation mainly reduces exchanges between patches of metapopulations. The far units of populations are, bigger the extinction risk is. Furthermore, disruption in population exchanges increases genetic erosion and species adaptability to environmental changes.

Construction of new roads leads loss and fragmentation of habitats, mortality when animals are crashed, and mostly leads barrier to dispersal and movements of vertebrates, amphibians in particular. Indeed, amphibians are very sensitive to destruction of terrestrial and aquatic habitats, because of their low dispersal capacity.

Many mitigation measures exist in order to improve the ecological impact of transportation project for amphibian's populations. Most common measures are underpasses systems to reduce mortality and reconnect habitats, and substitute spawning ponds to replace these destroyed by roadwork or to create news favourable habitats.

For this work we survey evolution and stickiness for amphibians of such mitigation measures, in particular substitute spawning ponds. Along the motorway between Angers and Cholet (Maine et Loire, France), 13 substitute spawning ponds have been in place for 5 years after road construction. Our work consists in evaluating their success by making an inventory of amphibian species and by characterizing each pond. It leads us to understand the key of this success or failure.

The final aim of this work is to improve existing mitigation measures so as to propose more effective ones for new roads building.

267 Spontaneous hedgerows of indigenous woody species / new hedgerow containing non-indigenous woody species. Examples from the upper Osterzgebirge (Eastern Ore Mountains), Saxony

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The predominant hedgerows on collected stone walls at field boundaries in the upper Osterzgebirge south of Lauenstein are of spontaneous natural woody species combinations, as observations have shown (Thomas 1983, 1990, 1999, 2008). Different site conditions cause the diversity of woody species communities and their maximum height growth. These site conditions are mainly local climate due to altitude a.s.l., relief position in watersheds, strong wind exposure on dry hilltops respectively wind shelter in moist depressions.

The "knowledge of structure and species combination of naturally occurring (spontaneous) hedges" is generally said to be condition of planning and realization of planting new hedgerows (Reif; Richert 1995). There exist examples of new planned and realized hedgerows mainly using indigenous woody species.

But there are also some negative examples, after 1960 planted new hedgerows often containing non-indigenous woody species. Some above all drastic examples are given in tables.

Non-indigenous woody species within agrarian areas can "destroy the special character of the landscape; drive away rare species and their environmental characteristics; endanger the genetic diversity of indigenous

species; change the natural living spaces of animal species depending on certain plants (pollutants, parasites, eaters)" (Reif; Nickel 2000). But: "More planted (non-indigenous) than naturally growing spontaneous shrubs occur in some regions today" (Reif; Nickel 2000).

In agrarian open field areas should be reared and planted only indigenous woody species from the region. This can reduce introgressive hybridization. Suggestions will be given for rare and successive naturalization of hedgerows with non-indigenous woody species: part-cut and support of native woody species.

268 Protection of the Lady's slipper orchid and the Lily leaf lady-bell versus protection of Natura 2000 habitats

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The Lady's slipper orchid (*Cypripedium calceolus*) and the Lily leaf lady-bell (*Adenophora liliifolia*) grow in forests with sparse stand, in boundary forest communities, xerothermic shrubs and grasslands. Protection of these plant populations requires particular preservation of the habitat conditions which are connected with a special kind of habitat utilization. All Polish stations of the Lily leaf lady-bell and most of Lady's slipper orchid stations are planned to be protected in Natura 2000 sites.

Considering the presence of the above mentioned species in Natura 2000 habitats (beech forests, oak and hornbeam forests, steppic woods with *Quercus spp.*, *Juniperus communis* formations on calcareous grasslands, semi-natural dry grasslands), the relations among their habitat requirements and favourable conservation status of the habitat types were analysed.

Generally, the protection objectives for the species and their habitats converge. In some sites, however, conflicts both with the protection of habitats (e.g. 9160 - oak or oak-hornbeam forests of the *Carpinion betuli*, 6210 - semi-natural dry grasslands) and other Natura 2000 species have been identified.

269 Establishment of artificial populations of a rare fern species: an ongoing *Asplenium septentrionale* (Aspleniaceae) project in Estonia

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Asplenium septentrionale is a disjunctly circumboreal fern species. In Europe it is mainly distributed in mountainous and arctic regions as a lithophyte, being rare or absent in several lowland areas. In Estonia *A. septentrionale* is a very rare species represented by a single small population in a locality with strong human impact. Preparatory activities for establishing of new populations in safer localities were started in 2006. Laboratory tests showed a high intragametophytic selfing rate in the species and the existence of spore bank in the soil. Preliminary results of an in situ study on the basic requirements of *A. septentrionale* showed its preference for acidic substrates and well-illuminated habitats. Also, according to the results of a garden experiment young *A. septentrionale* sporelings grew better in acidic soil and needed certain shade for successful establishment. For the establishing of new populations young sporelings have been propagated ex situ from spores collected from the Estonian population and from the closest localities in Finland. Search for new suitable habitats for artificial populations, as well as collection of spores and cultivation of gametophytes and young sporophytes for the establishment of new populations are in progress.

270 Response of spider communities to landscape changes in a wet heathland complex

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The complex of wet heathlands (i.e. wet heathland s.s., poor fen and bogland) underwent an important fragmentation process in Belgium over the last two centuries. In order to prevent typical communities to go extinct in a near future, several projects recently targeted the restoration of the complex of wet heathland habitats. A LIFE-nature project took place on the high plateau of Saint-Hubert (Ardenne). To assess the answer of species to habitat restoration we used spider communities. This taxon is known to be sensitive to landscape changes and spiders are therefore considered as good bio-indicators. We compared the composition of spider communities in patches of three different age categories : three patches of newly

restored habitat (i.e. <5years old), three patches of middle-aged habitat (i.e. 10-15 years old) and three patches of old habitat (i.e. >50 years old). Data were collected through pitfall and moericke traps from April 2007-April 2008. In order to relate spider assemblages to environmental characteristics, vegetation structure around each trap was assessed. A total of 11.125 individuals, from 195 species, were identified.

271 Selecting the best mother seed trees of wild cherry in west forests of Guilan province, due to ecological restoration in mentioned area

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Morphological variations of forest tree is a good factor about considering genetic variation. Because of tree phenotype we can get to tree genotype (genetic characteristics). But nevertheless these two factors are not much dependent to each other wild cherry with scientific name "cerasus avium" is from rare species and considerable one in the north forests of country which is spread from Astara region as far as Gorgan region that Like small societies with other species. This research has been carried out in two forestry plan in the water shed of 8 in Shafaroud, consisted of: series-3compartment 307 and series 14 compartment 1425. for selecting the best mother seed trees, with evaluating about their morphological characteristics, all available wild cherry trees in mentioned compartments with the method of complete statistic (100%) and by descriptive manner after forest walking and using of honorable experts ideas in selecting the place of research has been analyzed by the method of quantity and quality. Quantity measuring consisted of: diameter, height, wood density and Vitality and Viability of seed and its growth strength. Quality measuring consisted of leaf and fruit form, stem form, angle of branch and percentage of freshness. Also Pedology studies with digging profile in each compartment and explaining and considering of PH, amount of materials such as Nitrogen, phosphorous absorbable potassium absorbable, carbon, texture and structure of soil were evaluated. Results with analyzing of data with helping of Spss software and calculations of statistics such as variance analysis, average test, Danken test and K-square test and achieved results from soil data such as amount of material inside soil and PH and texture, structure, has been showed that trees in 307 compartment in series-3 forest management plan, can be good stand for Mother seed trees and as a result for selecting a seed orchard.

272 The seed bank of the National Botanic Garden of Belgium: the ex situ approach at the service of in situ conservation

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A seed bank is a facility that stores the genetic, hereditary material of plants, in the form of seeds for short-, medium- or long-term conservation. The National Botanic Garden of Belgium (NBGB) holds the only seed bank in Belgium designed to ensure the conservation of endangered wild species of the Belgian flora. So far, the NBGB holds 1.300.000 seeds belonging to 482 threatened species (one third of the Belgian flora), most of them being collected in about 30 nature reserves all over the country.

From the conservation point of view, the NBGB seed bank constitutes a safety reserve of the most valuable plants of Belgium. It provides the possibility for direct production of material (new plants and seeds) which can be used for re-establishment of plants in their natural habitats. Besides scientific research, this plant material can indeed be used for reintroduction activities and can prevent local extinctions by strengthening endangered populations, thereby using the ex situ approach at the service of the in situ conservation.

Of course, the priority should always be given to the in situ conservation, but the reality of the current situation is that it will not be possible to ensure the survival of an increasing number of threatened taxa without effectively using a range of complementary conservation approaches and techniques.

273 Conservation of local endemic plant species of Pendadactylos range (Cyprus)

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Cyprus is among the European countries with the richest plant diversity. The most important areas for plant diversity in Cyprus are the two mountain ranges of the island; Troodos (central) and Pentadactylos (northern) ranges. The latter hosts 62 endemic plants, out of which 16 are local endemics to the area.

During the last few years, the flora of Pentadactylos range has been facing great pressures, mainly due to the constantly increasing building and quarrying activities. Therefore, measures have to be taken to secure the survival of the unique plant diversity of the area.

