Anne Tolvanen & Anne-Maarit Hekkala (Eds.)

ABSTRACTS

SER2014

THE 9th EUROPEAN CONFERENCE ON ECOLOGICAL RESTORATION

Schedule at Glance

	Sun Aug 3	Mon Aug 4	Tue Aug 5	Wed Aug 6	Thu Aug 7	Fri Aug 8
Morning 1	Pre-conference excursion July 31– Aug 3	Bus to University	Bus to University	Mid-conference excursions	Bus to University	Bus to University
		Registration and coffee	**Plenary:** Hanski Aradóttir		**Plenary:** De Groot	**Parallel:** EU Life Resilience Peatlands Green infra Environmental education
		Opening ceremony: Kolström Lajunen Hölzel			Coffee	
			Coffee		**Parallel:** EU Life Grassland: balancing bd Peatlands Mineral extraction sites Passive restoration	Coffee
Morning 2		**Plenary:** Alanen Murphy Palmer	**Parallel:** Building networks Grasslands Peatlands: biogeochemical Marine/freshwater Native plant material			**Plenary:** Câmara Tolvanen
		Lunch	Lunch		Lunch	Closing Ceremony
Afternoon 1		**Parallel:** Building networks Alternative grazing Ecosystem services Native plant material Forests	**Parallel:** Improved evaluation Grasslands Peatlands: biogeochemical Marine/freshwater Green infra		**Parallel:** EU Life Farmland Peatlands Mineral extraction sites Passive restoration	Lunch
		Coffee	Coffee		Coffee	Bus to City
Afternoon 2		**Parallel:** EU 2020 Alternative grazing Ecosystem services Native plant material Forests	**Parallel:** EU Life Grassland Peatlands Marine/freshwater Traditional knowlege		**Posters 2** / SER Europe General member-ship meeting	Post-conference excursion Aug 8-11
Evening	Registration at hotel Scandic 17:00-20:00	**Posters 1**	Bus to City		Bus to City	
		Bus to City				
		Ice-breaker	City of Oulu reception		Conference Dinner	
		Bus to City				

The 9th European Conference on Ecological Restoration

Abstracts

Editors: Anne Tolvanen and Anne-Maarit Hekkala

August 3–8, 2014, Oulu, Finland

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Welcome to SER2014 European Conference

Dear Friends and Colleagues,

The ecosystem service concept and the valuation efforts of ecosystem services are changing the discussion concerning land use policy and natural resource management. Increasing knowledge on the importance of healthy ecosystems for human well-being is leading to situations in which multifunctional and ecologically sustainable land use is seen as an option to simultaneously generate ecological, social, and economic benefits. Ecological Restoration is seen as a crucial means to bring back the function and structure of degraded ecosystems. Also EU puts high effort on Ecological Restoration through its Biodiversity Strategy 2020, which includes a target to restore 15% of degraded ecosystems in the EU by 2020.

On behalf of the European Chapter of the Society for Ecological Restoration, we are pleased to welcome you to the 9th European Conference on Ecological Restoration. Each specific Conference in the series of SER European Conferences focuses on different topics around restoration. The focus of SER2014 European Conference is Restoration, Ecosystem Services and Land Use Policy. The timely topic relates the Conference directly to global, EU and national level policies, which aim at safeguarding the environment and biodiversity, and mitigating Climate Change impacts. By acknowledging and discussing international and EU level strategies and targets, the Conference aims at increasing the link between the science and practice of ecological restoration and land use policies.

There will be almost 400 attendees from 35 countries in the Conference, and we will hear over 200 oral presentations and see almost 100 posters. In addition with top scientists giving plenary lectures and session lectures, delegates from the EU DG Environment, EU Life+ programme, and EU level consultancy firms will provide information on the EU perspective on restoration. A representative from the Finnish Ministry of Environment will give her view about restoration policies in Finland. All this shows that the Conference receives wide international interest among audience from inside and outside the scientific community.

The Conference is organized in Oulu, northern Finland, which is the first time for SER European Conferences to be hosted by one of the Nordic Countries. Oulu, which boasts to be the Capital of Northern Scandinavia, is an excellent place to host such event. Oulu can offer a functioning Conference venue at the University Campus and provide abundant opportunities for one-day mid-Conference excursions to see northern Finnish nature slightly south of the Arctic Circle. Some lucky Conference attendees will have a chance to go to see the subarctic nature in Finnish Lapland and northern boreal forests in north-eastern Finland during the pre- and post-Conference trips.

We cordially thank our co-organisers, sponsors and partners to make this Conference real. We also thank the Conference attendees, who showed such an interest to join us and who will create the inspiring atmosphere in the Conference. Our fundamental thanks go to SER Europe Board; without you and your support there would be no SER2014 European Conference in Finland in August 2014.

Anne Tolvanen

Finnish Forest Research Institute and Thule Institute of the University of Oulu
Conference Chair, on behalf of the Organizing Committee

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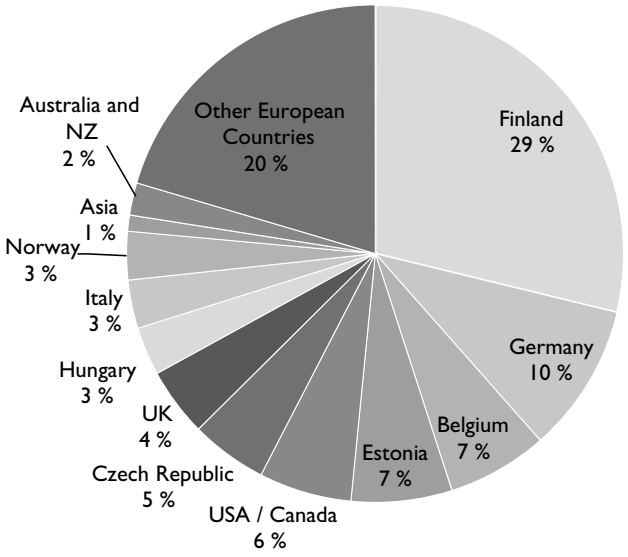
Statistics for the SER2014 European Conference on the 6th June 2014

Total Attendance	382
Countries Represented	35

Attendance by country or region

Finland	110
Germany	37
Belgium	25
Estonia	25
USA / Canada	23
Czech Republic	19
UK	17
Hungary	12
Italy	12
Norway	12
Asia	4
Australia and NZ	8
Other European Countries	78



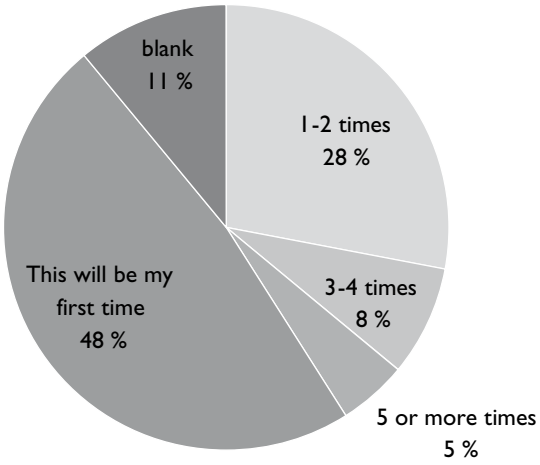
Scientific Programme

Number of plenary presentations:	8
Number of oral presentations:	214
Number of posters:	82
Total number of authors in Conference abstracts:	780
Number of oral sessions:	40

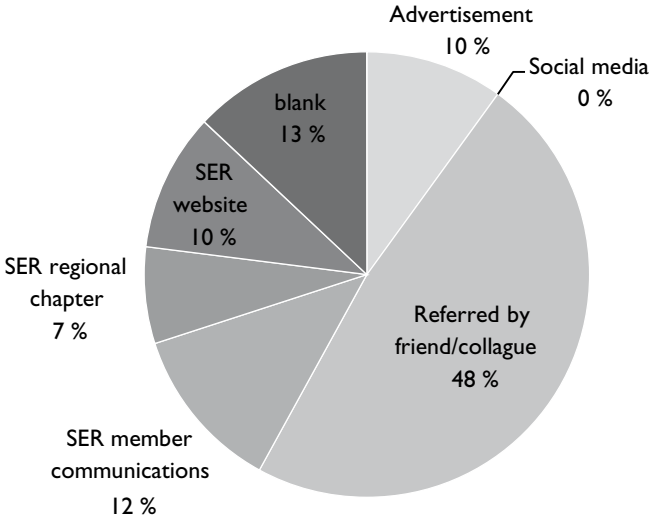
Themes or sessions having more ten or more presentations

Peatlands and wetlands (two session titles):	33
EU Life as means for safeguarding and protecting environment:	23
Grasslands (two session titles):	22
Marine and freshwater ecosystems:	16
Native plant material	14
Mineral extraction sites:	12
Passive restoration:	12
Forest ecosystems:	11
Alternative grazing practices:	10
Ecosystem services and land use:	10

How many past SER / SER Europe Conferences you have attended?



How did you hear about the SER2014 European Conference?



Content

Plenary presentations

in order of appearance

Plenary 1

National level conservation and restoration policy; targets and their fulfilment

Aulikki Alanen
senior environmental advisor, Ministry of the Environment (MoE), FINLAND

In Finnish nature conservation policy, the restoration of ecosystems has become an important tool for mitigating biodiversity loss and safeguarding ecosystem services. The Government promotes restoration in both protected areas and commercial forests. In the background of the national activities lie the European Union Biodiversity Strategy and the CBD Nagoya targets, highlighting ecological restoration as a key means to halt biodiversity loss by 2020. The advantages of preserving and restoring mires with regard to mitigating climate change have finally been recognised in the climate policy.

The need for ecological restoration in Finnish forest habitats was first discovered during the national Red Listing of species in 1985. The primary reasons for the decline of forest species were identified as changes in the habitat structure and functions: lack of fires and decaying wood etc. Some experiments of mire restoration were conducted in 1980's, but the restoration methods and targets were systematically developed in 2003 by the habitat restoration working group of the MoE.

Ecological restoration became a standard means of managing protected areas when METSO Forest Biodiversity Programme for Southern Finland was launched 2003. The Programme is a collaborative effort between the MoE, the Ministry of Agriculture and Forestry, the Finnish Environment Institute and the Forest Development Centre Tapio. METSO Programme aims to halt the ongoing decline in the biodiversity of forest habitats and to establish favorable trends in Southern Finland's forest ecosystems. Already ca 40,000 hectares of protected forests and mires have been restored, and the goal is to restore another 30,000 hectares by 2025.

METSO restoration measures are mainly aimed at forests and mires as one-off actions. Continuous habitat management is performed at regular intervals in herb-rich and esker forests and the habitats of white-backed woodpecker and other threatened species. Specific restoration objectives may be achievable within several years (e.g. raising the water table of degraded mires), several decades (reappearance of natural vegetation), or only after centuries (structure and dynamics of mature tree communities).

The Finnish Board on Ecological Restoration (FBER) is a co-operation body of best national experts and authorities in restoration. It evaluates, develops and promotes the quality and status of the ecological restoration of natural and semi-natural habitats, and their impact on society. FBER improves national restoration expertise by preparing guidebooks and organizing training events.

Plenary 2

Patrick Murphy
EU, Dg Environment

Plenary 3

Stream Restoration: Successes and Limitations

Margaret A. Palmer
National Socio-Environmental Synthesis Center, University of Maryland, USA

Ecological restoration has grown rapidly, and now encompasses not only classic ecological theory but also utilitarian concerns such as preparedness for climate change and provisioning of ecosystem services. Dominant perspectives on the science and practice of restoration are driven not only by science but of course by social dynamics both external to and internal to the community of scientists and restoration practitioners. This has been particularly pronounced for restoration of running waters. I identify three dominant perspectives that compete to influence the science and practice of river restoration. The first, "restoration as engineering" is restoration to mimic channel morphology or produce a stable channel. The strong focus on channel morphology leads to approaches that involve major earth-moving activities such as channel re-configuration with the unmet assumption that ecological recovery will follow. The second perspective, "restoration of ecological function", uses dynamic functional perspectives of river restoration to regain biogeochemical, ecological, and hydrogeomorphic processes that make up a healthy river. While there is well-accepted theory to support this, research on methods to implement and assess functional restoration projects is in its infancy. The third perspective, "restoration to reverse stressors", aims at identifying and correcting the underlying causes of stream degradation. A plethora of new studies from around the world report trends on why and how rivers are being restored. A smaller number of studies have quantitatively evaluated the ecological effectiveness of restoration; I place these studies within the framework of these three perspectives and present patterns in project outcomes. These outcomes should inform societal and management decisions on the methods we use in attempting to restore running-waters and what is realistically possible in human dominated landscapes.