This paper describes a project focusing on the conservation of eight of the most rare and threatened local endemics of Pentadactylos range (*Brassica hilarionis*, *Delphinium caseyi*, *Ferula cypria*, *Onosma caespitose*, *Phlomis cypria* ssp. *cypria*, *Salvia veneris*, *Sideritis cypria* and *Teucrium cyprium* ssp. *kyreniae*). Most of these species are included in Annex II of the Habitats Directive. The project adapts two approaches for the ex situ conservation of these plants: Storage of seeds in seed banks and establishment of living collections in botanical gardens. The main stages of the project are:

1. Data collection regarding the habitat characteristics of the targeted species.
2. Study of their reproductive strategy.
3. Collection of seeds and investigation of seed germination characteristics.
4. Storage of seeds in the National Seed Bank of the Cyprus Agricultural Research Institute – Utilization of the outcome of stages 2 and 3.
5. Provision of plant material to the Forests Department, for establishing living collections of the targeted taxa in the Department's Botanical Gardens – Utilization of the outcome of stages 1-3.

Both seed banks and living collections can provide plant material for the reintroduction of these species in their natural habitats.

The project is funded by the Research Promotion Foundation of Cyprus

274 Works ahead! Conservation objectives in Natura 2000 sites and priorities for Annex I Breeding Bird Species

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To successfully apply Natura 2000 conservation objectives for habitats and species of the Habitats Directive as well as for birds of the Birds' Directive, often choices will have to be made in habitat management and restoration of sites. Global conservation objectives on regional or national scale can provide guidelines for a better weighting of this choices.

In the Flanders Region (Belgium) global scientific conservation objectives have been proposed for the three mentioned groups (Van Landuyt, 2008). Their feasibility is currently examined by the administration. For 25 regularly breeding bird species of Annex I of the Birds Directive, we defined conservation status and proposed objectives for minimum viable population, habitat requirements and species priorities in Special Protected Areas (SPA's) based on present occurrence. For each species we calculated their relative importance in each SPA as a percentage of the total population inside all Flemish SPA's and for the total Flemish population. This provides a guideline for targeting the important sites for each species. Presenting this results on a SPA base shows which species are the most important within a site. This information, together with data on former presence of Annex I species in the SPA and total species richness, can be taken into account during the priority decision process in the Natura 2000 sites.

275 Monitoring plan for intertidal structure restoration in the Venice lagoon

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In Venice lagoon, the shallows surrounded by the city of Venice, St. Michele island, Certosa island and Marani channel are particularly exposed to north-east wind (bora) resulting in the progressive erosion of tidal flats and the damage of the city embankments due to wave motion. In this area, belonging to the Natura 2000 network (sic it 3250031 - Laguna superiore di Venezia), a morphological reconstruction project has been recently launched by the Venice Water Authority.

The aim of the project is to reduce wave height and it is pursued through intertidal structures restoration (also based on historical configuration) and the consequent fetch reduction.

We present the plan of the monitoring activity that is on going concurrently with the interventions realization and prolonged for 3 years after the end of works.

The final goal is to evaluate the project sustainability, to check the restoration effectiveness in reproducing natural morphological conditions, to verify project effects on surroundings, to measure the obtained wave reduction. The activity will include the evaluation of hydro-morphological parameters (waves and topographic

evolution), the control of structures evolution and the quantification of environmental matrices (water, sediments and biota).

Results obtained from this monitoring activity will be addressed to evaluate environment response to the restoration project, to define a guide of best practices for future restoration projects and to make these efforts consistent with ecological and chemical objectives imposed by European directives (eg: birds, habitats and water framework directive). Comparison with other monitoring projects will be made, paying attention to methodological issues and conditions.

276 Early salt marsh succession in the intertidal part of the IJzer estuary (Belgium), five years after large-scale restoration measures were taken

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Within the framework of Life, one of the larger ecological restoration projects in Flanders was realized on the right bank of the estuarine part of the IJzer at the beginning of this century. The aim was to restore the generic habitat "Estuaries" (1130). To do so, several large buildings and roads were removed, an entire tidal port was restructured, and some 500.000 m³ dredging material was removed. Topographical measures were taken to avoid abrupt transitions along ecological gradients. Vegetation succession on old salt marsh relicts and in the newly created intertidal areas was intensively studied, using a dense network of ca. 500 permanent plots. Vegetation was sampled every two years. In this contribution we present the results of three consecutive vegetation surveys, enabling to reconstruct early succession and allowing to express expectations on future developments.

Early vegetation development was characterized by immediate colonisation by annual salt marsh species. Only recently, the newly created salt marsh area was colonized by perennial salt marsh species. Despite present-day dominance of annual species, we expect from a comparison of the inundation frequency range of old and new salt marsh habitats, that the newly created areas will rapidly evolve into a perennial grass dominated marsh (*Elymus athericus* or *Puccinellia maritima*). Whether the introduction of sheep grazing will significantly influence succession to preferred *Puccinellia* dominance (*Puccinellion maritimae*) or to unwanted *Elymus* dominance (*Atriplici-Elytrigietum pungentis*) remains an open question. Given the definition of the Natura2000 habitat 1330 (Atlantic salt meadows), as it is used in Belgium, we aim at a mosaic of both. Continued research is needed on optimal grazer species, grazer density and grazing period in order to reach this goal.

277 Ecological restoration of the River Durme

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The river Durme is an important tributary of the river Scheldt (Belgium). At present, the ecological role of the Durme is reduced because of past water management decisions and because areas have been claimed for urban and agricultural expansion. The remaining habitat is often degraded. The revised 'SIGMAplan' – a master plan for the entire river Scheldt – combines a focus on safety and ecology to restore the multi-functional role and develop a more natural river Durme. The restored tributary will have an important role in developing a more robust Scheldt ecosystem. Therefore the land use of almost 700ha needs to change within the valley. The ecological design of the downstream part of the valley focuses on tidal energy dissipation and mitigation of floods over provision of natural habitat to a contribution in the cycling and recycling of nutrients. This ecological restoration and safety contribution will be realized by means of managed realignment and use of sluice constructions to introduce a controlled reduced tide (CRT). Upstream the valley, wetland habitat is created to mitigate loss of natural river meandering by reinforced dykes. The goal in this part of the valley is to create species rich grassland, sedge and reed marshes and other diverse riverine ecosystems. The process, used methods and various restoration measures to realize the ecological rehabilitation plan are discussed. Although plans have sound scientific basis, the fine-tuning with local stakeholders shows the need for maximum synergy between beneficial measures for ecosystem and society to gain public support for ecosystem restoration.

278 Considering social perception for floodplain lake restoration projects: the cases of the Rhône and Lower Ain Rivers (Rhône-Alpes, France)

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From 1999 to 2005, ecological restorations of floodplain lakes were completed on the Rhône River and on the Lower Ain River classed as Natura 2000 since 2003). Within the contexts of the LIFE program and the Decadal Restoration Program for the Ain River and the Rhône River respectively, it included a policy of consultation that was open to all actors. A large section of the program was therefore devoted to communication. This policy centred on public participation provoked a number of questions among environmental managers: how to better associate local populations with restoration projects? What content should be given to communication's actions?

In order to partly answer to these questions, an internet survey using photo-questionnaires has been conducted. The aim was to understand the social perception of floodplain lake environments. Surveyed people – chosen for their specific knowledge of these environments or conversely for their lack thereof – were asked to assess 16 photographs according to subjective criteria such as "beauty" and "ecological health". Photographs were chosen according to two series of variables: visual variables (transparent or reflecting water, with or without aquatic vegetation) or ecological variables (trophic levels and flood disturbance gradients).

The quantitative results of this study increase the operational knowledge of social perception. On the one hand, taking the results into account will enable us to better understand the reasons why local actors subscribe or not to the achieved restoration politics. On the other hand, the results contribute targeted information to better raise public awareness of specific environmental preservation issues.

279 Increasing public support and acceptance using participation and a decision support system to preserve xerotherm habitat on previous alluvial sites in the upper Rhine valley, Germany

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Ground water recession due to the straightening of the Rhine River (after Tulla, 1817-1876) resulted in a change of the former flood-plain vegetation to xerothermic vegetation.

In the 1950s the forest administration tried to increase forest productivity by planting Scots pine (*Pinus sylvestris*). However, these plantations are unproductive and have low nature conservation value. On adjacent non-forested sites xerotherm habitats developed, now protected as a part of a Natura 2000 site. These sites are subject to cost intensive conservation measures to preserve their valuable species and habitats, but they cannot prevent ongoing succession.

Our objective was to show how participation and a decision support system can be used to improve decision making in land-use planning by combining forest management with the aims of nature conservation.

We identified the land use objectives of five stakeholder groups. These objectives were defined as desired landscape conditions through criteria and indicators. The present condition of the landscape and the landscape conditions desired by the stakeholders were evaluated. Land use conflicts were identified and three compromise variants were designed as possible development directions for the area. The results were discussed with the landowners (municipality of Neuenburg and the forest administration of Baden-Württemberg) and an example treatment was applied.

Within this project we developed a concept showing how the traditional cultural landscape in the former alluvial sites of the upper Rhine valley can be transformed by improving habitat qualities. This could become a model for restoration practices in the region.

280 Ecological restoration in the Schelde estuary: a process of integrated policy

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The river Schelde is characterised by the presence of a complete salinity gradient and a free tidal amplitude, reflected in the spatial sequence of the ecosystem types and therefore an important compound of the Natura 2000-network with several SPA's of the Bird and Habitat directive. The typical ecosystem types are

brackish and freshwater tidal mudflats and marshes, deep water with natural shores, wet meadows, reed land marshes and alluvial forests. Unfortunately many anthropogenic impacts have lead to the deterioration and destruction of characteristic habitats and ecosystem processes. At present the ecological state of the Schelde is considered as far below the minimal level.

To move towards ecological rehabilitation and to avoid future conflicts a new approach of integrated projects was necessary. Projects such as the Long Term Vision for the Schelde estuary (LTVS), the updated Sigmaplan and the Strategic Planning Process of the Port of Antwerp (SPPA) try to combine socio-economical growth with ecosystem restoration in order to make the Schelde and its surrounding wetlands more resilient against disturbances. These projects prove to be effective strategies to deal with Natura2000 directives in regions with multiple claims. Consultation and collaboration of the different stakeholders is required though often not easy. By collaborating with different partners and participating in integrated processes it is possible to leave conflict models in favour of win-win situations.

281 The emperor's new clothes: Can you see them? Placing your work in a true cultural context

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As the world became more urban than rural for the first time in 2007, perhaps it is time to recognise that if ecology has shout out to modern society, it has to extend its influence into peoples daily lives , it has to hit the places where people live, places people can experience. It needs an imperative. If you believe in your subject, do you know where the real action is? Do we sometimes delude ourselves between conferences, that we are making a difference? Are we willing to see reality?

The real test for ecology, culture, and biodiversity, is that it facilitates change for the better

Where are the really hot areas of activity? rather than those just involved in review or evaluation? Or is it like Groucho Marx said " I don't care to belong to a club that accepts people like me as members."

The workshop will feature a special and surprise happening, that will be an important lead in this discussion, and an important outcome. The concept to bring to this workshop is to test your believe in taking ecological principles a little bit further than what if. We believe it needs a new imperative. Do you believe in pushing barriers? Bring your dreams to this session, and listen to other peoples.

Liverpool is European Capital of Culture in 2008 - outcomes from this event will be exhibited in the City, as part of these celebrations.

282 How important are fine structural resources in habitat restoration. Case study of larvae of two threatened butterfly species: *Proclissiana eunomia* and *Boloria aquilonaris*

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According to Natura 2000 conservation policy, functional network and high quality habitat patches are required at the same time for suitable conservation strategy. But in this context, habitat patches are usually delineated on the basis of vegetation types or diagnostic plant species. However, the role of habitat quality should be considered and included as well. This is why habitat has to be thought as the set of resources required for the populations of a concerned species to settle and thrive and this can be either consumable, functional and structural resources. Here, we focused on two relict butterfly species, inhabiting wet meadows and peat bogs of the Belgian Ardenne: the bog fritillary *P. eunomia* and the cranberry fritillary *B. aquilonaris*. Both species need specific micro relief and micro climate at larval stage that can be either favoured or penalized according to ecosystem management choice.

- (1) In wet meadows, ecosystem loss through natural succession can be prevented by mowing or by extensive grazing with cattle. Several field studies conducted in the Belgian Ardenne showed that mowing can strongly affect populations of *P. eunomia* due to the removal of tussocks on which caterpillars live and then should be applied in long-term rotation, to preserve sufficient refuge areas every year. Grazing has also a negative effect, but if used with caution (stocking rate < 0,2 LU/ha/year, late summer and alternated grazing preferentially), it can successfully preserve both populations and habitats.
- (2) In peat bogs, larvae of *B. aquilonaris* thrive only on *Sphagnum* hummocks covered by the host plant, the cranberry. By observing caterpillar behaviour, we can make the assumption that this is probably because only this kind of hummocks acts as a buffer for daily temperature fluctuations. But Belgian peat bogs are drying up and *Sphagnum* hummocks tend to disappear. So, to preserve this butterfly species in

Belgium, we might restore habitat by restricting reforestation on stations, by cutting spruce plantations surrounding the peat bogs and re-establishing suitable hydrologic conditions.

The recognition at fine scale of key ecological resources needed by a species is crucial to establish conservation rules and efficient restoration means.

283 Conservation and restoration of peatland fauna requires restoration of landscape heterogeneity

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Restoration of degraded bogs generally focuses on *Sphagnum* recovery by means of retaining rain water. To study whether rewetting rehabilitates fauna diversity, we compared aquatic invertebrate assemblages between degraded and rewetted bog remnants and intact bogs. Invertebrate assemblages of the most nutrient-poor bog pools in Estonia were absent in The Netherlands and species characteristic for natural transitions between ombrotrophic and minerotrophic parts of bog landscapes were lacking. Drainage, peat extraction and atmospheric N deposition have resulted in the loss of nutrient-poor parts and such transitions.

Populations of characteristic macroinvertebrates (possessing traits like low dispersal-capabilities, slow growth, high tolerances to acidity and temporary drought) had been able to survive the slow process of degradation, persisting as relic populations in bog remnants. However, they are unable to cope with rapid, large scale rewetting and the subsequent lower habitat diversity.

Therefore, we recommend restoration strategies safeguarding relic populations of characteristic species, as these are the remaining sources for colonisation of restored sites. Furthermore, a restoration strategy focusing on retaining rain water generally results in similar changes at large scale, leading to loss of landscape heterogeneity. We recommend to consider opportunities for restoration of the regional groundwater system, that may rehabilitate the heterogeneity in both ombrotrophic and minerotrophic parts of bog landscapes, required to rehabilitate peatland invertebrate diversity.

284 Effect of the Natura 2000 habitat restoration on bird population in coastal meadows: experiences and management implications from the EU Life project in Estonia

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The semi-natural Boreal Baltic coastal meadow (1630*) is among some of the most critically endangered biotopes among the Natura 2000 habitats. This habitat has been diminishing in size and degrading in quality at large extent throughout the Baltic Sea region due to changes in agricultural practices and land abandonment. The loss of relevant habitats and lack of their quality has consequently lead to severe population decline of a several characteristic breeding bird species of coastal meadows.

In the presentation, the monitoring results of the coastal meadow restoration and its effect on bird populations are analyzed in the case study from EU Life Nature funded project in SW Estonia. The pre-restoration state of habitat and bird population's is compared with the dynamics of the restoration progress and bird population responses to these actions.

The experiences learnt from the project implementation and recommendations for relevant restoration and management planning activities will be given.

285 Nutrient accumulation during reed encroachment reduces efficiency of restoration of Baltic coastal grasslands

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Boreal Baltic coastal meadows are a priority habitat type (*1630) of Habitats Directive because of its importance for both plant and animal diversity. It is severely threatened because of its dependence on grazing. As a semi-natural habitat, it has developed under moderate human impact which has prevented

the encroachment of reed or brushwood and maintained open habitats. Recent economic situation, however, does not favor maintenance of coastal grasslands, leading to abandonment of these areas and subsequent overgrowth by reed. Hence, the conservation agencies have started several large-scale restoration projects in order to restore these habitats.

Reed encroachment, however, does not only bring a shift in vegetation. Due to fast growth of *Phragmites* and large biomass it accumulates, as well as due to changes in biomass removal, the amount of nutrients increases remarkably in soil of abandoned grasslands. This natural eutrophication does not wear out fast and affects the plant growth also in system where grazing is reintroduced and reduces success of restoration. Our comparison of abandoned, well-managed and restored coastal meadows revealed large differences between them in both relative and total amount of nutrients in soil and vegetation. The phytomass reacts much faster to the restoration than plant species composition. There also is a large difference between various chemical properties of soil in how quickly they react to the reintroduction of grazing. We will present the shifts in nutrient flows in soil-plant system of differently managed habitats and discuss the implications of delayed responses on restoration success.

286 Restorative grazing and the role of the seed bank in Estonian coastal grasslands, a priority habitat type of Natura 2000

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During the last decades, many coastal grasslands have been abandoned in the Baltic region. After abandonment, succession often leads to the dominance of reed or brushwood, while coastal grassland species may disappear. In several projects, grazing is reintroduced to restore coastal grasslands. Soil seed banks may form one source for the re-establishment of species.

In Western Estonia, species composition was recorded in sites with continuous and restorative grazing, and 'early' and 'late' stages of abandonment ('late': cover of *Phragmites australis* > 50%). Soil seed bank was analysed in grazed and abandoned sites by the emergence method.

Grazed and abandoned sites differed with respect to plant species dominance and vegetation structure. After 2-4 years of restorative grazing, species composition was intermediate between grazed and 'late' successional sites. Characteristic species of the Natura 2000 priority habitat type 'Boreal Baltic Coastal Meadows' decreased in 'late' successional sites, and increased again during restorative grazing. They were overrepresented in the seed bank of abandoned sites compared to the vegetation. 78 taxa were identified in the seed bank.