Plenary 4

Viability of species in fragmented landscapes – implications for restoration

Ilkka Hanski

Metapopulation Research Group, Department of Ecology and Evolutionary Biology, University of Helsinki, FINLAND

Loss of habitat has been, and continues to be, the main cause of declining biodiversity and extinction of species nationally and globally. Whenever the amount of remaining habitat is small or relatively small, the spatial configuration of habitat (habitat fragmentation), apart from the total amount of habitat, influences the viability of populations and the capacity of landscapes to support biodiversity. I demonstrate the significance of habitat fragmentation with the species-fragmented area relationship (SFAR), which extends the familiar species-area relationship to fragmented landscapes [1]. Species respond gradually to habitat loss and fragmentation, which leads to extinction debt. I describe the factors that influence the magnitude of extinction debt, which is easily underestimated for species inhabiting highly fragmented landscapes [2]. In practical restoration, one needs to know where and how much habitat should be restored. I describe a quantitative modelling approach that can be used to answer such questions for species that exhibit metapopulation dynamics [3]. For other species, a more qualitative approach is needed. For this purpose, I have advocated the third-of-third principle, which offers a more general guideline for the protection of biodiversity and may lead to cost-effective conservation and restoration [4].

1. Hanski, I., Zurita, G.A., Bellocq, M.I. and Rybicki, J. 2013. Species-fragmented area relationship. Proc. Natl. Acad. Sci. US 110, 12715–12720;
2. Hanski, I. & Ovaskainen, O. 2002. Extinction debt at extinction threshold. Cons. Biol. 16, 666–673;
3. Several chapters in Hanski, I. & Gaggiotti, O. (Eds.) 2004. Ecology, genetics, and evolution of metapopulations. Elsevier, Academic Press, Amsterdam, 696 pp;
4. Hanski, I. 2011. Habitat loss, the dynamics of biodiversity, and a perspective on conservation. Ambio 3, 248–255.

Plenary 5

Drivers of ecological restoration: a Nordic perspective

Ása L. Aradóttir
Agricultural University of Iceland, Keldnaholt, Árleyni 22, IS 112-Reykjavík, ICELAND

Many factors motivate ecological restoration, including the provision of ecosystem services, concerns about biodiversity and the mitigation of land degradation and damages to ecosystems caused by construction. Legislation, policy and various monetary incentives are also possible drivers, together with moral and idealistic factors. Furthermore, demographic changes, economic and technical development and various cultural factors can be indirect drivers of restoration.

The Nordic countries – Denmark, Finland, Iceland, Norway and Sweden – have experienced ecosystem degradation to a various degree. This is caused by a host of factors, including agricultural extension, deforestation, wetland drainage, overgrazing, the introduction of exotic species, river channelization and various infrastructural interventions. Covering more than one-eighth of Europe, most of the Nordic countries belong to the boreal and alpine zones, where short growing seasons and slow ecosystem recovery hamper ecological restoration. A recent analysis of ecological restoration in the region, under the Nordic project *ReNo*, shows that restoration efforts in these countries reflect both diverse land use pressures and differences in biophysical conditions. The restoration is commonly associated with land-use changes, such as abandonment of agricultural land (Denmark and Norway) or discontinued use of rivers that were channelized for timber floating (Sweden). Ecological restoration is also often a part of mitigation actions related to building of power plants, roads and other infrastructural interventions. The extent of habitats and their use often dictates restoration, as in Finland where most restoration is geared towards fragmented and deteriorated forests and peatlands. Likewise, most restoration efforts in Iceland are focused on the country's extensive severely degraded and eroded landscapes. There, the halting of soil erosion and restoration of ecosystem productivity and other services are strong drivers of restoration, together with romantic notions of restoring the "former riches" of the land. Conversely, concerns about biodiversity and conservation values are more common drivers of restoration in the other Nordic countries. The importance of law and policies as drivers for ecological restoration varies among the countries and seems related to the strength of the relevant policy frameworks and funding opportunities. Emergent drivers for restoration in the region include climate change mitigation and improved resilience of ecosystems to natural hazards.

Plenary 6

Values of Ecosystem Services and Benefits of their Restoration

Rudolf de Groot
Environmental Systems Analysis Group, Wageningen University, NETHERLANDS

Ecosystems provide a range of services, many of which are of fundamental importance to our health, livelihood, economy and general well-being. Yet, despite international commitments global biodiversity continues to decline at unprecedented rates. Ecosystem degradation and the loss of biodiversity undermine ecosystem functioning and resilience and thus threaten the ability of ecosystems to continue to supply the flow of ecosystem services. In addition to the environmental and social costs, ecosystem degradation has huge economic costs: a recent publication in Global Environmental Change (Costanza et al, 2014) estimated the global damage, mitigation and repair costs at between 4–20 trillion US$/year.

This presentation will give an overview of the main principles of valuing ecosystem services based on recent findings from, among others, "The Economics of Ecosystems and Biodiversity" (TEEB) study (www.teebweb.org). It will include examples from different ecosystems and compare the values found with the costs of restoring these ecosystems (over 19.000 papers were screened and the results, published in Conservation Biology (De Groot et al., 2013) showed that for all major biomes the benefit-cost ratio was positive).

Demonstrating the value of ecosystems is one thing, turning it into 'real money' is still a major challenge. The presentation will therefore end with some examples of the use of the ecosystem services concept in practice and conclude that investing in nature conservation and restoration "pays"; i.e. provides more benefits than costs, if we are honest about all the externalities involved.

For more information see: www.es-partnership.org

Plenary 7

Gilberto Câmara
Brazil's National Institute for Space Research (INPE), BRAZIL

Plenary 8

Is scientific knowledge heard in the natural resource management?

Anne Tolvanen
Oulu unit, Finnish Forest Research Institute and Thule Institute

A common concern among scientists is that scientific knowledge is overruled by political agenda and secret motives of decision-makers in the natural resource management. It is also stated that there is a wide gap between science and policy-making and this is largely due to different motives: researchers seek for objective knowledge and direct utilization of the scientific data, whereas policy-makers aim at making decisions that all stakeholders would accept at least partially. There have also been arguments for decades on how to measure the extent of impact of scientific knowledge in the decision making, and the issue has ramified into discussions on theoretical science-policy frameworks, the role of institutional arrangements in aiding the science-policy discussion, the importance of knowledge transfer, etc.. The science-policy interaction has become a topic of scientific interest per se. To keep the discussion simple even for a straightforward natural scientist, it is important to consider whether and why there are gaps between scientists and policy-makers, between scientists of different disciplines, and between scientists and general audience. And even more important is to think what should be done to make the gaps narrower.

A prerequisite for people of different backgrounds and motives to approach each other is to find a common language, which helps at finding common aims, fitting together versatile needs and making compromises. Pressure has been put on scientists to make their work better understandable and to tie their work more closely to solve practical problems. There is usually little effort however, until science funding begins tarts to direct the research. A tighter connection between policy-making, business and scientific research funding guarantee that the direct use and cost-efficiency of the research is maximized. Nevertheless, a well-known problem is the loss of scientific autonomy, and the fact that by responding to existing environmental problems through research, scientific thinking is partially misused, at science should provide ideas and tools to hinder the problems in advance.

In my presentation I show our past and present work that relates to the use of scientific data in land-use and natural resource planning. New way of thinking is required among scientists, which allows for developing new research ideas while solving practical problems and disseminating actively in the public. Researchers working in the interface between science and policy-making can essentially increase the use of scientific knowledge in the natural resource management.

Oral presentations

O 1

Demand and challenges for native seed production: The Norwegian experience

Trygve S. Aamlid, Bioforsk Landvik, Bioforsk, NORWAY

Collection, multiplication, storage and sales of seed of alpine species for Norwegian restoration projects was initiated in 2005. Our objectives were to provide seed of local provenances and (2) to develop production of such seed into an economically viable enterprise for Norwegian farmers. We mostly focused on monocot species such as Agrostis mertinsii, Avenella flexuosa, Festuca ovina, Phleum alpinum, Poa alpina and Luzula multiflora ssp. frigida. First generation seed crops were established by raising plants in nurseries and transplanting them onto beds covered by black plastic to avoid weeds. Part of the yields from these multiplications were stored in the Nordic Gene Bank (NORDGEN) as a basic seed collection for alpine restoration. Second generation multiplications were contracted to a total of ten growers not far from the Norwegian mountain range. The seed crops were established in stale seed beds without cover crop. The harvested acreage gradually increased to 14 ha in 2012 and the average seed yields to 123, 150, 488, 230, 750 and 62 kg/ha for A. mertensii, A.flexuosa, F. ovina, L. multiflora, P. alpinum, P. alpina and L. multiflora, respectively. This increase was facilitated by more than 30 on-farm trials into seed crop management, first and foremost the control of grass weeds which are a major problem due to the slow Growth rate and poor competitive ability of native alpine species.

Unfortunately for this project, most of the seed fields had to be plowed in spring 2013. This was due to a much lower demand for native seed than anticipated at the start of the project. The low seed sales was mostly due to new research showing spontaneous vegetation from the soil seed bank to be sufficient, even at high elevations. In the future, use of native seed in Norway will probably mostly be limited to slopes which are prone to erosion.

O 2

Wildfire in Central Europe sandstone landscape: effect on long-term forest vegetation development

Martin Adamek, Institute of Botany, ASCR, CZECH REPUBLIC
Veroslava Hadincová

In European context, the majority of studies on forest fire ecology are from the Mediterranean and Fenno-Scandinavian regions, where the fire is considered to be an integral part of forest dynamics. In temperate forests of the Central Europe the ecological role of fire is largely neglected, despite documented high fire frequency and occurrence of forests prone to fire. In our study we focused on semi-natural Pinus sylvestris dominated forests of Central European sandstone regions resembling the boreo-continental pinewoods that are claimed to be fire-adapted. To assess forests fire adaptation, we studied forest ability to recover after the fire events. Specifically, we observed the long-term forest development at the plots affected by fire of different intensity to find out (i) the rate of forest recovery, (ii) forest development trajectory and (iii) whether and when the forests develop into the stands with structure and func-

tion similar to unburned stand. We also assessed ability of the tree species to survive the fire events. The forest vegetation development was observed by vegetation sampling of different post fire succession stages and at unburned plots for the comparison. We recorded 98 fire plots 1–168 years old and 54 unburned plots. We evaluated post-fire temporal species composition changes, differences in tree survival ability, compared successional trajectories under different fire intensities and compared the final development stages with the unaffected plots of the same age. Our results revealed that fire affects strongly the forest species composition in early succession phases, while after several decades of forest development the stand structure and species composition becomes similar to unaffected P. sylvestris forests. However, several differences in species composition are still evident after more than 100 years. We conclude that Central European pine forests are highly resilient to fire events as the succession on the burned plots results in the pine forests typical for the area.

O 3

Institutional constraints on landscape scale restoration for conservation

William Adams, Geography, University of Cambridge, UNITED KINGDOM
Ian Hodge, Nicholas Macgregor, Lindsey Sandbrook

Aims: Landscape scale restoration has become an important element in conservation strategies, but presents novel institutional challenges. In the UK it has became a central element in government policy. The 2011 White Paper The Natural Choice built on the case made by the Lawton Committee in 2010 for 'more, bigger, better and joined' areas of wildlife habitat: restoring and reconnecting areas of habitat in managed landscapes. Such approaches demand coordination of management across large areas, and the creation of partnerships between public authorities, local communities and landowners and conservation trusts.

Methods: This paper reports qualitative research based on in-depth interviews with project managers of large-scale conservation areas in the UK.

Results: The paper evaluates the diverse institutional architectures used in landscape conservation initiatives, particularly those involving a range of kinds of landholders and aiming to restore biodiversity and improve connectivity across intensively managed land. The paper explores the challenges of creating and coordinating partnerships between organisations to lead such schemes, and of coordinating landholders to undertake ecological restoration.

Conclusions: The social dimensions of landscape-scale restoration need careful consideration. Issues critical to success include trust between conservation organisations and local communities faced with large-scale ecological restoration. The paper seeks to identify the factors contributing to the development of successful landscape scale restoration initiatives.

O 4

Differences in iron and phosphorous accumulation in groundwater fed fens have strong influence on plant species composition

Camiel Aggenbach, Ecosystem Management Research Group, University of Antwerp/ KWR, NETHERLANDS

Willem-Jan Emsens, Fons Smolders, Rudy van Diggelen, Pieter Stuyfzand

In a field study we addressed the question if degraded fens drained in the past, had a stronger accumulation of Fe and P in the topsoil than pristine fens and how this influence restoration of fen vegetation. In 14 groundwater fed fens in NW-Europe, varying in degradation state, geochemistry and pore water chemistry of the peat profile and vegetation were described. We distinguished 4 chemical types which differ clearly in plant species composition. We conclude both Fe- and P-concentration of the groundwater feeding the peat body and degradation history have a strong influence on the biogeochemistry and vegetation of fens. Fens fed by Fe-en P-rich groundwater have a more productive vegetation. Fens with a low productive vegetation are fed by groundwater very low in Fe and P and are riches in mesotrophic fen species. In iron rich fens drained in the past for a long time had a strong accumulation of Fe and P by decomposition of the peat (concentration effect) and by oxidation in the aerated topsoil. After rewetting these peatlands have a strong anaerobic decomposition and high Fe-concentrations in the pore water. The observed patterns in geo- and hydrochemistry influence vegetation structure and composition by nutrient availability and by toxicity effects of ferrous iron in pore water. Therefore for heavily degraded, Fe-rich fens restoration prospects for brown moss/ small sedge are less than for degraded, Fe-poor fens.