The results are complemented by the outcome of a field experiment on the functional role of seed bank and vegetative growth in gap recolonisation at the German Baltic coast.

We conclude that seed bank is relevant for the re-establishment of some species, and that restorative grazing of coastal grasslands after reed invasion is promising, but takes longer than a few years.

287 Importance of riparian survey for river management and restoration in relation with the presence of three aquatic rodents species: Muskrat, Coypu and European Beaver

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The three largest European aquatic rodents, i.e. coypu (*Myocastor coypus*), muskrat (*Ondatra zibethicus*) and European beaver (*Castor fiber*), are present in France. After escaping from fur farms during XXth century, Muskrat and Coypu are widely spread and considered as pests because of negative impacts on banks and fields. By contrast, Beaver, almost disappeared in XIXth century, is reconquering streams since 1960's with a protected status. At present time wildlife managers have to elaborate suitable plans to conciliate two invasive rodents management and conservation of a third wanted one. In that way, questions are answered: Are beaver sites floristically similar or different from the other ones? What are links with near-by protected areas? What is the impact and consequences of invasive rodents on such areas? In that context, riparian surveys are essential to guarantee ecosystem structure and biodiversity in restoration plans.

The aim of the present study was to characterize physical and vegetation components of thirty stream sections with 500'20 meters on each bank, in French Ardennes. Among this sections, eleven have muskrat alone, thirteen have muskrat and coypu, and six have beaver, muskrat and/or coypu. Ten sections are in Natura 2000 areas and three have national protected status. We selected nine physical factors and identified 187 plant species. Results contribute to river restoration projects, for example efforts must be done on coypu

problems which make more damages than muskrat. Beaver activities enhance plant species biodiversity so its presence and protected status could be use as complementary natural tools for river management.

288 Invasive plant species management tests and advices along river banks in the Walloon region

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The rivers network as other linear elements in the landscape plays a major role in the dispersal of invasive plants. These habitats are often disturbed and have been shown to be highly sensitive to invasions. Their linear trait facilitates the invasive plants dispersal and the subsequent invasion of other habitats sometimes of high ecological value like Natura2000 habitats.

In respect to the CBD (Rio, 2002) aims and managers requests, the DGRNE-Direction of the non navigable rivers (Walloon region-Belgium) has been financing since 2006 a research project aiming at furnishing advices to manage several target invasive plants species along rivers : *Impatiens glandulifera* Royle, *Heracleum mantegazzianum* Sommier et Levier, *Fallopia japonica* (Houtt.) Ronse Decraene, *Fallopia x bohemica* (Chrték et Chrtková) J. P. Bailey). Management methods mentioned in literature often lack scientific assessment and follow up. Since 2006, some mechanical and chemical management techniques have been tested in the field, along streams, to assess their efficiency, cost and feasibility. Data were collected each month during the last 3 years. Results and concrete implications for managers will be exposed in this presentation.

289 Invasive Species: Impact and Control in the Natura 2000 network. The case of the Northern Vosges streams

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The Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitriche-Batrachion vegetation was identified by the Council Directive 92/43/EEC on Conservation of Natural Habitats and Wild Fauna and Flora as a key habitat (n°3260). This habitat type defined by *Ranunculus peltatus* in the Northern Vosges Reserve Biosphere (North-Eastern of France) is represented by two sites "Moder river and Sauer river". The habitat type has been adversely affected by nutrient enrichment, acidification due to coniferous plantations, physical rectification and bank resectioning. Moder and Sauer are small rivers, mainly notable for their physical diversity and by the presence of ponds. In the upper reaches, *R. peltatus* lack and communities are dominated by *Potamogeton polygonifolius*. In middle and downstream reaches, *Ranunculus peltatus* are overabundant in the river channel, often growing in association with Callitriche species (*C. hamulata*, *C. platycarpa*, *C. obtusangula*) and the invasive aquatic macrophytes. Some protected species such as *Calla palustris* are present in the Moder river. Two fishes *Cottus gobio* and *Lampetra planeri* and one dragonflies *Ophiogomphus cecilia* -are included into the Annex II species. These sites are very vulnerable to human activities. Our aims were 1) to investigate the relationships between *Ranunculus peltatus* overabundance and the protected species, 2) to evaluate the impact of invasive species on autochthonous flora, and 3) to identify key points to be taken into consideration for habitat conservation (water flow dynamic restoration, control of invasive plants).

290 Are we doing more good than harm? Evaluating effectiveness of nature restoration policy in Europe

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Numerous policy interventions now aim to halt and reverse the decline of biodiversity in Europe. There is a danger that implementation of such policies is regarded as an end in itself and that such well-meaning interventions must be doing more good than harm. There is an urgent need for transparent, critical and objective evaluation of their effectiveness so that we can build on success and learn lessons from failure. This paper describes a practical structure for building an evidence-base to improve the effectiveness of nature restoration.

291 Ecological restoration in practice: how do we achieve sustainable outcomes?

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292 Out of sight, out of mind: the critical importance of baseline data in marine ecological restoration

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The anthropogenic impacts to marine biodiversity which resulted from industrialization of developed countries are poorly documented in a large range of habitats. The lack of baseline data makes it difficult to measure the extent to which marine ecosystem functioning has been altered by the human footprint on the long run. As a result, our baselines are shifted and the definition of ecological restoration objectives is biased.

We illustrate this fact with a case-study from the Belgian Part of the North Sea (BPNS). Through processing and cross-referencing various historical data sources, we rediscovered a species-rich "gravel" field formerly hosting wild beds of the native European flat oyster *Ostrea edulis* and spawning herring (*Clupea harengus*). We carried out a multidisciplinary sampling survey to evaluate the present state of this forgotten habitat. While oyster beds are extinct since long, we gathered evidence of shifts in the relative abundance of species in the associated community since the early 20th century in relation with bottom trawling pressure. We also discovered small refuge areas where sensitive species thrived, suggesting that some level of ecological restoration, including recovery of oyster beds, is feasible in this habitat.

The rediscovered area qualifies for designation as a Marine Protected Area since it matches criteria set by the OSPAR convention and the EC Habitats Directive. The project thus demonstrates that efforts aimed at a "valuation" of biodiversity to implement spatial planning of human activities will be meaningless if they are not associated with a thorough investigation of the local environmental history.

293 Creation of Atlantic salt meadows and salt marshes in the polders of Flanders

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The expansion of economic developments in the inner port of Zeebrugge, situated in the Special Protection Area (SPA) – Birds '3.2 Poldercomplex', requires nature compensations according to article 6 of the Habitat directive. A considerable part of these compensations concerns salt marshes and salt meadows.

The surface area of salt marshes and salt meadows to be created has to reflect the conservation requirements for annex-I species of the EC Birds directive.

The compensations will be realized in the SPA-Birds '3.2 Poldercomplex' and the SPA-Habitats 'Polders' with Natura 2000 habitat types 1310 and 1330.

These salt meadows can only develop where brackish groundwater has an effect on the vegetation. In some areas of the coastal polders of Flanders the influence of brackish water is strong. Whether or not salt vegetations will develop, depends on local hydrological conditions whereby qualitative and quantitative hydrological parameters are important.

The occurrence of salt vegetation is strongly correlated with the surface elevation. Soil type, local specific abiotic conditions and management practices are steering parameters in the occurrence of salt marshes and meadows. For the creation of salt habitats these parameters have to be regulated by implementing specific habitat restoration measures.

Possible ways to create or optimize the hydrological conditions for the creation of salt habitats or to improve the conditions of present salt vegetations are demonstrated, based on actual management plans.

Limiting conditions in the compensations project for the port of Zeebrugge which restrict the realisation of habitat creation are illustrated. Budget constraints and shortage of available land for habitat creation are particularly important. The pragmatic approach of the limiting conditions in this project, warranting the fulfilment of conservation requirements, is explained.

294 Evaluation of habitat restoration: assessing the consequences of Rat eradication on biodiversity in a Natura 2000 area

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Currently claimed as one of the most important sources of biodiversity loss, the invasion of ecosystems by alien species may cause particularly strong damages in protected area. Of special concern is the introduction of rats on islands. In September 1996, eradication of *Rattus norvegicus* aiming to benefit to biodiversity from two islands of the Iroise archipelago (Bretagne, France: Natura 2000, MAB Reserve, Natural Reserve) was successfully achieved. Those islands are of special interest because of the threatened fixed greys dunes ecosystems (habitats of European interest).

Impact of eradication was measured on bird, mammal and terrestrial invertebrate populations. Birds were annually monitored on the main island from 1996 before eradication to 2001 and in 2007. Shrews were sampled in 1994 and 2004. The direct and indirect impacts on the invertebrate community (pitfall trap) were evaluated by a comparison before and after eradication (eleven years) on 6 neighbouring islands: two rat-eradicated islands, two islands without rat, and two islands occupied by rats. We found a significant increase of populations of three bird terrestrial species (from 70 to 700%), of shrew, and of large size invertebrates species (spiders, beetles which are all potential preys for rats). Hence, eradication leads to an in-depth modification in island community structure suggesting a strong meso-predator release effect.

Through the increase of functional diversity, the results of this experimentation in natura which manipulated the presence of one species within a complex trophic web highlight the benefit on biodiversity of such restoration management at short and long term time.

295 Restoration operations of cliff vegetation along the French Atlantic coast: where, who, why, how?

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During last decades, many sites of the French coast suffered from degradation linked to over-frequentation. In response, restoration programs were initiated notably in the Natura 2000 network sites.

In order to have a global evaluation of ecological restoration practices on French atlantic coast, an inventory of these operation was conducted. This inventory concerned cliff-top vegetation, mainly areohaline vegetation (1230) and coastal dry heathland (4030).

Contacts with different stakeholders allowed us to identified concerned sites. All managers were met and available information concerning sites, restored communities and methods were collected.

35 main sites were identified which were concerned by one or several restoration operation. Most of these sites (30) were included in the Natura 2000 network but most of restoration operations, were conducted and financed in the framework of other national, regional or local program.

Methods of restoration varied greatly even if, in most case, restoration operations were based on visitor traffic control, completed by active methods.

An important point was the lack of surveys and evaluation of most restoration operation. Indeed for half of the site no real survey was made. In many site only photographic surveys were realised and vegetation surveys were conducted only in one third of the sites.

This study allows us to have a good photography of restoration operations along the French atlantic coast. It stressed on the lack of coordination of restoration operation and the real need and will of managers for knowledge about restoration operation techniques. It will allow us to give then back a global (both ecological and economical) evaluation of ecological restoration operations on cliff-top vegetation.

296 Long-term survey of maritime cliff-tops vegetation restoration: a tool for assessing and modelling restoration process

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The impacts of human activities, especially caused in some places by tourism, have resulted in the degradation and the destruction of coastal heathland and grassland vegetations (4030, 4040, 1230). The awareness of this natura 2000 habitats loss, which was extreme in some places, has induced land-managers

to reduce the pressures on the vegetations. Areas have become restricted access in order to stop the degradation, and a variety of restoration techniques have been tried. These techniques were mostly based on the natural resilience of the vegetation, but various ecological engineering techniques (turfing, topsoil and litter transplant, jute geotextiles, soil decompaction) have also been experimented to enhance the revegetation in the worst degraded areas such as along former footpaths. There have been few scientific reviews of the success of existing experiences; consequently it is difficult to choose the most appropriate method for the habitat restoration. This paper is based on five Natura 2000 areas where pin-point data sets have been recorded over time showing the revegetation process in some sites for up to 15 years. Statistical analyses allow to model restoration processes and show the differences between successions according to the exposure, the initial disturbance and the restoration methods. This aims to supply guidelines for the restoration of these Natura 2000 habitats.

297 A participative approach for the definition of best practices in the management and restoration of French Pyrenean ski pistes

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Native species are now widely considered to be best tool for initiating ecological restoration of damaged sites. Moreover, restoration of ski pistes in subalpine and alpine areas has been shown to be improved by the use of native seeds (seeds of local origin) and by ecological restoration practices. In the French Pyrenees, ski resorts managers have faced recurrent technical failure of their revegetation efforts when using available commercial seed mixtures. During the last two years, they have been asking experts to provide them tools for sustainable revegetation practices; such as use of seeds of local origin and development of good practices guidelines.

At a workshop involving: ski resort technical agents, ski resort managers, nature conservancy local authority, financial providers of ski resort planning, technical experts, ecologists, land planning authority, we defined good practices for planning and revegetation of ski resorts. The key issues considered by the stakeholders were:

- recycling of the soil and preservation of soil properties during planning,
- conservation of the existing herbaceous cover (e.g. using turf transplant),
- avoidance of the destruction or the modification of sensitive and wetland natural habitats (e.g. by limiting fertilization and avoiding engine circulation),
- native flora conservation by using native seed mixtures (local origin of the plant species was based upon their genetical diversity pattern).

Three meetings involving no less than a third of Pyrenean ski resorts (some located in Natura 2000 areas), led to the current publication of a common guide for revegetation. The participative approach used here gives the published guide an important value for its practical use and for the monitoring of revegetation quality by the various stakeholders.

298 Beehives (still) permitted in Dutch Natura2000 reserves? If not, negative consequences for plants?

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Dutch legislation claims that each human activity in or around Natura2000 reserves should be judged on its (possible) negative effects in order to look if permission is required. This should also count for beekeepers placing many of their beehives in nature reserves in order to harvest large amounts of nectar and pollen of wild plant species. This suggests less food for wild insect species. In the case that honey bees are not any longer permitted to forage in nature reserves, we should first know if this has a possible negative effect in the pollination service of wild plant species.

To answer this question we used a database with 453 plant species including shrubs and trees all visited by honey bees. In a stepwise analysis, selection factors were added concerning the attractiveness of the plant species for honey bees and the dependence on insect pollination. We found that 10 rare species (most naturalized species) and 47 common species are possibly harmed in their pollination if the honey bee would be absent. On the contrary, all species had alternative pollinators. Therefore, we expect that if the honey bee is absent this will not lead to a severe pollination disruption of plant species.

These results, together with already existing legislation regarding the placement of beehives in nature reserves, will be discussed.

299 Land consolidation: from nature destruction to ecological restoration

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In order to reorganise the agricultural areas for more economical benefits land consolidation was introduced in Belgium in 1956. The sectoral approach caused a lot of damage to nature and landscape. Due to a growing environmental concern during the '70 and '80 many efforts were done to modernize the instrument to a much more integrated one, without changing the chief purpose: creating continuous and regular parcels of land that are situated as close as possible to the farms and which have a single exit. But in the strongly mixed rural areas of Flanders, the objectives of the integrated projects are broadened and the reallocation must fit into a landscape and ecological framework. Moreover, this framework can be developed by the instrument of land consolidation itself: restoration of Natura 2000 and other habitat types, improving the connectivity in ecological networks,... The results are numerous but hardly known. Among biologists, nature conservers,... the modernized instrument is too often associated with the nature and landscape destructive activities in the past. Aim of the presentation is to describe the evolution of land consolidation, to present the possibilities towards ecological restoration and to illustrate this with some executed examples.

300 Of land dunes and swamps. Restoration in the Belgian Campine region: re-introducing dynamics, mosaic, landscape and ... people

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The LIFE project Grote Nete by the NGO Natuurpunt focuses on ecological restoration in the Grote Nete lowland river system. After the second World War large parts of the river landscape drastically changed due to the abandonment and loss of traditional agriculture, embankments, eutrophication, invasion of exotic species, disturbance by recreation etc. Since about 1980 Natuurpunt tries to restore the ecological values in the area. The approach shifted from the initial "protecting and locking up nature behind a fence" to the current "trying to increase awareness and involving people", while thinking on a more landscape or ecosystem scale. The presentation will illustrate and discuss the new ways of thinking and acting on people involvement, with a focus on collaboration with local governments, participation of local people and nature volunteers in the management, communication to the public, improving the accessibility for walkers and cyclists and even incorporating the latter in the management plan as a measure to preserve habitat types lacking natural dynamics.

301 Amphibians' ecosystems restoration on the territories of the historically important parks as a way to save these animals in the Moscow city

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There are 15 amphibian and reptilian species on the Moscow City territory, all of them are constantly declining last decades. Law protection and habitat maintenance in 13 natural protected territories do not help. Besides general causes of the herptiles disappearance there are two additional fatal factors in Moscow: uncontrolled recreation and wide invasion of fish *Perccottus glenii*. A way to save herptiles in the City is the restoration of their populations and corresponding ecosystems. The restored ecosystem would include suitable breeding pond and adequate core terrestrial habitat. I suggest that the restoration would be conducted in historical parks and gardens with restricted visiting to avoid destroying recreation. This work could be a part of general projects of architectural restoration of such places.

We started an experiment on the restoration of pond ecosystem with population of a salamander *Triturus vulgaris* in park of the manor Znamenskoe-Sadky in 2006. This English park with a system of ponds was founded in XIX. Now the manor is half abandoned and protected as architectural memorial. Nearly all amphibians have disappeared here recently mainly because of *Perccottus*. We have found only one permanent pond free of this fish. It was prepared in accordance with the triton ecology. Twenty five larvae of different age caught in an artificial breeding site of the same metapopulation were released in the pond in the summer of 2007. They developed normally till metamorphosis. We plan to continue the work combined with the whole park and buildings reconstruction.

302 Biogeochemistry in Restoration Ecology

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The restoration of wetlands has, to a large extent, been based on a trial and error approach. By presenting research on the restoration of a variety of ecotypes, including bog remnants, softwater lakes, dry and wet meadows, floodplains, and fens, we will show the strong advantages of an approach based on system ecological research.

This method, focussing on key factors and key processes, provides insight into the actual causal relationships between environmental changes and ecosystem responses. In addition, it indicates the target processes for restoration, and thereby enables scientists and nature managers to predict restoration prospects for locations that differ with respect to their starting conditions.