O 5

Vegetation restoration in open-cast mines in Spain: natural regeneration or manipulation

Josu Alday, Ecology and Marine Biology, University of Liverpool, UNITED KINGDOM

Rob Marrs, Carolina Martinez-Ruiz

Despite advances in methods for mine site reclamation in recent years, treatments are not always successful in restoring vegetation that is typical of the surrounding areas. In this context, we examine whether natural regeneration could be an option to restore vegetation on mined sites. Here, we synthesised information from extensive research programmes and revegetation experiments carried out during the last 10 years on reclaimed mine sitesin northern Spain (Palencia). Our results show that there are mined sites were the vegetation establishment is clearly prevented by limiting mechanisms (i.e. lack of soil or hostile conditions), where the use of manipulative treatments is recommended. In contrast, there are some mine sites where the environmental conditions are not so harsh and hence there is good natural colonization, mainly of shrub species. These shrubs can be used as ecosystem engineers to create heterogeneous micro-environmental conditions that promote the natural colonization of trees. Here, we discuss the implications of these finding for future restoration and research approaches.

O 6

Working for wetlands with the landowners and local stakeholders: Life+ Return of Rural Wetlands

Mikko Alhainen, Sustainable Wildlife Management, Finnish Wildlife Agency, FINLAND

Finland has experienced major loss of wetlands due to drainage for agriculture and forestry. The results of the drainage have provided income for nation, but with costs for nature due to loss of habitats, water quality and flood retention services. In many sites where drainage hasn't provided expected results they can be brought back to compensate for the lost habitats and services.

The Rural Wetlands project is a biodiversity project targeting the nature values outside of protection programs such as Natura 2000. The focus is in waterfowl habitats and brood production of quarry ducks.

The main objectives are 1) to motivate people to take care of home village wetlands for the benefits they provide for recreational use, such as hunting and birdwatching, water protection and landscape, and 2) to demonstrate a landowner based frame for cost-effective wildlife habitat restoration working at local level and utilizing the Finnish tradition for voluntary work. This is achieved through building a network of demonstrative wetland sites with landowners and by active communication, education and awareness rising to all stakeholder groups.

In January 2014 the project has already done 43 demonstrative wetlands varying from half a hectare to more than 20 hectares in size. The values of wetlands have been delivered in hundreds of events to thousands of people. The project achievements have been publicized in the Metsästäjä magazine send to 300 000 hunters in Finland. The project website provides information of wetland restorations and the experiences from project sites.

Waterfowl have welcomed the sites well with high brood production already in the first summer. If the project approach is continued in a long term it can have a meaningful effect on waterfowl populations and wetland biodiversity on a landscape level.

O 7

Near-natural restoration promotes resilience in semi-natural grasslands

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Knut Rydgren

Aim: Among various measures to counteract the present decrease of semi-natural grasslands, near-natural restoration appears promising, but we need more information to target species-rich, resilient vegetation.

Methods: We established an experiment in a newly constructed road verge to test the effect of seed sowing, hay transfer by hard and light raking and natural revegetation. We investi-

gated the vegetation development annually in 2004–2007. In 2012 we reanalysed the vegetation in selected plots, as well as in plots in surrounding, hydroseeded vegetation. We extracted the vegetation gradient structure by global non-metric multidimensional scaling (GNMDS). The repeated measurements and nested sampling design required the use of general linear mixed-effects models in all other statistical analyses.

Results and discussion: We find large compositional changes in the restored vegetation over time. Lack of treatment-year interactions give parallel, successional trajectories over the first four years, but after eight years, all treatments return towards their source vegetation. Such pattern is characteristic of disturbed environments, and indicates considerable vegetation resilience. Compared to the surroundings, the trial vegetation holds a much higher share of target species and larger species richness. The hydroseeded, surrounding vegetation appears highly resistant to potential seed influx both from adjacent grasslands and from the trial plots. We conclude that near-natural restoration performs fundamentally better than hydroseeding in preservation of biological diversity, and that all the near-natural treatments promote ecosystem resilience.

O 8

Assessing tradeoffs in ecosystem service provision under alternative mineral extraction site restoration strategies

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Michael MacDonald, Richard Bradbury

Restoration of mineral extraction sites for nature conservation can provide high-quality habitat and enhance local biodiversity. However, the ecosystem services and associated socio-economic benefits delivered by this restoration option are not well understood, relative to other restoration options such as social amenities and agriculture. Here, we address this research gap by presenting preliminary results from an ongoing research project that aims to evaluate the benefits of mineral site restoration across north-west Europe under alternative restoration scenarios. We use a combination of primary field data, benefits transfer, visitor questionnaires and process-based modelling to assess the biophysical aspects of a range of ecosystem services (global climate change mitigation, agricultural production, water yield, nutrient retention, recreation provision) delivered by former mining sites. Our results provide insight into the synergies and tradeoffs in ecosystem services provided to different beneficiaries under the alternative restoration scenarios and how these vary with the spatial context of each site. These focused ecosystem service assessments present planners and decision-makers with tangible place-based outputs that highlight the wider importance of restored mineral sites to both local and wider society.

O 9

Temporal evolution of ecosystem services delivery in restoration projects: impact on the net present value of a managed realignment project in the Scheldt estuary

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Patrick Meire

Managed realignment (MR) projects became recently very popular as a restoration measure in estuaries because of its multi-functional character. By giving land back to the river, many ecosystem services can be provided. Monetary valuation of ES could support ecological restoration practices by improving our knowledge on the positive and negative effects of the project for the society. Long term assessment of restoration projects is complex since ES delivery is rarely constant over time, certainly in high dynamic estuaries. Therefore we argue that it is important to take into account the ecological succession in the project area in a long term evaluation.

In this study on a MR project of more than 400 ha in the Scheldt estuary, biophysical and monetary data is collected to calculate the impact for 22 ES of different habitat types present in the project area: cropland, mudflat, pioneer, low and high marsh and grassland on the dikes. To incorporate the ecological succession of the project area in the evaluation, four development stages with different habitat configuration were defined. For a long term assessment over 100 years, four scenarios are created for a slow, moderate or fast succession process and without ecological succession but with immediately the climax situation.

Based on the ES assessment we can conclude that, although the high investment cost, the MR project is beneficial for the society (i.e. positive Net Present Value (NPV)). Without taking into account the period of ecological succession, the calculated NPV is a large underestimation because ES delivery in the climax situation is much lower. The time span of the succession process has however no impact on the total NPV over a 100 year time horizon.

O 10

Intraspecific variation of copper tolerance of four endemic plant species from katangan Copperbelt (D. R. Congo)

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Harsh ecosystems are at the origin of speciation processes in plant communities. In metalliferous areas, plants develop physiological adaptations to tolerate metal excess which lead to high species and population diversity. South of the Katanga province, more than 600 species including 54 endemics occur on hills with one of the world's largest concentrations of copper in soils (up to 10 000 ppm available Cu) and the populations are isolated on more than 100 copper hills scattered in miombo forest.

In order to improve restoration strategies of threatened species, we aimed to identify intraspecific copper tolerance of 4 endemic plant species from katangan copper outcrops: Crotalaria cobalticola, Diplolophium marthozianum, Gladiolus ledoctei and Triumfetta welwitschii.

Seeds were collected in 3 distinct populations in the katangan Copperbelt and sown according three soil contamination modalities: control (no addition of Cu), 100 and 1000 ppm of Cu concentration using hydrated copper (II) sulfate. Each combination had 10 repetitions. Height, number of leaves, number of flowers and number of fruits were measured once a week during one rainy season.

For all species, no significant difference of copper tolerance appeared between populations. In contrast, populations had distinct germination rate and growth rate, especially for T. welwitshii. C. cobalticola grew significantly better in highly contaminated soil than other soils. G. ledoctei did not show any significant difference between populations and soil treatments.

O 11

Social aspects and spatial planning aspects of lakeshore restoration

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Éva Pádárné Török, Tamás Ács

Having in mind the increasing recreational demand and also the related ecological concerns, lake-restoration of many Central-European lakes is absolutely needful and topical. The purpose of our study is to develop a decision-preparing assessment method for shore-restoration of medium-sized lakes, utilised primarily for recreational purposes, by the example of a Hungarian study-area (Lake Velence).

As primary step, structured interviews were made:personal visits were paid to four settlements along the lake including local governments, competent national park management, water management and environmental protection authorities. As secondary method, the regulations on use and urban development, stipulated in the local plans, were assessed. To determine possible shore sections for restoration, the previous two steps were completed with a detailed field survey, intersecting the shorezone into assessment plots (100x100 m).

The results showed, that just a bit more than 7% of the assessed plots are suitable, or partially suitable for shore-restoration. Though, there are relatively few plots suitable for restoration, it is still very advantageous, that there are also long, continuous sections of more hundred meters, where all the plots have suitable features for restoration. The results provided new information to have a better understanding on social demands and approach, and highlighted the importance of local plans, as potential limiting factors of restoration.

O 12

Optimal allocation of restoration investment across multiple tropical ecosystems for carbon and biodiversity

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We develop and apply a new framework of restoration prioritization that accounts for temporal contribution of a variety of restoration actions in heterogeneous tropical landscapes, which vary in cost and benefits, to maximize the utility of restoration investment. We propose a simple approach to characterize degradation for the basis of plausible restoration actions, and provide transparent methods to quantify restoration costs and benefits. We explore four scenarios to investigate trade-offs between two objectives, carbon sequestration and biodiversity conservation, to inform REDD+ policies. By applying our framework in East Kalimantan, Indonesia, we discover that highly degraded lowland forest with 21–40% AGB remaining is the most prioritized area for restoration, especially if investment is limited. We also identify that line planting as the most prioritized restoration action. There are spatial trade-offs among scenarios for the benefits of carbon and biodiversity, but the trade-offs highly depend on the level of investment. Our finding highlights the importance of degraded lowland forest for the inclusion into REDD+ policies in the context of enhancement of carbon stocks, despite lowland forest is identified as the most threatened ecosystem. The trade-offs between carbon and biodiversity provide opportunity to create premium price of carbon sequestration or willingness to pay of restoration project.

O 13

Are Maya domestic forest gardens surrogates for nature?

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We examined 30 Yucatec, Mopan and Kekchi domestic gardens and three edaphically-dissimilar samples of nearby forest to evaluate whether the gardens mimicked the forest in terms of species composition and ecosystem services. The gardens were hyper species-rich: habitat to 645 species of flowering plant, of which 515 were native. Many of the garden species were trees; all of the garden species had economic utility to the Maya. In terms of physical structure, the gardens were indiscernible from the forest and the boundaries between garden and forest were likewise imprecise. Using nonmetric multidimensional scaling ordination, we compared the species compositions of woody plants in ten Yucatec gardens vs. the forest plots, and found a high degree of similarity among their oligarchies. These patterns structure, alpha and beta diversity suggest that Maya gardens are surrogates for the forests around them. Moreover, our data suggest that the Maya Forest may be anthropogenic, descended from forest gardens gone feral during pre-Columbian times.

O 14

Evaluation of reasons of farmer participation in an agri-environmental policy contract; conversion of arable land to grassland and fodder strips

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Agriculture has a significant impact on the landscape capacity to provide ecosystem services. The agri-environmental measure of the Czech Rural Development Programme contains among others two schemes: the first is aimed to strengthening the prevention of soil degradation, particularly by reducing the risks of water erosion – conversion of arable land to grassland on sensitive soils – and the second preventing a further decline in the number of species on arable land – fodder strips. The effectivity of both the schemes depends on long-term and repeated participation of farmers. Factors which influenced farmer's participation in AEM contracts were studied. The research was based on the contract theory.

Methods: qualitative methods, questionnaire survey and in-depth interviews; factor analysis of some scores.

Results: farmer participation in the studied AECM titles was influenced by many factors, most important of which were identified level of payment, land ownership, understanding of the purpose of the schemes, and trust in the agri-environmental measure as representation of agricultural policy. It was demonstrated that external motivation of a farmer can limit internal motivation. The results suggest that it is easier to build on the internal motivation in case of conversion of arable land than in case of the fodder strips. The sufficient participation of farmers on the scheme "fodder strips" needs more effort in overcoming the difficulties in contract. It was clear that activities of an independent "agents" (often local gamekeepers) were able to help farmers to at least partly overcome the difficulties and deficiencies in the contract. The conclusion is that the way, by which the implementation of a policy is carried out, should clearly reflect the type of the contract and the subject of the contract. Biodiversity represent public goods, which are difficult to explain to farmers, it is difficult to measure the results – in addition influenced by factors, which are not in hands of farmer, and are usually highly specific.