303 The decline of metallophyte vegetation in floodplain grasslands in the Netherlands: implications for conservation and restoration

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The endemic metallophyte vegetation of the river Geul valley (the Netherlands) has strongly declined in the previous century. In that time the Belgian mining industry had closed and more and more floodplain grasslands had been taken into intensive cultivation. As a result, the characteristic metallophyte vegetation has almost become extinct and is nowadays protected on both a national and international scale. To reveal the causes of this decline, a combination of correlative field investigations, laboratory experiments and field experiments were performed. The results show that the decline of the metallophyte vegetation is not caused by a lower deposition of Zn via the river, but by a combination of eutrophication and alkalinisation. A higher P availability stimulates the growth of more competitive pseudo-metallophyte grasses while a higher soil alkalinity leads to a lower Zn availability that hampers the growth of metallophytes. Metallophyte vegetation only occurs at acidic sites (pH-H₂O 4.5-5.5) with a relatively high Zn availability (total Zn > 40 µmol/g dw⁻¹ and Zn/Ca > 0.8). Results of a field experiment show that removal of the P saturated alkaline soil layer (0-20 cm) improves the soil conditions enabling re-colonisation of introduced metallophytes at the cost of pseudo-metallophyte grasses. A laboratory study indicates that artificial acidification of the soil (mimicking historic deposition of fresh acidifying pyrite particles) might be an additional measure to increase the Zn availability at relatively Zn poor sites. The results might be applied in future restoration strategies.

304 Ecological restoration of agricultural areas

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More and more agricultural land is becoming available for ecological restoration projects. However, nutrient levels in the top layer of the soils are extremely high because the agricultural lands have been heavily fertilized for decades. However, a low availability of nutrients, P in particular, seems to be a prerequisite for long-term co-existence of plant species. The frequently observed, dominance of *Juncus effusus* on moist or wet soils, for instance, appears to be determined by the Olsen-P concentration in the soil.

It may take at least decades, and in many cases more than a century, before P becomes limiting as a result of a mowing regime (harvesting of the vegetation and removal of the biomass from the site). Therefore, the restoration of a diverse and species-rich vegetation on former agricultural lands, will in most cases not be possible within a reasonable time-span without removal of the nutrient enriched topsoil. Although top soil removal, is almost always a relatively expensive measure, it may be cheaper in the long term than keeping up a mowing regime for decades. Mowing mainly appears to be beneficial when P availability is already very near the required values, or to maintain biodiverse vegetation types. If removal of the top-soil is considered to create P-limitation, it is important to study P concentrations at various depths in order to establish the amount of soil that has to be removed.

P availability is known to be limited on calcareous soils, due to precipitation of dicalcium phosphate (CaHPO_4) and sorption of P to calcite. Although, P availability (expressed as the Olsen-P:Total-P ratio) is strongly influenced by the total-Ca concentration of the soil, liming of agricultural soils is not an alternative to topsoil removal. Nevertheless, liming might be a valuable additional measure to enhance the quality of the soil after topsoil removal, and to prevent mobilization of P to groundwater or surface water. Although in exceptional cases a highly diverse vegetation may develop without species being re-introduced, in most cases, re-introduction of species will deserve serious consideration. Next, hydrology and hydrochemistry play an imminent role in the development of vegetation on former agricultural lands.

Historically, many nutrient-deficient heathlands and biodiverse grasslands have been turned into (pine) forest plantations. As these plantations have never been fertilized, redevelopment of nutrient deficient vegetation, after removal of the trees and litter, is easily achievable. A win-win situation can be created by establishing new forest plantations on former agricultural land and re-creating heathlands and/or biodiverse grasslands on land dominated by low-quality (pine) forest plantations.

305 The restoration of fens, based on ecological and biogeochemical knowledge

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The restoration of wetlands has, at least for a long time, been based on a trial and error approach. By presenting research on the restoration of fen ecosystems, we will attempt to show how significant biogeochemical and ecological knowledge at different spatial scales may be.

In combination with correlative field studies, experimental research (in the field and under more controlled conditions) is essential. This type of information provides insight into the actual causal relationships between environmental changes and vegetation responses including those related to the coupling of C-, N-, S- and P-cycling, nutrient availability, and phytotoxicity. In addition, it indicates the target processes for wetland restoration, and thereby enables scientists, water managers and nature managers to choose between different measures and to predict restoration prospects for locations that differ with respect to their initial conditions.

The present paper reviews the major environmental problems in aquatic and semi-terrestrial fens: desiccation, (internal and external) eutrophication, acidification, habitat fragmentation and intoxication. It discusses both the positive and the negative consequences of the restoration measures taken in fens, and strongly emphasises the biogeochemical and biological processes and factors responsible for the deterioration of plant and animal communities in fens. Only with the knowledge of these key processes and factors are optimal restoration and management measures possible.

306 Restoration of raised bogs: biogeochemical processes involved in the re-establishment of *Sphagnum*-dominated vegetation

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Restoration of bog remnants by hydrological measures generally leads to inundation and rapid development of *Sphagnum* vegetation when poorly humified peat is still present. The peat either swells up or becomes buoyant, creating a favourable substratum for *Sphagnum*. In many cases, however, only strongly humified peat is remaining and *Sphagnum* redevelopment is usually not observed. Waterlogging of peat remnants is therefore preferred in this case. Bulk density, peat structure and methane production all play an important role in the buoyancy of floating peat and newly formed *Sphagnum* carpets. Methane appears to provide peat buoyancy. Peat characteristics such as C/P and lignin/P ratios, and pH, determine decomposition rates and hence methane and carbon dioxide production. On locations where only strongly humified peat is present, floating raft formation can be stimulated by the introduction of peat with suitable characteristics. Methane production rates in acidic substrates can be enhanced by mixing the peat with small amounts of lime. Substrate derived carbon dioxide and methane both appear to serve as an important carbon source for *Sphagnum*. High carbon dioxide concentrations in the acrotelm strongly stimulate hummock formation by *Sphagnum magellanicum*. Typical hummock species are, however, usually very slow colonisers. Introduction of these species in carpets dominated by *Sphagnum cuspidatum* or *Sphagnum fallax*, or on bare peat, appears to be very promising. The results show that biogeochemical and ecophysiological knowledge is vital for the choice of sound bog restoration strategies.

307 Restoration of Dutch softwater lakes still very successful after 20 years

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Acidification and eutrophication has caused the decline of vegetation in many, carbon limited, softwater lakes in the Netherlands. Restoration measures such as sludge removal, controlled inlet of alkaline water and catchment liming proved successful on the short term; on many sites softwater vegetation returned. Twenty years after restoration, we studied the vegetation, water quality and sediment quality on a selection of restoration sites. We compared the results with a set of reference lakes.

Due to a strong reduction in atmospheric deposition, the ammonium and sulphate concentrations in the water layer of all lakes were more than 50% reduced and pH was slightly increased. In reference lakes, there was almost no recovery of the vegetation and a thick sludge layer was present. Most restored lakes were further colonized by characteristic vegetation and almost no renewed sludge accumulation had occurred. Ortho-phosphate levels and carbon dioxide levels were still very low (on average < 0.2 and < 100 micromol l^{-1} respectively). In acidified lakes, long term restoration of softwater vegetation was observed only when additional measures against acidification had been applied.

We identified several factors causing renewed decline of softwater vegetation: input of nutrients from agricultural land by waterfowl, insufficient water level fluctuation due to water conservation measures and competition with exotic plant species. We will present data on water and sediment quality and vegetation, and will discuss the mechanisms behind the observed changes.

308 Restoration of peat growth in fens: theoretical processes and practical limitations

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Currently large-scale rewetting of degraded fen peatlands is taking place throughout Europe, also with the aim to re-install peat growth. It is, however, an open question whether the re-wetting strategies applied are adequate to reach this goal by spontaneous vegetation succession.

This paper gives a theoretical overview of the variety of hydrogenetic types of peat formation and related fen types in Central Europe and discusses the state of the art in fen rewetting techniques. The type and rate of peat growth is estimated for various recently rewetted fens sites in N-Germany with special attention to (1) the hydrological, pedological and biological requirements for peat formation, (2) the different stages of degradation as starting point for the restoration, (3) the rewetting techniques and (4) further frequent theoretical and practical limitations.

Studies of hydrology and water quality, soil structure, living biomass, vegetation distribution and gas emissions from rewetted fens suggest net-accumulation of carbon, nitrogen and phosphorus at many sites. The processes involved are, however, not yet clearly understood. It is concluded that restoring peat growth or at least accumulation of organic matter is more likely than the restoration of a concrete hydrogenetic type of peat formation (e.g. peats formed under base-rich percolation or spring conditions). To restore the whole range of hydrogenetic types, strategies have to be developed that cover at least whole catchments.

309 Interacting effects of sulphate pollution, sulphide toxicity and eutrophication on vegetation development in fens: a mesocosm experiment

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During recent decades, both increased agricultural fertilization and the use of polluted river water to compensate for water shortage have, directly or indirectly, led to a higher availability of nutrients and potentially toxic

compounds such as sulphide. As a result, many characteristic plant species have disappeared and have been outcompeted by a few fast-growing species, leading to a strong decrease in biodiversity, vegetation development and terrestrialization. Eutrophication, however, may lead to higher biomass production and root development, which can have a dilution effect on toxic compounds in plant tissue and lead to oxidation of reductive sediments. Therefore, we investigated the effects of sulphate pollution in outdoor, semi-controlled fen mesocosms under nutrient-poor and nutrient-rich conditions using aquatic and semi-aquatic macrophyte species with different growth strategies.

Our results clearly showed toxicity effects of sulphide for most plant species. However, sulphide concentrations and toxicity effects were high under nutrient-poor conditions. Under nutrient-rich conditions, in contrast, they were still able to grow even after three years of sulphide toxicity although their biomass declined. Initial terrestrialization, however, was hampered in the sulphate treatments. This suggests that toxicity effects in plants can be masked in eutrophic areas, but may show up when nutrient availability is reduced after restoration measures have been taken. It is, therefore, important for the restoration of biodiversity and terrestrialization in fens that not only nutrient loads, but also sulphate pollution will be reduced.

310 Initial effects of re-wetting on vegetation structure and nutrient budget of riverine peatlands

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Under near-natural conditions riverine peatlands are habitats for endangered ecosystems with FFH-status as e.g. wet grasslands and spring mires. As transition zones between catchment and stream they accomplish important ecosystem services (e.g. nutrient retention, water regulation for flood mitigation). In most parts of Europe riverine peatlands have lost these functions due to drainage and intensification and/or abandonment of the land use during the last decades.

In this study we focus on two peatlands (complexes of terrestrialization and spring fens) of the upper Eider Valley (Northern Germany) that differ in land use (pasture, fallow). We measured the water table dynamics and the plant species composition along transects before and two years after re-wetting (ditch blocking). Furthermore, we calculated the loads (nitrogen, phosphorus) in the main outlets.

Results: 1. Water tables increased considerably in both peatlands but only in the fallow water tables above ground were detected. 2. In all transects ruderal species declined. 3. In the terrestrialization fen of the pasture characteristic wet grassland species increased whereas in the spring fens of both areas reed species enhanced. 4. The nitrogen and phosphorus loads decreased in the pasture. 5. In the abandoned area the nitrogen load slightly increased, but the phosphorus load decreased as well.

The results indicate that the effects of re-wetting strongly depend on previous land use intensity, the quality of the applied water and the height of the water tables. Already a few years after re-wetting positive effects regarding habitat quality and nutrient retention capacity of the peatlands have been observed. However, endangered fen species did not occur during the investigation period. We assume that the establishment of these species needs more effort (e.g. diaspore transfer) than only to improve the abiotic habitat conditions.

311 Restoration of plant communities in ditches and turbaries according to water and Natura2000 criteria in the Vechtplassen area

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Application of criteria for water quality improvement and for Natura2000 in ditches and peatponds in lowland peat areas show a discrepancy in their outcome. We studied the aquatic vegetation in the Tienhoven lakes and ditches by comparing the relevés over a 30 years time span. We compared the presence and cover of open water types respectively bank length of target vegetation types. After a great number of water quality improvement measures in the study areas the nitrogen and phosphorus levels are low but the aquatic vegetation did not recover. The Dutch criteria for implementation of Natura2000 "living ecosystems with a sequence of Chara-rich waters and development of calcareous vegetation towards terrestrialization" are not met. The vegetation relevés show over time no restoration of Chara blankets and the presence of loose, free floating Stratiotes plants in a sea of Ceratophyllum are a poor representation of the target types. Measurement of the surface area of vegetation cover and the bank length in 1970, 1993 and 2004 show a strong decrease of the target vegetation types. Although the species are present as seeds and plants, no ecosystem restoration could be found. Extra restoration measures e.g. dredging of the muddy bottom layer seem to be needed to meet the Natura2000 targets.

312 Vegetation and nutrient conditions on partly drained extremely-rich (calcareous) fen (Paraspõllu fen in North Estonia)

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The impact of slight but long-lasting drainage was studied with the prospective target of decreasing the drainage impact on fen vegetation. The study site is the extremely rich (calcareous) Paraspõllu fen in North Estonia. The fen consists of the natural north-eastern part and the drained central and south-western part. The coverage of bryophyte and vascular plant species was estimated in 23 relevés of 1 m² and the height of tussocks on 2 x 2 m plots. Ellenberg indicator values (EIV) were calculated. Groundwater depth, pH and electrical conductivity (EC), as well as the Ca, Mg, Fe, Na and K contents of pore water and N, P, and S contents of peat, were measured.

Vegetation analyses were grouped with cluster analyses (Ward's method) into five clusters that were arranged along the EIV gradients (EIV for moisture 9.2-7.8 in the natural part, and 7.6-6.8 in the drained part; EIV for nutrients 4.2-2.4, and 1.5-1.1, respectively).

Groundwater depth, pH and EC were insignificantly higher in the natural part than in the drained part. Species distribution was well related to the coverage and height of tussocks, depth to the water table, S, N and P contents of peat, and K content of pore water.

Drier conditions favoured the expansion of *Molinia caerulea* as well as of trees and shrubs contributing to the appearance of specialist shade-tolerant plant species.

To improve fen conditions, we propose damming to raise water level, cutting trees to improve light conditions and decrease evapotranspiration, and mowing tussocks to reduce the share of *Molinia caerulea*.

313 Survival and dispersal of rabbits in a translocation experiment in the Netherlands; food quality and the use of burrows

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Rabbit restocking is a management measure frequently used to counter decreases of rabbit populations due to RHD. Lack of burrows, and the moving between burrows has been suggested as one of the reasons for the low survival rate in these restocking programmes.

We were able to compare resident and restocked rabbit movement as part of an evaluation of the efficiency of rabbit restocking by translocation in Dutch coastal dune areas.

After translocation there was a high mortality by fox predation. Most translocated rabbits left the artificial burrows in the first night for unused natural burrows. They kept using several burrows. The quality of food in the new habitat was sufficient, and the translocated animals had an acquired immunity to RHD.

We conclude that this is not a lack of settling, but that where sufficient burrows are available rabbits will use more than one burrow.

314 Grass-encroachment in acid grey dunes: a matter of organic matter and P

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In The Netherlands, grey dunes (habitat type 2130) are threatened by grass-encroachment, due to N-deposition, decreased rabbits and differences in P-availability. We compared two acid, iron-rich dune areas with high and low rates of grass-encroachment, and vegetation from open to grass-encroached stages of 10, 20 and more than 25 years. We measured microbial characteristics, mineralization and different P-fractions.

The high grass-encroachment area had higher soil organic matter, but did not differ from the low one in N-availability. However, increase in soil organic matter lead to organic instead of mineral forms of iron, and increase in P-availability via iron-P-organic matter complexes rather than P-fixation in iron phosphates.

Grey dunes may thus be vulnerable and difficult to restore on older soils with high organic matter, because of the shift in P-availability. However, in more dynamic areas with low soil organic matter and P-fixation in iron phosphate, light grazing may be sufficient to counteract high N-deposition.

315 Can grey dunes be restored from afforestations of *Pinus nigra*?

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In the Amsterdam Water supply Dunes the area of grey dunes has partly diminished due to afforestation with *Pinus nigra*. Nowadays, forest management aims at the conversion into more natural types of dune woodland. However, rejuvenation of indigenous, deciduous tree species is not successful in areas with young soils. We investigated whether it is possible to convert a 60 year old coniferous stand into grey dunes. Different measures (tree cutting, tree cutting with litter raking, tree cutting with top soil removal) were compared with a control and reference situation (grey dunes). The effects were studied for soil and vegetation.

Afforestation has led to accumulation of litter and increase of organic matter, due to which the top soil has acidified, base saturation has declined, nitrogen content has increased and anorganic phosphorous has diminished. Tree cutting with or without litter raking caused a decline in organic matter content, but not in nitrogen and phosphorous. Only tree cutting with top soil removal resulted in an increasing pH and strong decline of organic matter and nitrogen content.

Vegetation developed slowly after tree cutting with top soil removal and responded quickly to tree cutting with or without litter raking. After 6 years, the coverage of ruderal grasses had declined in all treatments, except tree cutting. Number of grey dune species only approached the reference situation after tree cutting with top soil removal, but their mean coverage surprisingly increased most after tree cutting with litter raking.

316 ANDREA, a new life for ancient dunes!

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Along the Flemish coast a few fossil dune-areas emerge from the surrounding flat polder plain at a distance of 2 up to 3,5 km from the present maritime shoreline. These sand-bodies are supposed to have formed between at least 1.000 and 4.500 years ago as strand-walls in a tidal landscape of sandy beaches, mudflats and salt marshes. They occur at Adinkerke, near the French border, Westende and Bredene – De Haan. These former strand-walls or fossil dunes are characterised by a rather low and gently undulating or even quite flat topography and decalcified soils that explain the occurrence of the Natura 2000 - habitat '2150* Atlantic decalcified fixed dunes (Calluno-Ulicetia)'. According to the annex 1 of the European Habitat-directive the maintenance of that type of habitat deserves priority. As the remaining fossil dune-areas have until recently all been strongly degraded, the Agency for Nature and Forest of the Flemish Regional Authority has started a specific nature restoration campaign called 'ANcient Dunes Restoration Action', abbreviated as 'ANDREA'. Between 1997 and 2007 important land-purchases were realised and some efforts have already been made on the field. In 2005 the owner of the main fossil dune-site at Adinkerke, the water-supply Company I.W.V.A., agreed to entrust the management of its domain 'Cabour' to the Agency for Nature and Forest. This management-agreement allowed the Agency to commission the elaboration of a management-plan for that area to scientific consultants and to start experimental management measures. The same kind of management-agreement with another water-supply company, the V.M.W., allowed the Agency to also significantly expand the Flemish regional nature reserve at Bredene with the adjacent domain of the V.M.W.. Here also a management-plan has to be drawn and nature restoration measures are being executed, with special attention for habitat -defragmentation. The results of the measures that since 1997 were carried out in the fossil dunes of Bredene to restore biodiversity are very satisfactory. The Agency also seeks to share experience about the management of decalcified ancient dunes with dune-managers from other European countries.