O 15

Effects of long term water level variation caused by man-made dam management on riparian and littoral vegetation of Eastern Canadian boreal shield lakes.

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The research project aims to understand the impacts of lacustrine dam installation and removal on i) the littoral morphology and ii) the succession processes of riparian vegetation. Long term (> 10 years) anthropogenic changes of water level are expected to modify the configuration of riparian habitats, including both their emerged and submerged areas. Due to persistent

water level rise caused by dam, these areas should show morphologic characteristics resulting from various physical alterations of the original landscape. Following dam removal, revegetation processes should be closely linked to the new relationship between water, soils and vegetation. However, very little is known on the period of time needed for these emerging ecosystems to show comparable structures and to provide similar services to original riparian ecosystems.

Shore morphology patterns have been studied on 7 lakes that showed contrasting dam management histories. Hydrological regime of each studied lakes has also been defined to identify its role on shore morphology. Evolutionary dynamics of the riparian vegetation in relation with the lowering of water levels will be analyzed in order to determine temporal gradient stages of natural revegetation.

These data will be used to determine the stages and processes that govern the return to natural vegetation composition on the shores of the different lakes of Eastern Canadian boreal shield The results of the study should provide a better understanding of the interactions between the different variables involved and therefore contribute to evaluate the relevance of removing dams in the context of adaptive management and restoration of ecosystem services.

O 16

Mediating overabundant moose impacts in a protected area (Terra Nova National Park, Newfoundland, Canada)

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Luise Hermanutz

Non-native species often have serious negative effects on natural ecosystems, possibly resulting in alternative successional trajectories. Newfoundland (Canada) is the world's 16th largest island where non-native species outnumber the few indigenous species. For example, 12 of the 26 mammals present on the island are introduced species, including moose (Alces americanus), the island's largest herbivore. Terra Nova National Park (TNNP) encompasses coastal forests dominated by balsam fir (Abies balsamea), which is primarily driven by natural insect disturbance. However, the island's very high moose density results in the regeneration failure of the balsam fir forests. Due to moose over-browsing, forests remain open following natural disturbance, becoming "moose meadows", rather than the normal closed canopy forests. Multi-aged balsam fir forests provide critical habitat for many rare native species making forest restoration a priority. Forest restoration by seedling planting, combined with the recent implementation of a moose hunt in TNNP, is seen as a first step to reverse native forest loss. To develop sustainable restoration protocols, we planted 10,000 seedlings at different densities, under various ground treatments and in a range of disturbance types across the park. Preliminary results show that ground manipulations removing grasses did not improve seedling survival, suggesting that grasses act as 'nurse' plants, facilitating survival in the first summer of growth. Seedling growth and browsing damage were monitored, but differential responses are not expected until the second year of the experiment. The study's outcomes will lead to the development of scientifically based restoration protocols for balsam fir forests degraded by overabundant herbivores.

O 17

About Hamsters, Brown bears, limestone pavement and oak forests: how is the European Court of Justice interpreting the restoration obligations in the Habitats Directive?

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Restoration has been put more firmly on the political agenda of the EU, with the target of 15% restoration of degraded ecosystems (Target 2 of the Biodiversity Strategy). The Biodiversity Strategy also includes the target to significantly improve the conservation status of habitats and species covered by EU legislation (Target 1). A European Parliament Resolution of 2012 calls for a considerably higher restoration target.

This presentation will look into the legal mechanisms provided in the Birds and Habitats Directives, to reach these policy goals. It is based on an analysis of legal sources (including the nature Directives, Commission guidelines and legal rulings by the European Court of Justice) as well as a desktop study of legal literature. The Directives contain some explicit obligations with regards to restoration. Also, some Commission guidelines shed some more light on these obligations. However, the ultimate interpretation of the Directives lies with the European Court of Justice. Recently, some cases have been concluded which holds some interesting rulings relevant for restoration.

With regards to the obligation to avoid deterioration and disturbance of the habitats and species (article 6, § 2 of the Habitats Directive) we will discuss the opinion of the Advocate General in a preliminary ruling of an Italian case (Cascina Tre Pini) and the Court ruling itself, which deals with the possibility for declassifying a Natura 2000 site, under the condition that the (restoration) obligations under article 6, § 2 have been fulfilled. We will also look at the Court case against Spain with regards to the deterioration of a site designated for the Cantabrian brown bear, which is particularly interesting for connectivity between two habitats. The preliminary ruling in the Irish Sweetman case deals with the partial destruction of a protected site. Finally, the Hamster case against France deals with restoration obligations of a habitat outside Nature 2000.

O 18

Gravel pit rehabilitation and recovery of ecosystems services in the Upper Rhin floodplain: an experimental study case

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Cybill Staentzel, Antoine Perrier, Corinne Grac, A Rozan

Sand and gravel extraction is common in many European alluvial floodplains and usually leads to strong changes in hydrosystems functioning, a loss of biodiversity and ecosystem benefits. The Woerr is a protected area surrounding a former gravel pit in North East of Alsace (France), where the Lauter river meets the Rhine river.

Some rehabilitation works started in winter 2012 in order to (1) re-create several ponds enhancing biological connectivity for aquatic species throughout the Woerr site (2) smooth off the former gravel pits'banks, enhance native macrophytes colonization, create sustainable habitats for a protected species reintroduction (*Emys orbicularis*) and limit the extension of *Elodea nuttallii*, an invasive species. These works create the opportunity to study mechanisms of the aquatic plant colonisation (roles of plants dispersal and seed banks) during such restoration works. This was also the opportunity to test the use of macrophytes transfer as a way to enable a quick colonisation by a reference community and limit the *E. nuttallii* invasion, through potential biotic interactions (allelopathy, competition).

We here present the results of transplanting, bank transfer and temporary disconnection experiments together with an attempt to estimate the recovery of ecosystem services in the Woerr site according to the adapted HEP method.

O 19

Limitations and constraints for water quality and biodiversity improvements with the project Life CREAMAGUA (Life09ENV/ES/000431)

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The EU Life project CREAMAGUA is carried out (2011–2014) to show the adequacy of restored and constructed wetlands for improving the quality of water discharged from irrigated agricultural areas to river Flumen (Huesca, NE Spain) and the biodiversity of these ecosystems. The project is a joint venture of local governments, water authorities, private companies and scientific researchers. While scientific criteria were clearly established, results related to these aspects are critical because of planning and budget limitations. However, the objectives of the project, both in area of restored wetlands and technical work developed, are successful because of the relatively high retention of nitrates, particularly during periods of irrigation, in relation with relatively high nitrate discharges from agricultural, observed in some restored wetlands and the recovery of plant structure in some restored riparian zones. Better results for protecting water quality and biodiversity could have been obtained after more balanced budget among planning, restoration works and monitoring works. From the experience of this project, it is observed that more efficient results could be obtained with long-term projects and a more flexible management of the Life Program. In any case, improvement of wetland ecological structures and processes are clearly taking place as results of CREAMAGUA project.

O 20

A framework for overviewing benefits and efforts of EU Life projects from the actors' perspectives

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Anne Tolvanen

Official (governmental) restoration programs are organized in different countries. The EU Life program is European Government's funding instrument for the environment. The general objective of LIFE is to contribute to the implementation, updating and development of EU environmental policy and legislation by co-financing pilot or demonstration projects with European added value. Projects submitted by any public or private organization established in Europe are selected annually since 1992. Among the 4,000 projects funded the major interest was dedicated to nature conservation during the first decade. The recent prioritization has been on projects dealing with climate, soil and the urban environment. Hence the focus is changing towards applied environmental and climate issues. The newest, forthcoming phase is large-scale integrated projects, which aim at the implementation of plans, programs or strategies required by EU environmental and climate legislation.

The EU Life program has had a huge positive impact for the improvement of the ecological status of species and ecosystems all around Europe. However, the lack of precision in the definition of priority actions and subjects of interest, and lack of continuity and the assumption of responsibility by local and national authorities has decreased the benefits of the Life Program in Europe.

O 21

Site productivity and community assembly in initial restored grasslands

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Johannes Kollmann

Community ecologists consider the local environment as a filter of the regional species pool where species are selected based on functional traits required to establish, grow and reproduce under specific site conditions. Species within a community should thus exhibit a restricted range of trait values around an optimum, reflecting environmental filtering. The range of possible trait values may be driven by niche dimensionality, i.e. the number of limiting resources. Thus, a reduced niche dimensionality at productive sites where only one resource is limiting should lead to a smaller range of trait values most beneficial to acquire this resource. We tested these predictions in a field experiment with manipulated productivity in 54 plots. Each plot received a unique seed mixture of 25 grassland species that were randomly drawn from an experimental species pool. To infer how productivity mediates community assembly processes we calculated community-weighted mean (CWM) trait values and ranges for three functional traits (seed mass, specific leaf area, height), and functional beta-diversity within treatment levels. In the fourth month of the experiment, there were directional trends towards

changes in CWMs in all three traits and beta-diversity decreased with increasing site productivity. This indicates that productivity-mediated assembly processes operate at the earliest stages of community assembly, with a strong role of reduced niche dimensionality at productive sites. For restoration practice, this demonstrates that adequate preparation of site conditions is a crucial step during restoration. Otherwise, restoration goals may not be achieved as some species are partly filtered out in the establishment phase, and their re-introduction could be more problematic once priority effects act.

O 22

Bord na Móna Biodiversity Action Plan 2010–2015 measuring success

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Bord na Móna (the Irish Peat Company) launched its first Biodiversity Action Plan in 2010 which sets out specific targets for completion in the period 2010–2015. Since its publication, a number of the targets set out have been met and an overview is presented. The key elements of the plan centre around three aspects – biodiversity and carbon, rehabilitation planning and communications.

In terms of biodiversity the core work involved habitat mapping of the 80,000ha of Bord na Móna bog areas. This work has been completed and all of the data recorded in a GIS database. The mapping work illustrates the current extent of habitats that have already developed on cutaway bog areas as well as a number of biodiversity hotspots. These hotspots are largely in marginal areas but also in bogs never fully developed for peat production. A further step was developing a 'future' habitats map whereby it was possible to predict how cutaway areas would develop under a particular drainage regime post-production.

Once the baseline habitat mapping was carried out, a number of rehabilitation 'challenges' or targets were also identified, such as, how to increase colonisation of areas slow to revegetate. Other measures to enhance bird use and encourage spread of target species were also trialled and results are presented. Research has also been initiated on both cutaway bogs and restored raised bog areas to determine the potential for carbon offsetting through rewetting drained peatland areas.

Throughout the work a framework for communication with internal Bord na Móna managers and with outside consultees was developed. This has been central to achieving the targets set out in the Biodiversity Action Plan, and will inform the review of the plan which will be updated for the next planning phase – 2015–2020 - in 2014.

O 23

Reciprocal knowledge transfer for effective dryland restoration

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Mchich Derak, Ramon Vallejo, Alberto Vilagrosa

Dryland degradation is one of the most threatening environmental problems worldwide. Ecological restoration can be a suitable alternative to combat desertification. Scientific advances in this area have been substantial, but communicating these advances has proven difficult. Here we discuss various tools to facilitate these processes and we evaluate its effectiveness. In recent years, we have used different approaches to enhance communication and knowledge transfer to managers and other stakeholders. Among these, scientific publications, demonstration projects, graduate programs, specialized workshops and participation in networks. We have evaluated these tools based on the number of people and interest groups involved, and the body of knowledge transferred. The tools used differed in several aspects, particularly in the interest groups that were reached. Their effectiveness may be substantially enhanced by combining different tools. For example, demonstration projects represent an ideal tool to optimize information transfer if combined with postgraduate courses and workshops. Tools also differed in their geographic scope. Thus, depending on the tool, stakeholders were locals (local networks, graduate programs) or lived in distant areas (scientific publications). Our analysis shows that stakeholder participation in the design and implementation of these initiatives increases their efficacy. In conclusion, the analysis of transfer and communication actions shows the need to develop an integrated strategy that will foster communication and allow reciprocal learning.

O 24

Dynamics of shrub patches and restoration of degraded Stipa tenacissima steppes

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Victor Rolo, Beatriz Amat

The increase in shrub cover and density is a widespread phenomenon in drylands worldwide. Its causes and consequences are complex and strongly idiosyncratic, owing to differences in environmental factors and species composition. Detailed knowledge on the rate of shrub colonization, and its abiotic and biotic drivers is crucial to fully understand and restore these areas. Shrub patches are commonly dominated by keystone species with large impact on community composition and ecosystem functioning. As such, their establishment has been the target of restoration projects over the last 20 years. We used a chrono-sequence of aerial photographs (1956, 1978, 1985, 1998 and 2009) and field studies to relate the dynamics of large shrub patches, and abiotic and biotic properties of semiarid steppes in SE Iberian Peninsula. We found that shrub patch density increased over the second half of the 20th century, and this increase was dependent on patch composition, plant cover and abiotic factors as precipitation, average air temperature and aspect. Thus, patches dominated by Ephedra fragilis were denser, and took longer to establish than patches dominated by Quercus coccifera. Patch establishment was earlier and patch density higher in areas with lower average precipi-

tation. Our results suggest that recovery of degraded steppes may occur spontaneously at varying rates, and environmental factors and species composition must be considered when prioritizing restoration actions.

O 25

How residents perceive and value an urban river planned to be restored? Results of an eye-tracking experiment about the Yzeron River (France)

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Marie Augendre, Dad Roux-Michollet

Ecological restoration projects often rely on approaches aiming to assign values to environments. Experts traditionally use sets of ecological indicators built from scientific knowledge. However this kind of environmental assessment is nowadays recognized to be too reductive and needs to be completed by other types of indicators translating how lay-people value ecosystems. This issue is all the more important in urban areas, where natural environments are known to contribute to human well-being and thus should meet social expectations. What are, according to lay-people, the environmental characteristics which make an environment valuable? To address this issue, and since environments are mainly experienced through the senses, the implementation of a sensorial assessment of environments might be informative. This paper presents an eye–tracking experiment that enabled to collect environmental perceptions and valuations.

This experiment has been carried out last year along the Yzeron River, a tributary of the Rhone River located in an urban area, near Lyon (France). Current 2014, an ecological restoration project will be conducted. 27 residents living near the river were asked to walk along the waterway, wearing eye-tracking glasses. They had to assess, at several predetermined stops, the quality of the scene, by answering to a questionnaire.

The eye-tracking and the questionnaire data have been both qualitatively and quantitatively analyzed. The results enabled to identify few environmental attributes focalizing the visual attention when assessing the value of landscape and to determine in what extent these attributes are influencing the environmental perceived value.

O 26

Optimal location of seed production of populations of Alpine and Arctic grass species for ecological restoration purposes in Norway

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Trygve S. Aamlid

Several problems like susceptibility to diseases, slow establishment, uneven ripening and seed shattering, are associated with seed production of undomesticated species. The objective of

this study was to investigate whether the seed production of Arctic and Alpine populations should be in their area of adaptation or if it has to be moved to lowland areas that are presently producing seed of forage grasses.

During the summer of 2011 seed production trials of three selected species important for restoration were established at three locations representing the southern lowland (present seed production area), the mountains range and the northernmost part of Norway. The populations had been collected in different Arctic and Alpine areas from 2005 to 2008 and propagated for one generation. At each location six populations and one cultivar of Festuca ovina, seven populations of Phleum alpinum and four populations of Poa alpina were sown in a randomized design with three or four replications. The trials were seed harvested for two years. Winter survival, plant height, diseases, time of ear emergence, number of generative shoots, weight of panicles, thousand seed weight and germination were registered.

Preliminary results shows variation explained mainly by location, but also by population and fungicide. The southern location had the best wintersurvival and the highest seed yields for all species. This location also had effect on seed yield from using fungicides in the Phleum alpinum trial. There were major occurrence of diseases at the mountainous location in one year, highlighting the annually variation for several observations and the importance of recurrent testing.

O 27

Using ISCO with perozone for the remediation of a cocktail of organic contaminants at an EX-rated industrial site in operation

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At an operational terminal a soil and groundwater contamination with chlorinated solvents, BTEX and volatile hydrocarbons is present. Given the different characteristics of the contaminants, remediation using traditional in-situ techniques would result in a time consuming and expensive process.

This project focuses on in-situ chemical oxidation (ISCO) as a cost and energy efficient and environmental advantageous remediation technology for in-situ remediation of complex contaminations in industrial and high risk areas.

Perozone, a mixture of hydrogen peroxide and ozone, is capable of oxidizing all types of organic contaminants. Since the presence of strong oxidants may cause major issues with regard to health and safety (H&S) on explosion sensitive (EX-rated) sites, the development of an extensive H&S plan and monitoring of H&S parameters during the remediation are of prime importance.

The remediation concept comprises an excavation of the source area outside the tank farm and ISCO by perozone of the plume area and the source area inside the tank farm. Process and H&S parameters and groundwater concentrations of the main constituents are monitored frequently.

So far one plume area has been treated successfully, regarding both H&S and the effectiveness of the ISCO. The treatment of the area around the former excavation is on-going. Significant ozone and VOC emissions have been measured and tests have been carried out to optimize the injection regime in order to minimize H&S issues. The remediation will probably be finished in 2016.

The interim conclusion is that ISCO by perozone is a feasible remediation technology to treat a cocktail of organic contaminants in industrial and explosion sensitive areas. However a meticulous monitoring of process and H&S parameters is needed and injection regimes should be adjusted if pre-defined threshold values are exceeded.

O 28

Economic valuation to understand land use decisions: farming and forestry in Flanders

Lieven De Smet, Research Institute for Nature and Forest, BELGIUM

Wouter Van Reeth, Steven Broekx, Leo De Nocker, Peter Van Gossum, Kris Vandekerkhove, Suzanna Lettens

In the urbanized region of Flanders there is an increased land use competition for the remaining open space. When faced with the choice to allocate open space to farming or sustainable forestry, private landowners try to maximize the private benefits of marketed ecosystem services. The objective of our study is to investigate to what extent the inclusion of non-marketed ecosystem services would alter the choice of private landowners in favour of sustainable forestry.

We map the economic value of food production, timber production, climate regulation and recreation under a farming and forestry scenario, using spatial data like soil type, land cover, land use restrictions, demographic and other socio-economic data. The aggregated valuation maps indicate where and to what extent the four combined economic values of sustainable forrestry outweigh those of the current land use. Based on these four ecosystem services sustainable forestry tends to generate positive net social benefits in areas closer to densely populated centres and with a lower farm productivity.

Including social values of non-marketed ecosystem services in private land use decisions would have a significant impact on the landscape. The current institutional setting however promotes capturing the private benefits of marketed ecosystem services and does not provide the appropriate incentives to motivate such a land use change.

O 29

Fast and promising spontaneous recovery of alkali grasslands at the landscape-scale in restoration projects

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Pannonian alkali grasslands are among the best preserved grassland ecosystems in Europe. A major threatening factor for these habitats is fragmentation and altered water balance caused by drainage channel systems established in the 1960s. Several landscape-scale restoration projects aimed to eliminate channels by soil-filling to restore grasslands and improve landscape connectivity. We studied the vegetation of recently and old filled channels in East-Hungary. We surveyed micro-topographic profiles by a high-precision geodetic survey. We found that in old filled channels environmental heterogeneity had a positive effect on total species number and diversity but had a negative effect on the cover of the target grass species Festuca pseudovina. We found that the vegetation of filled channels became similar to the surrounding grasslands within seven years. Our results show that grassland recovery on soil-filled channels was fast since they were surrounded by target grasslands, which enabled the fast immigration of target species. As alkali grasslands typically have a species-poor vegetation with a high cover of F. pseudovina, precise soil levelling is essential in restoration projects, as even few centimetres unevenness in soil surface can hamper restoration success.

O 30

Peatland Conservation, Restoration and Palm Oil Development in Central Kalimantan, Indonesia

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Paul Dargusch

Indonesia holds over 45% of global tropical peatland areas and 60% of carbon stored in peat biomass. This peatland resource serves important socio-ecological functions and provides services that benefit stakeholders at local, regional and global scales. Despite holding these important features, peatland areas in Indonesia are facing long-term degradation threats, mostly as a consequence of land conversion practices, drainage and recurrent fires associated with land use activities. Conversion of tropical peatland for oil palm plantation development is often perceived as one of the major drivers of peatland deforestation and degradation in Indonesia. Indonesia shares around 52% and 49% of the global oil palm production and oil palm export respectively in 2013. Indonesia's oil palm production and export figures are expected to increase gradually for a number of years to come in response to growing global and domestic demand for bio energy and various food products that use palm oil. This will further amplify peatland deforestation and degradation rates which is likely to put more greater threats on the sustainability of peatland ecosystems and their associated biodiversity. The Indonesian government has strengthened and deployed its 'command and control' law and policy instruments to conserve and protect its existing peatland areas and promote restoration of degraded peatland ecosystems. However, little is known to what extent these regula-

tory measures are implemented consistently in-practice, notably with respect to oil plantation development. Therefore, this paper discusses these issues in the context of Central Kalimantan Indonesia.

O 31

Loss of wetlands since the 1950's and their restoration potential in the densely populated region of Flanders (Belgium): a GIS and ecosystem service exercise

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Jan Wouters, Sander Jacobs

Flanders is a flat and densely populated region in the northern part of Belgium. Together with the Netherlands it is known as 'the low countries' of Western Europe and, by nature, it therefore used to contain a large area of wetlands. We reconstructed the occurrence of different types of wetlands based on detailed soil maps from the 1950's and 60's. It is estimated that Flanders lost about 75% of its wetlands during the past half century. About 17% was lost by urbanisation, the rest by drainage for mainly agricultural purposes. Recognizing the significant losses for biodiversity and the need to deal with more extreme flood events due to climate change and soil sealing, there is renewed interest in wetland restoration and floodplain functioning. We calculated that Flanders still has the potential to restore about 200.000ha of wetlands, 75% of them being potential wet floodplain and polder grasslands. In the hypothetical scenario that all wetlands of different types could be restored, we explored the consequences for the delivery of different ecosystem services to society.

O 32

Riparian headwater streams passive ecological restoration: what a ten years vegetation succession tells us?

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Ivan Bernez, Isabelle Muller

Headwaters ecological restoration is a key issue to improve water quality and aquatic ecosystem functioning. In Normandy, France, headwaters are surrounded by traditional pasture and often highly impacted by livestock. Passive Ecological Restoration (PER) operation, using fences, settle passages and drinking troughs, were implemented all along degraded stream banks. To study the potential of spontaneous succession of plants communities to restore river banks, vegetation surveys, were implemented before and after restoration on 3 streams, passively restored respectively 3 years, 5 years and 10 years ago. Riparian vegetation clearly responds to PER. Stream banks are spontaneously recolonized by both herbaceous and ligneous in a short amount of time. For the three streams, comparable taxonomic succession occurs. Floristic composition of the three streams tends to converge after PER, leading to homogenization intra and inter streams. Ecology of recruited species evolves. Over the course of succession, they are more sciaphilous (linked to trees recruitment), less hygrophilous (con-

text of bank drying out), and more ruderals. Reasons of such changes will be discuss and compared with community of a stream historically not disturbed by intensive farming, considered as a reference brook. As desired by river managers, a woody riparian buffer is recreated, reducing considerably costs in time and money of an active restoration. Shading, stabilization and filtration functions of banks are recreated thanks to PER. However, at the riparian community level, PER is not much interesting. Banks vegetation evolution does not emphasis a gain in biodiversity, all the more so most of the species are ruderals. Also, to conclude on the efficiency of succession to restore stream systems, our study should be completed by implementation of a multi indicators approach, including aquatic and terrestrial, organisms. This would help to understand consequences on the whole ecosystem and to complete evaluation of PER.

O 33

On the development of soil protection and monitoring strategies at agricultural waste disposal areas

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Among the management options of agricultural wastes, landspreading seems to offer many advantages to the agricultural sector since it recycles nutrients and organic matter to the land, which would otherwise be lost in disposal to landfill or thermal destruction. Before land distribution is decided, a series of actions should precede. An effective waste management scenario should take into account the specific local conditions and has also to safeguard and prevent soil and land degradation from single field to the whole catchment. The monitoring of the disposal areas should include the following six measures:

1. Identification of potential and current waste disposal areas-recording in a GIS geo-database
2. Characterization of disposal areas-Risk assessment
3. Evaluation of risk level
4. Definition of the landspreading conditions
5. Adoption of soil quality indicators
6. Periodical monitoring of soil indicators-Evaluation of the results

The adoption of integrated measures ensures the control of the disposal areas, but mainly the future protection and improvement of soil quality.

Two LIFE projects, namely AgroStrat and PROSODOL focus on the development and application of such strategies at pistachio cultivation areas and at olive mill waste disposal areas, respectively.