317 ZENO, the latest Life nature – restoration – project along the Flemish Coast

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Along the short Flemish coastline already 4 LIFE nature projects ('ICCI', 'FEYDRA', 'Salt meadows at the Flemish coast' and 'The Uitkerkse polder') played an important role as a tool for the implementation of the

European network Natura 2000. Essential elements in these successes were a thorough scientific preparation and a sustained action for public support.

Besides their initial program, these projects also had a favourable influence on the conservation policy of the Flemish government and stimulated dialogue between conservationists, local authorities and other interest groups.

With the experience and results of these successful LIFE nature projects it was time for a fifth one, ZENO! ZENO stands for Zwindunes Ecological Nature Optimisation and is a LIFE nature project of the Agency for Nature and Forest of the Flemish government (ANB).

The project area is the Flemish Nature Reserve 'The Zwin Dunes and Zwin Polders' at Knokke-Heist.

During the 20th Century a large part of this area was largely negatively influenced by human activities. Grey dunes and wet slacks are now subjected to invasion by scrubs and grasses. Also the nature values of dune meadows decreased resulting from too strong fertilization in the past.

The legally approved management plan of the concerned nature reserve is the basis for this LIFE project. The main objective is the restoration and maintenance of the natural habitats of coastal dunes and their transitions to polders.

The paper presents the preparatory steps to build up such a project, the different actions, the aims and the first results of the LIFE nature project ZENO, and invites other participants for the international workshop about nature restoration in dunes and dune-polder transition areas at the end of the project (2010).

318 Integrating hydrologic and ecologic models in floodplain restoration, the case of the Drie Beken, Flanders, Belgium

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A main concern in floodplain restoration is the integration of different functions, especially in densely build areas such as Flanders. Different stake holders claim the limited remaining space. Integrated floodplain management aims to conciliate water and nature management goals which in principle are highly compatible. As the implementation of new water management schemes often involves important investments, the consequences of different scenarios in terms of benefits for water management and biodiversity should be evaluated. A combination of hydrological and ecological models is needed to provide a solid basis to choose the appropriate scenario.

The floodplain of the Drie Beken is a confluence area of rivers of different sizes, with an area of 2000 ha. It is historically a very wet area covered mainly with peaty soils, but over the centuries water management was optimized for agricultural. Plans to adapt the water system for the restoration of the wetland involve an increase of the groundwater levels combined with higher seepage fluxes. These measures should not have negative effects on safety and flooding events, or on agriculture outside the floodplain.

A set of water management scenario's was developed and evaluated with the aid of a chain of three models. A surface water model (InfoWorks-RS, Wallinfort) simulates water levels in the rivers and flooding areas. A groundwater model (Triwaco, Haskoning) calculated groundwater levels and seepage area. These hydrological conditions are subsequently implemented in a hydro-ecological model (NICHE), which calculates whether certain vegetation types can develop under the modelled site conditions.

319 Integrated modelling of ecological potentials of new restoration sites along the river Meuse

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To evaluate restoration measures along the Common Meuse an integrated, dynamic ecological expert model ECODYN was developed. It predicts the potential for habitat development and species presence under changed river dynamics at restoration sites. Data generated by hydromorphological and hydrological models are integrated to predict spatial distribution of habitats in a restored river ecosystem. In the integrated model, variations in river and ground water dynamics are considered to be the main drivers for ecotope differentiation. Area specific knowledge on 1. boundary conditions in river dynamics for forest development in the riverbed, 2. vegetation succession in present pilot project areas and 3. impact of grazing on floodplain grasslands, further determines spatial development potentials in each river zone of the Common Meuse Valley. The model output gives us information on potential distribution for Natura- 2000 habitats: running water (3260), muddy banks (3270) and calcareous pioneer grassland on sandy (6120) and stony substrate (6110). To predict floodplain habitat development, two management options (grazing and autonomous development) were included in the model, giving predictions on potentials of mesophile grasslands (65) and

tall herb meadows (6430 and 6210).

For the Dutch - Belgian restoration plans of the River Meuse project different restoration measures and management scenarios are compared and habitat potentials are evaluated. Bottlenecks arising from these restoration measures are revealed and alternatives are suggested. Integration of hydromorphological, hydrological and ecological modelling appears a powerful tool to evaluate and adjust restoration measures along the river Meuse so the appropriate restoration objectives could be realised.

320 Impacts of restoration of connectivity in side channels on freshwater habitat types

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During the two past centuries, the Rhine floodplain was submitted to important and successive engineering civil works (rectification, channelization, ...) that severely damaged floodplain functionality, e.g. through disconnecting side-arm channels. For several years, restoration works were carried on in order to create permanent connections between those former side channels and the main course. The aim of these works was mainly to restore functionality of the whole system and to recover "natural" freshwater habitat types such as EU 3260 – Water courses with the *Ranunculus fluitans* and *Callitriche-Brachion* vegetation. Impact of restoration works on Natura 2000 habitat types was assessed through the recovery of aquatic vegetation functionality.

Established aquatic vegetation, propagule bank content (latent biodiversity), including sexual and vegetative propagules, and relationships between above-ground-vegetation and propagule bank were studied in 4 restored side channel and 2 reference channels (target) that were never disconnected from the main course.

Propagule bank was estimated by the seedling emergence methods adapted for aquatic communities. An addition sampling was also carried out in order to estimate the amount of aquatic species resprouting from rhizoms.

Conservation status of the habitat types, propagule bank contents, up-stream / down-stream vegetation pattern, and links between each type of propagules in the soil and established vegetation were analysed according to the date when the restoration occurred.

Thanks to those results, temporal patterns of (1) natural habitat types reconstruction, (2) propagule bank reconstruction, and (3) recovering of the vegetation dynamics following connectivity recovering could be emphasized.

321 A tool to evaluate the contents of river rehabilitation projects: the APR-protocol

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Although several authors have proposed standards and minimum requirements for river restoration projects and its success there is still a lack of information among practitioners. We have designed a protocol to evaluate objectively the contents of a rehabilitation project its feasibility to be completed and its relevance for restoration purposes. In this protocol 5 steps in the project content are evaluated: Diagnosis, Objectives, Measures, Monitoring program and Budget. Both from the environmental and socioeconomical point of view. In each part different aspects are considered, e.g. in Diagnosis the biological integrity, hydrogeomorphical quality, physicochemical quality and a synthesis of impacts and degradation processes. Each of this aspects is scored with points (e.g. 0-40 points for biological integrity). Thus if no data is presented, 0 points are scored, while if the project has used all the available data, e.g. data from administration or research studies, or includes specific field trips to study this aspect, the project receives 40 points. Using this rationale up to 500 points may be obtained for each project in both aspects, environmental and socioeconomic, and therefore the maximum score is 1000 points. The application of this method to 50 projects in Catalonia (NE Spain) shows that very few projects score more than 750 points, and many others may sum less than 250, giving the idea that the elaboration of restoration projects is still in its infancy in this area of the world.

322 Restoration of wet meadow communities after long-term abandonment

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In order to re-cover biodiversity after 30 years of abandonment a mowing regime (two cuts/year) was re-established in previous *Calthion* and *Caricion fuscae* communities which had been abandoned in the Oste valley (NW Germany) already in the 1950s. Starting with extremely species poor tall forbs and tall grass communities (*Filipendulion* / *Magnocaricion*) we found a significant reduction of the standing crop with re-mowing and a threefold increase of the species numbers on permanent plots already during the first years. Small growing vascular plants such as *Lychnis flos-cuculi* became dominant which significantly changed vegetation structure and flowering aspects. The new established plant species partly represented the species pool of former *Calthion* and *Caricion fuscae* communities which had been recorded on these stands in 1952 prior to the abandonment. They established from the soil seed bank which apparently survived the fallow period. On the other hand, other target species such as *Carex fusca*, *Bromus racemosus* and *Senecio aquaticus* failed in re-colonizing even though an appropriate mowing regime had been installed. Our experiments show that wet fallow communities are capable of storing seeds and therefore “memorizing” previous biodiversity conditions for decades. However, the complete species assemblage of original plant communities was not possible to be re-established due to limited seed persistence and reduced invasion from the surrounding landscape.

323 The European Natura2000 policy: an example of good practice for the world?

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Natura 2000 presents an interesting and inspiring attempt to develop conservation plans and actions across a broad regional/continental scale. In this paper I consider the success and limitations of the Natura 2000 approach, and how well ecological restoration is incorporated into the program.

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