O 34

Native plant materials: What nurseries can provide following the Target Plant Concept

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Jeremiah Pinto

Every restoration project is different but the goal is the same: reestablish native plants on the project area. Because each project area is unique and often severely disturbed, the native plant materials defined through the Target Plant Concept, can be diverse, reflecting a wide range of variables dependent on plant form (morphology), propagule form, and propagation system. North American nurseries are providing myriad types of plant materials for restoration including wetland plants, mosses, grasses, ferns, forbs, shrubs, and trees. Seeds are still the major type of propagule, but cuttings (stem and roots), bulbs, rhizomes, grafting, and micropropagation can also be used depending on species and project objectives. Propagation must address sexual diversity, especially for dioecious plants, and genetic diversity associated with the origin of the propagules, whether they be wild-collected, harvested from increase plots at the nursery, or obtained through complex breeding programs. Finally, the propagation system provides additional opportunities to produce a wide variety of stocktypes, such as bareroot or container stock, seeds harvested from increase plots, and plants grown on erosion-control devices or even submerged in pools of water. Using the Target Plant Concept, nurseries can produce most any type of plant material for any type of ecological restoration. This presentation will combined operational examples with current research to explore the possible range of plant materials available for ecological restoration.

O 35

Sources and stabilisation of soil aggregate carbon in urban grassland restorations

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Jenifer Yost, Kathryn Schreiner, Corey Palmer

Aim: As urban development continues to replace or transform native grasslands, restoration and management have become increasingly critical for promoting soil organic matter accrual. This study explores whether urban soils, including abandoned old fields, can be restored to C-accruing grasslands.

Methods: Soil cores were taken from 15 different prairies that represented five categories of restoration and management in Chicago, Illinois, U.S (population ~ 9 million). The soils were wet-sieved into micro- (53–250 μm) and macroaggregate (≥250 μm) size classes, and then analyzed for C content (by combustion), source (stable isotopes), and stabilisation (TMAH thermochemolysis GC-MS).

Results: Soil aggregate C content increased significantly between early- (< 5 years) and later-stage (>10 years) and model restorations (those resembling pristine prairies), and aggregate C levels in model restorations approached those in prairie remnants. Stable isotope

δ13C signatures indicated that C3 forbs were increasing contributors to macroaggregate C content with increasing tome of management. In contrast, microaggregate δ13C signatures showed increasing inputs from C4 plants over time. Lignin phenol analysis (thermochemolysis GC-MS) demonstrated variations in both lignin content and degradation state between macro- and microaggregates, and also among different management categories.

Conclusions: Carbon accrual occurs with urban grassland restoration; markers of restoration success and perception of a high quality restoration are reflected in C accrual; and management type rather than simply the duration of management are important in promoting C accrual.

O 36

Sheep grazing as a restoration tool of open sand vegetation: the combination of seed dispersal and trampling is important

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Christian Storm, Angelika Schwabe

Low-intensity grazing with domestic herbivores is an effective conservation and restoration tool for a broad range of ecosystem types. Especially sheep grazing is a much valued tool for the following reasons: sheep are kept in large flocks and are generating a high impact on the grazed ecosystem, they are able to walk long distances and can be used to graze isolated habitats in a series and they have properties promoting seed dispersal, i.e. a dense and greasy fur.

We carried out several studies in open, threatened sand habitats in the Upper Rhine Valley, Germany. In a first step, we aimed at quantifying the potential of sheep as seed vectors in these systems and found high numbers of vascular plant species (in total: 93 taxa) and seeds in fur and faeces (a flock of 800 animals is able to disperse seeds in a range of some millions per day). In a second step, we aimed at quantifying and better understanding zoochorous colonization. We found that sheep trampling has the potential to enhance post-dispersal establishment success by incorporating seeds into the soil or cracking dung pellets. We conclude that sheep assist plant species in reaching new sites and in successfully colonizing these sites.

O 37

Binding phosphate to improve the ecological status of a hypertrophic lake

Tim Epe, Limnology, Institut Dr. Nowak, GERMANY

The ecological structures and functions of lakes are threatened by intensive land use and nutrient enrichment that have occurred over decades. As a result, many ecosystem services typical for lakes are severely impacted, e.g. recreational and cultural values, fish supply or the availability of clean water for irrigation and drinking.

To lower the trophic level and to restore ecosystem functioning, we treated the hypolimnion of a lake in northern Germany (0.63 km²; mean depth of 6.2 m) with lanthanum modified clay and monitored the lake for a period of 5 years in close collaboration with the public authorities. The phosphate precipitation took place following the implementation of measures aimed at reducing external nutrient imports.

Prior to the application, the lake was in a hypertrophic state, characterised by intense 'internal loading' from sediment P release, regular cyanobacterial blooms and an impoverished species composition.

Following the restoration measures, ortho-phosphate was completely eliminated from the water column and total phosphorus was reduced by an average of 75%. Since then, stable mesotrophic conditions have developed, a shift in the algal community has taken place and both the diversity and maximum colonisation depth of macrophytes have increased.

The long-term results show that limiting the phosphorus balance of the lake by precipitation and interruption of P-cycling between sediments and the overlying water column was a feasible way of inducing more stable conditions, enhancing ecosystem services and accelerating recovery.

O 38

Coastal lagoon recovery by SEagrass RESTOration. A new strategic approach to meet HD & WFD objectives

Chiara Facca, DAIS, Ca' Foscari University of Venice, ITALY

Andrea Bonometto, Rossella Boscolo, Alessandro Buosi, Massimo Parravicini, Consuelo Pedrali, Andrea Siega, Valerio Volpe, Adriano Sfriso

Seagrass meadows play a crucial role for the preservation of coastal environments, as they support biotic communities, improve water quality and reduce erosion effects. SeResto (LIFE12 NAT/IT/000331) has been recently funded to achieve the following objectives in Venice Lagoon (Adriatic Sea, Italy):

- Restoring and consolidating Habitats 1150* by transplantation of aquatic seagrasses;
- Contributing to achieve a good ecological status and demonstrating the effectiveness of the proposed actions to meet the objectives of the WFD (2000/60/EC);
- Quantifying and highlighting the value of ecosystem services provided by the lagoon environment and the angiosperm meadows.

The basic idea is to restore the Nanozostera noltii and/or Zostera marina meadows on a large scale by triggering and supporting the natural re-colonization processes, in areas where the environmental conditions returned to be suitable for the rooting of these species. The methodological protocol does not require heavy restoration interventions but widespread transplantations of small sods of seagrasses and manual dispersion of rhizomes and seeds. Results will be evaluated by an intensive monitoring activity of several environmental parameters and biological elements (sensu WFD). Concrete restoration actions will be mainly made by local fishers (associated with a partner) daily living the lagoon for recreational activities, that will be specifically trained in the framework of the project and supported by the staff of scientific partners.

O 39

Vegetation succession of a rehabilitated industrial cutaway Atlantic blanket bog: in the west of Ireland

David Fallon, Bord na Móna, IRELAND

David Fallon, Mark McCorry, Catherine Farrell Bord na Móna, and James Moran, Sligo Institute of Technology

Industrial peat production by Bord na Móna (Irish Peat Company) is extensive across the Irish Midlands with one former industrial production site in the west of Ireland at Bellacorick, County Mayo. Milled peat production at the Bellacorick site was carried out between 1961 and 2003 from an area of 6,500 ha of former Atlantic blanket bog complex. Peat was supplied to an adjoining peat burning power station and production ceased in 2003. A site specific rehabilitation plan was designed and implemented on the site between 2003 and 2005. The main aims of the rehabilitation were stabilisation of the former peat production areas and restoration of peat-forming conditions where possible. The key rehabilitation measures included drain blocking and berm creation.

A baseline ecology survey of the site was completed in 2001 and the site was re-surveyed in 2011. The main changes in vegetation cover and composition between 2001 and 2011 were recorded. The study found that areas successfully rewetted were relatively quick to revegetate with typical peatland species. Dry slopes and gravel ridges have been slower to re-vegetate. Overall, vegetation cover increased across the site from approx 50% to 90%.

Seven vegetation communities were recorded from the former production areas. Six of the communities were assigned as rudimentary forms of poor fen with one assigned to dry heath. The six poor fen communities represent various stages of vegetation development ranging from pioneer Juncus effuses-dominated stands to Sphagnum-rich/abundant areas. In general Juncus effusus was the first plant to colonise the bare peat and in doing so created shelter and allowed for other plant species to establish. Over time these areas become more diverse, culminating in Sphagnum-rich/abundant poor fen in areas where that are permanently rewetted. The establishment and spread of poor fen habitats with a high cover of Sphagnum species indicates that there is potential for increasing sections of the site to revert to peat-forming systems.

O 40

Traditional Maya Forest Gardens as Agricultural Restoration Ecology

Anabel Ford, MesoAmerican Reseach Center, Exploring Solutions Past, USA

The Mesoamerica and the Maya forest is among the most biodiverse areas of the tropical world, today this region is a conservation hotspot with the expansion of ecologically unsustainable practices of pasture and plow. Yet this is an area that supported one of the world's most remarkable civilizations supported by farming that developed in the context of the forest. Today, the forest is dominated by plants that are useful to humans obviously a product of millennia of management. Yet the local traditional agricultural systems have been ignored in

the conservation efforts. I will show how the traditional Maya milpa-forest garden system can support high densities of populations and maintain land cover at the same time. These strategies need to be brought into the future development designs for the region and apply to the tropics world wide.

O 41

Comparison of forest reclamation with unassisted regrowth on post mining sites

Jan Frouz, Institute for environmental studies, Charles University, CZECH REPUBLIC
Olga Dousova, Petr Dvorscik, Jiri Cejpek, Ludek Bujalsky, Martin Bartuska

The aim of this contribution was to compare development of forest coves, plant biomass, soil formation, accumulation of major makroelement, water budget and temperature balance in reclaimed and unreclaimed post mining sites. Reclaimed sites were planted by alder (Alnus glutinosa) while unreclaimed soil was overgrown by willow (Salix caprea), aspen (Populus tremula) and birch (Betula pendula).

Historical air photograph was used to evaluate development of forest cover. After 20 years, forest canopy cover 20–80% or unreclaimed sites and 10–98% of reclaimed sites, in reclaimed sites canopy cover increased a significantly faster in first 15 years but when older sites are compared difference is not significant. Comparison of overall plant biomass as well as C accumulated in biomass or soil did not show significant differences between reclaimed and unreclaimed sites. Unreclaimed vegetation accumulates more P and reclaimed more N.

Reclaimed sites had higher water holding capacity but also higher wilting point. Comparison of daily temperature fluctuation in reclaimed and unreclaimes site show large buffering of temperature in reclaimed sites compare to unreclaimed ones with similar canopy cover. This indicates large evapotranspiration of reclaimed sites.

In conclusion in given post mining site the difference between reclaimed and unreclaimed sites was surprisingly small. This apply only on sites where wave like surface was produced after heaping and sites was kept intact, not even leveled after heaping. In leveled sites the development of woody vegetation was substantially reduced.

O 42

Recovery of soil and soil biota in post mining sites along climatic gradient across USA

Jan Frouz, Institute for environmental studies, Charles University, CZECH REPUBLIC
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Soil and soil biota were studied at post-mining chronosequences along a climatic gradiant in the USA (TN, IN, IL, WY). Each chronosequence contained young and post-mining and a climax vegetation (hardwood forest TN, IN, tallgrass prairie IL, shortgrass prairie WY). Microbial biomass, microbial respiration, ergosterol, composition of microbial community (using PLFA), community composition of soil nematodes and macrofauna, soil chemistry, and soil microstructure were studied. Carbon and nitrogen content increased with successional age, decreased. Microbial biomass in forest chronosequences increased with age, actinobacteria were associated with prairie sites, fungi were associated with forest sites. Both nematodes and macrofauna were dominated by root feeders in WY sites. Earthworms were absent in WY sites but were present in the wetter, eastern sites. In forest chronosequences, saprophages were abundant. Absence of saprophagous groups, and especially, resulted in the absence of bioturbation in WY sites while biogenic structure formed an important part of the soil in other chronosequences. Restoration sites were much closer to the climax in WY than in the other sites, suggesting a more rapid development of the soil community in WY. The WY soil community contained root-feeding organisms, which may establish quicker than the more saprophagous soil biota at the other sites. Smaller study in TN and WY compared soil biota development in sites restored under SMCRA regulation with pre SMCRA sites. These show that while in forest sites in TN SMCRA application rather slow approach towards climax in shortgrass prairie in WY SMCRA speed up soil recovery.

O 43

Impacts of a recent restoration measure on the decomposition of leaf litter in a lowland river

Friederike Gabel, Institute of Landscape Ecology, University of Muenster, GERMANY
Carla Ortmann

Great efforts have been undertaken to restore rivers all over Europe to increase biodiversity and prevent further degradation of aquatic ecosystems and adjacent wetlands. However, the success of the restoration measures has been evaluated less frequently and effects of restoration on the ecosystem functions have been mostly neglected. We studied the effects of a recent restoration project on the decomposition of leaf litter, a key ecosystem function, in a sandy lowland river. Therefore, we exposed fine and coarse meshed litter bags filled with alder leaves over a period of six weeks and measured organic weight loss and colonization by macroinvertebrates. We compared recently restored sites, where the shoreline reinforcement has recently been removed and coarse woody debris has been inserted, with still developed, not restored, river reaches. Results showed that decomposition of leaf litter and colonization by macroinvertebrates was significantly lower at the restored sites than at the developed sites. The abundance of shredders was about four times lower in the bags at the restored sites than

at the developed sites. Hence, the building activity and the removal of the shoreline reinforcement decreased leaf litter decomposition on the short term. Further studies have to investigate for how long this trend persists and when (and if) relevant ecosystem functions are re-established or even improved after river restoration.

O 44

Evaluation of biogeochemical soil parameters as requirement for restoration of peatlands on the Maputaland Coastal Plain, South Africa

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Franziska Faul, Niko Roßkopf, Jutta Zeitz

The restoration of peatlands is strongly influenced by the properties of their soils. Therefore, the success of rewetting measures depends on the knowledge of biogeochemical parameters. Peatlands on the Maputaland Coastal Plain face a lot of pressure from human activities and show severe signs of degradation. Information on soil properties of degraded sites however is scarce. For choosing appropriate restoration means, it is crucial to determine these yet unknown properties and the severity of degradation, which leads to impairment of the natural biogeochemical processes. So far 6 sites in different hydrogeomorphic landscape settings were investigated. Each site was examined along 1–3 transects. In total 128 soil-profiles were cored. In doing so, a first characterisation of the substrates, the degree of decomposition, the structure and the soil reaction were made. Further, typical soil profiles of each site were sampled measuring in the laboratory additional physical and chemical properties, such as bulk density, hydraulic conductivity, water retention characteristics, hydrophobicity and C, N contents. The bulk density for instance and the degree of decomposition provide an insight into the state of degradation. Hydraulic conductivity, water retention characteristics and hydrophobicity yield important insights in the soil water movement and allow evaluations on the susceptibility of rewetting measures. Intermediate results shall be displayed in this presentation. By the end of the project in 2015 the results should provide a pedological basis for restoration principles and wise use concepts for peatlands in Maputaland.

O 45

The French restoration network REVER (Reseau d'Echanges et de Valorisation en Ecologie de la Restauration)

Sébastien Gallet, Université de Bretagne Occidentale, FRANCE

Renaud Jaunatre, Marie-Pierre Vecrin, Elise Buisson

REVER, the French-speaking network on ecological restoration, was created in 2008 with the help of CNRS/IRSTEA funding aimed at developing networks in the field of ecological engineering. The purpose of REVER is to organize and promote the relationships and exchanges between managers, practitioners, students and scientists in the fields of restoration ecology

and/or ecological restoration. To do so, the network created a website in 2009 (reseau-rever) allowing the various stakeholders (about 200 people registered) to share information and to contribute to databases. Indeed, facilitating access to technical and scientific information should help improve the quality of ecological restoration projects. Every year or so, the network also co-organizes a 2-day conference open to all stakeholders concerned by ecological restoration, which generally gathers between 100 to 200 participants. Talks are mainly given jointly by a minimum of two speakers with a different background to highlight the issues, but also the advantages of scientist-practitioner collaborations in restoration projects and to keep information more easily translated into on-the-ground activities. In 2011, REVER became an official NGO base in France. Thanks to this official status, REVER actively participates in institutional working groups and meetings concerning. REVER also builds relationships with other networks involved in ecological engineering.

O 46

From microdata to landscape analysis: transition matrix as a tool to quantify long term vegetation dynamic in ecological restoration projects

Sébastien Gallet, EA 2219, University of Brest, FRANCE
Jérôme Sawtschuk, Frédéric Bioret

The analysis of vegetation restoration process necessitates the acquisition of appropriate, precise and repeated dataset. In many cases such data can be obtain only in the framework of specifically designed scientific experimentations. Indeed, most restoration programs are not followed by standardized ecological surveys. When they exist, they are carried out at various scales and consist mainly in visual survey such as photographs, or in in a variety of ecological surveys. When such surveys are repeated in time, transition matrix approach can contribute to the scientific valuation of these dataset and to the knowledge of ecological process in quantifying vegetation dynamic. Transitions were therefore studied at various scales in different ecosystems of western France using available diachronic vegetation surveys : pinpoint microdata, vegetation maps or aerial photographs. Microdata analysis illustrates how this approach allows having a view of recolonisation process at a very precise scale. Vegetation map analysis made on different types of vegetation (heathlands, estuary, riparian woodland) displays the influence of different anthropic interactions (tourism, restoration, agriculture and global change).

Based on these examples we show how the transition matrix approach can contribute to highlight restoration and dynamic process at different scales and how it can integrate the influence of anthropic practices. We will also discuss the interest and the limits of such statistical modelisation as support for discussion between scientist and site managers and as decision-making support.

O 47

Year-round grazing as approach for the restoration and management of sand grasslands

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Vera Vogt, Denise Rupprecht, Norbert Hoelzel

For the restoration and maintenance of open habitats the choice of an adequate management is crucial. Since the 1990s year-round grazing is proved as a tool for the management of different habitat types in Europe. However, knowledge about its suitability for the management of different vegetation types is still insufficient. We therefore studied its impact on vegetation, plant functional diversity and Orthoptera on five pastures. On one restored sand grassland site we comprehensively analysed the vegetation development after topsoil removal and grazing establishment. We also investigated the potential of endozoochory for the dispersal of sand grassland species.

Generally, vegetation of year-round grazed sites was characterized by a higher species diversity, a higher proportion of rosette and insect pollinated plants and a prolonged flowering period compared to that of fallows or seasonally grazed sites. Orthoptera species number and densities were also higher on year-round grazed sites than on adjacent fallows. On the restored sand grassland site, the content of soil phosphorus was considerably reduced by topsoil removal, and a high number of endangered species developed. However, also Betula pendula established large-scale. Our results also showed that due to their feeding preferences horses can, in contrast to cattle, contribute to the dispersal of target species.

Summing up, this study revealed that year-round grazing is suitable for the restoration and management of diverse grasslands on nutrient-poor sites. However, additional measures can be necessary to prevent undesired shrub encroachment.

O 48

The role of developers for creating new methods for ecological restoration -viewed from the perspective of an ecological consultant

Åsa Granberg, Umeå office, Enetjärn Natur AB, SWEDEN

One of the actors on the scene of ecological restoration in Sweden are the ecology consultancies who advise, plan or implement restoration projects on behalf of developers. The reasons for restoration vary from being an integral part of the developers own CSR-work to being part of offset measures required by the authorities. Restoration goals vary as well. When the restored area is required to offset impacts on protected nature, the goal is often strictly no-net-loss of the affected values. However, when ecological restoration is performed on a voluntary basis or is part of the offsetting of more common, non-protected nature, the goals for restoration can be set more freely. This gives room for restoration and creation of habitats that provide more potential for biodiversity than the habitats lost. However, for each project the site

and terms are unique. In order to reach both stricter and more freely set goals, new methods often need to be developed or old ones adapted.

However, developers seldom have the time or interest to carry out long-term experiments and evaluations. Consultants become very dependent on the work done by the scientific community to be able to propose the most suitable restoration measures for each specific site and goal.

Enetjärn Natur AB is one of the largest ecology consultancies in Sweden, and has long experience with restoration projects, for different reasons and with different goals. By presenting three diverse projects, ranging from transplantation of Hamatocaulis vernicosus via restoration of old growth forest to re-vegetation of alpine heath, we give our perspective on the application of scientific results on practical ecological restoration and how developers, together with authorities requirements, act as a catalyst for new solutions and methods for ecological restoration.

O 49

Impact of restoration on chemistry and biology of agricultural ponds in the UK

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Carl Sayer, Helen Bennion, Jan Axmacher

The agricultural landscapes of east and north-west England are dotted with ponds at a density >10 ponds/km². Despite agri-environment schemes encouraging regular pond management through tree and sediment removal, the agricultural pondscapes are currently dominated by highly terrestrialised ponds. Detailed studies on the consequences of restoration for biogeochemical processes and in turn biodiversity conservation are lacking. To fill this research gap, we studied two ponds at advanced stages of succession before and after restoration with a focus on analysing short-term changes in water chemistry and ecology.

Pond restoration comprised the partial removal of surrounding terrestrial vegetation and of pond sediments in 2011. Monitoring of these ponds and a third pond as a control was conducted for two years pre- and post-management on a monthly and bi-monthly basis, with a focus on thermal and chemical properties of the water column, macrophytes, zooplankton, macroinvertebrates and amphibians. Pond restoration significantly altered pond water chemistry. Pronounced oxygen stratification was recorded prior to restoration, whereas post-restoration, oxygen reached high concentrations throughout the water column. Additionally, biodiversity was enhanced across multiple taxa, with changes most pronounced in the pond representing the most advanced terrestrialised stage.

We conclude that pond management plays an important role in increasing aquatic biodiversity within intensively farmed agricultural land and the knowledge gained can inform future conservation practices.

O 50

EU-LIFE project Sandy Grasslands

Pamela Hafner, LIFE, Naturschutzfonds Brandenburg, GERMANY
Holger Rößling

The LIFE Nature Project "Sandy Grasslands" is currently being implemented. Between July 2013 and June 2019 several conservation actions are being realized in the Nature Park "Dahme-Heideseen" southeast of Berlin.

Xeric sand calcareous grasslands (*6120) support a large number of threatened species. They occur on dry, open, calcareous, nutrient poor and well drained sandy soils. Traditional land use such as shepherding, forest clearance and litter utilization supported open habitat types. Increasing intensity of land use, reforestation and the decline of traditional sheep grazing caused grasslands, heathland and open forests to diminish. Sandy grasslands were reduced to small isolated areas.

Today Brandenburg is one of the European core areas regarding the geographical distribution of xeric sand calcareous grasslands. Nevertheless, they are also among the most endangered habitat types in Brandenburg.

This project aims to protect and restore areas where sandy grasslands occur or can be developed. The main objective is to deprive the soils of nutrients and opening fallow areas. Important actions are initial mowing and grazing, sod plugging and the sporadic as well as extensive removal of woods. In suitable locations typical and endangered plant species will be reintroduced. The project will work closely with local farmers and land users. Agricultural use of dry grasslands that complies with the goals of nature conservation will be supported. Farmers and shepherds will be provided with fencing systems and wells to set up pastures. Project actions are planned to be implemented in 20 NATURA 2000 areas. The overall area of those NATURA-2000 areas encompasses approx. 7,100 ha. Altogether project activities are planned to take place on an area of about 241 ha.

O 51

Introduced *Festuca rubra* vs. local *F. ovina* as facilitators for restoration in alpine vegetation

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Seeding from introduced grass species has been the traditional technique to encourage establishment of a vegetation cover following disturbance in alpine areas. There is disagreement about long-term effects on ecology and genetic diversity in seeded habitats, and due to new legislation in Norway this practice will be prohibited in the future, so alternative solutions should be explored.

Vegetation in seeded (commercial seed mixture) sites and unseeded reference was compared 21 years after seeding. In a greenhouse experiment germination and establishment of introduced Festuca rubra and native F. ovina was tested in different soil types. The effects of seeding the Festuca species on the native shrub Betula nana was also tested.

Introduced Festuca species outcompeted rather than facilitated natural vegetation recovery in the seeded sites, and both native vegetation cover and species richness were higher in the unseeded sites. In the greenhouse native F. ovina was a better facilitator for seedlings of B. nana than F. rubra, that clarely outcompeted the native shrub. Competition from the introduced grass species was strongest on humus- and nutrient-available soil types.

The management implications is that seeding to promote vegetation recovery should be restricted and not used as standard procedure in alpine sites. Fertilizer and other soil improvements may favor seeded competitors at the expense of native species, and the combination of seeding introduced species and soil improvment may further delay successful natural vegetation recovery.

O 52

How can the Nordic countries achieve the CBD Aichi target on restoration of 15% of degraded ecosystems within 2020?

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The Nordic countries have committed to the CBD-target (Aichi-target) 15 on restoration of 15% of degraded land within 2020. The Nordic Council of Ministers supported this project to produce specific inputs on how the countries can formulate strategies for management and political authorities to approach this target. A project working group was established in June 2013 with representatives from governmental organizations in all Nordic Countries and Estonia, and the project will be reported during summer 2014.

The on-going 'EU strategic framework for setting priorities for ecosystem restoration' and recent assessments of Nordic Restoration (ReNo) are important pillars in the project. This Nordic project gives the opportunity to explore how the EU framework can apply in Nordic ecosystems and what are the challenges.

The project has put attention to the concept of degraded land, the quality and types of restoration, and priority setting and the limiting factors to success. Case studies from different countries and habitats are used to elaborate these topics and also to discuss the question of scale, monitoring and evaluation. We aim at formulating statements about the need for restoration in different habitats, inputs on priorities, and to present ideas on how to overcome obstacles to restoration in the Nordic countries and Estonia.

O 53

The role of the Pannon Seed Bank LIFE + project in developing new methodologies for plant species reintroduction

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The Pannon Seed Bank EU funded LIFE + project aims to collect half of the wild flora of the Pannonian ecoregion (800 species between 2010 and 2014), and to test how the stored seeds can be used for reintroduction at degraded areas. More than 20 experts and institutions participate in the collection of the seed samples mainly in Hungary, and to a limited extent in the Pannonian region over the borders. In addition to the foundation of the seed bank, the project aims to show a potential application of samples for nature conservation purposes. Therefore ten species of the sand steppe community typical to the region have been selected for the test case at a Natura 2000 priority habitat (Pannonic sand steppes and inland dunes) of the Kiskunság National Park. The main challenge of using seed bank samples for conservation is the propagation of samples to reach sufficient amount for reintroduction. There is very limited knowledge on the cultivation methodologies for native species. Trials have been set up in 2011 at two locations to test the conditions of survival and propagation for the selected species. At one site no active management took place after strip ploughing and seeding, at the other site weeding and watering helped the survival of seedlings. Only five species survived by the second year at the site with no management. At the managed site all species germinated except for Onosma arenaria. Propagation of seeds to a sufficient amount for restoration requires special care when seeds are limited and later agricultural techniques to ensure a gradual increase of production. Breaking seed dormancy is another challenge for dicot species.

O 54

Resilience ecology: restoration and reparations

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Aim
Expanding the concept of ecological restoration in the context of Climate Change, this paper considers the potential for resilience, the effectiveness of restoration and investigates false, 'bodged' or inappropriate remediation. It aims to address the following questions: 1. What are the full economic, social, cultural, and psychological costs of cognitive dissonance, hypocrisy, and mendacity? 2. Could reparations give way to ecological resilience? 3. What rights determine the fate of a landscape, a people or a species, and how do we choose between their fate?

Methods
For many years restoration ecologists have addressed degraded ecosystems, and defined the roles of landscape remediation, however this continues to generate more questions than answers. From conservation and restoration to regeneration and renewal, to reinvention and now resilience. Interpretations and applications of resilience offer different approaches and methods for understanding ecological restoration.

Results
This approach provides useful perspectives in developing 'capable futures' rather than problem-based solutions, or outmoded notions of 'sustainable development'.

Conclusions
Resilience ecology may act as a necessary critique of the 'Ecosystem Services Approach' to include reparations as a fundamental right. And through reparations we may further understand the wider implications of social and environmental justice being undermined by deliberate, accidental, and consequential damage to ecosystems. We must consider what is just remediation and compensation for such destruction. Reparations question the whole ethical notion of offsetting as a solution to destruction, or 'ecocide', as some environmental activists calls it.

O 55

Long-term effects of seeded grass species in restoration projects

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In ecological restoration there are long traditions to seed with grasses to speed up development of a stabile vegetation cover. The long-term effect of this practice is however unclear. Does seeding facilitate, inhibit or delay the establishment and growth of native species? We examined the long-term impact of seeding commercial grasses on the development of native plant cover on eight spoil heaps, established between 1974 and 1984, in W Norway.

We estimated the cover of the seeded Agrostis capillaris, Festuca ovina, F. rubra, Schedonorus pratensis and Phleum pratense and native species in 0.25 m² plots in the early 1990s and in 2008 or 2011 at eight spoil heaps, and analysed how the proportional cover of the seeded grasses compared to native species developed through time. We applied a linear mixed-effect model to account for the nested data structure.

The cover of seeded grass species was below 20% except in the early 1990s at the three lowest lying spoil heaps where it was between 30–72%. Only three of the five seeded grass species (F. rubra, F. ovina and A. capillaris) made large contributions to the total cover of seeded species. The proportional cover of all seeded grasses was very high in the early 1990s but showed a considerable decrease with time, except for the highest lying spoil heap where it slightly increased. Nevertheless, the proportional cover of all seeded grass species is still high after 27–34 years and likely indicates that the seeded grasses inhibit the establishment of native species.

O 56

Can seedling functional traits be targeted to increase restoration success?

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Knut Anders Hovstad, Bischoff Armin

Adverse soil conditions often cause high seedling mortality in assisted restoration of disturbed soils. Such failures to establish a vegetation cover can lead to surface erosion and present opportunities for invasive species. Better control of this early phase of restoration may call for species adapted to harsh environmental conditions to stabilize and re-establish ecological processes. One approach is to target functional seedling traits; here we address traits that affect responses to drought during seedling establishment. Many trait combinations may be important like growth patterns, stress resistance, plasticity and acclimation abilities etc. Drought episodes are unpredictable so we also have to consider the need for species with fixed strategies for worst case situations or more plastic species with larger ability to acclimate to fluctuating conditions. Our main objective was to identify key traits for seedling survival and establishment under harsh conditions. We show results from a set of experiments of how germination and seedling traits affects the ability to establish under dry conditions, how plasticity of root growth and allocation affects water balance, survival and demography under drought. Our results show that the species differed in critical traits linked to survival and establishment under dry conditions. We conclude that the trait based approach is useful to understand the mechanisms of vegetation establishment during restoration and may improve restoration success under harsh conditions.

O 57

Species richness of riparian plants increases with time after restoration of northern Swedish streams

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A lack of positive ecological outcomes from stream restoration has been prevalent in recent literature, with many studies reporting insufficient time for recovery. To further understanding of the long-term outcomes of stream restoration on northern Swedish riparian vegetation, we used a space-for-time substitution consisting of 13 stream reaches restored 5 to 25 years ago along with 5 channelized reference reaches. We inventoried all vascular plant species in the riparian zone along 60-m study reaches and quantified cover and biomass in small plots. We found that while species richness increased with time, understory biomass decreased. Forbs made up the majority of the species added, whereas the biomass of graminoids decreased the most over time, suggesting that the reduced dominance of grasses favored less competitive forbs. Using multiple linear regression, we found that time along with riparian slope and width explained the most variability in species richness, but variability in forb and graminoid biomass was explained by time, buffer width, substrate, and latitude. Given our results, we suggest that restoration practitioners focus on making riparian slopes as gentle as is feasi-

ble and appropriate for the geomorphic setting. Because riparian buffer width is important for plant species richness and productivity, the land around the stream should be protected before stream restoration commences. Finally, timelines for achieving specific objectives should be extended to 25 years or more if recovery is defined as a leveling off of the accumulation of species over time.

O 58

Understory dynamics following restoration of boreal forests in Finland

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Oili Tarvainen, Marja-Leena Päätalo, Anne Tolvanen

Forest restoration is widely used in Finland to bring back essential components typical to natural forests, which have been reduced by efficient forest management. The structural variety of conifer stands is increased by adding dead wood by felling and by re-introducing fire-disturbance, which has been almost eliminated from Fennoscandian forests. We conducted a large scale study on four Natura 2000 protection areas in Finland including three forest restoration methods: tree felling with and without subsequent burning and storm simulation. We studied the effects of these methods on plant species composition and tree seedling establishment. The results of the seven-year study showed that tree felling with subsequent burning had considerable effects on vegetation and tree stand structure, enhancing especially deciduous tree seedling establishment. Felling only did not affect plant species composition or seedling establishment and the changes in tree stand structure were less substantial. The storm simulation created patches of exposed soil, initiated vegetation succession and especially pine seedling establishment on these patches and hence caused increasing heterogeneity on the forest stand. Since the vegetation responses reflect the overall forest ecosystem functioning after restoration, we conclude that the dominant restoration method, tree felling, could be increasingly replaced by more effective methods, i.e. burning and storm simulation, which have faster and greater positive impacts on the forest ecosystem.

O 59

Large-scale calcareous grassland restoration in Estonia: the science behind and the work ahead

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Annely Reinloo

Dry calcareous grassland communities on shallow soil (<20 cm) on Ordovician or Silurian limestone are called alvars. Alvars are semi-natural habitats. i.e. their characteristically high biodiversity depends on moderate human impact (mostly grazing). One third of alvar grasslands in Europe occur in Estonia, where cessation of traditional management has led to massive overgrowing with shrubs and trees. Area of alvars in Estonia has decreased from ca. 50

000 ha in the 1930s to 9800 ha nowadays and this can result in loss of number of habitat specialist species in the future due to existing extinction debt. Out of the remained grasslands, most are also more-or-less overgrown, and only 2000 hectares are currently suitably managed.

From 2014 to 2019, a large-scale restoration project "Life to Alvars" will be carried out in Estonian alvars. Project is funded by EU programme LIFE+ Nature, and it targets 2500 hectares of most valuable alvar grasslands. During restoration, shrubs will be removed to obtain optimal cover of ca 30% and grazing possibilities for local farmers will be created by building cattle fences and restoring access roads. Regions for restoration were selected based on current condition of grasslands and historical abundance of alvars in the region. Historically alvar-rich regions have larger grassland species pool and the restored sites have better connectivity which will support plant recolonization and pollinator availability. Since the beginning of the project preparations, large effort has been put on dissemination and increase of public awareness in Estonia.

We will provide overview of the scientific rationale of the site selection, best-practice management, and plant and pollinator monitoring methods that will be implemented during this restoration project.

O 60

What restricts generative regeneration of *Calluna vulgaris* in a continental region: seed production, germination ability or safe site conditions?

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Goddert von Oheimb, Sabine Tischew

Heathlands at the edge of their distribution (eastern, continental region) are often heavily degraded by an over-aging and disappearance of earlier age stages of C. vulgaris due to land abandonment and changing environmental conditions. Therefore, a large-scale field experiment in an abandoned former military training area in Eastern Germany (Oranienbaumer Heide) with free-ranging Heck cattle and Konik horses was implemented to test their effects on over-aged C. vulgaris populations in heaths and mosaics with dry basophilic grasslands. In addition, combinations with a onetime cutting management, as well as small-scale disturbance-events were tested.

Grazing and onetime cutting promoted the vegetative regeneration. Small-scale disturbance-events supported generative regeneration especially in Calluna dominated stands. However, all combinations of management did not initiate a considerable increase in generative regeneration. For that reason, other possibly limiting factors were studied: seed production, germination ability, safe site conditions. Seed production of over-mature Calluna-stands was extremely variable, ranging from 139,639 to 760,451 seeds m^{-2} but not lower as reported for other heaths in literature. Germination experiments showed no significant differences between seed germination of different Calluna ages. Short distance to the nearest adult. Calluna individual, moderate shadowing and high proportion of bare soil significantly supported the generative germination and survival of seedlings.

In conclusion, safe site conditions are crucial but not alone responsible for a successful generative regeneration of C. vulgaris in field. Other reasons, especially water limitation in the germination period due to lower spring/summer precipitation (climate change) also seem to be an important restricting factor in continental regions and will be studied in the future.

O 61

Degraded grasslands: How much recovery and towards which reference?

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Restoration of subtropical grasslands is challenging due to a lack of quantitative degradation measures, deficits in understanding thresholds for recovery, and debate about the reference for restoration. We studied permanent grasslands of variable management intensity, and grasslands recovering from use as cropland or pine plantations, in a total of 40 sites in the southern Brazilian highland. We recorded abiotic factors (soil pH, nutrients), biotic composition (vegetation, invertebrates) and ecosystem functions (above- and belowground biomass and forage quality, pollination, decomposition). Ordination and cluster analysis showed that converted sites were distinct from permanent grasslands; restoration thresholds most likely exist here. Significant variation also occurred within converted and permanent grasslands. Alpha plant diversity of grazed-burnt grassland exceeded that of unburnt grassland, which had greater cover of dead biomass and tussock graminoids. In terms of vegetation structure and composition, these grasslands are degraded and burned grassland serves as reference. Meliorated grasslands surpass both types in forage quality, soil nutrient quantity, invertebrate activity, but also feature non-native fodder species, whose role in restoration is hotly debated. An integrative measure of degradation, based on all factors recorded, is developed.

O 62

Forest restoration: Thinking about more than just trees

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R. Kasten Dumroese

In Finland, typical forest restoration focuses on restoring absent or degraded habitat features such as dead and decaying wood, charred wood, and variation in age and space distribution of trees. By creating favorable habitats, threatened plant, animal, and fungal species are expected to make a return. Deciduous trees, hosting many of our rare or threatened insect and fungal species, are also sometimes planted to create diversity in the most fertile sites. Although basic knowledge on propagation of our rare deciduous tree species exists, research and practical experience to improve seed and seedling production is very limited. New seed orchards of, for example maple (Acer platanoides) and oak (Quercus robur), are coming to seed production age, but tools to use these effectively are lacking. In addition, in Finland we lack the basic

research for the propagation of many of our forest understory species compared, for example, to North America where a great variety of non-commercial native plant materials are grown for forest restoration. By expanding our vision beyond trees, we have opportunity to include a much larger cadre of plant species and forms for restoration work within forested ecosystems. Given the context of climate change and the resulting changes in species distributions, now is an opportune time to begin work on understanding how to propagate our understory species and to enhance propagation of our deciduous trees. The Target Plant Concept can help drive the process. Many understory species in Finland are also found in other parts of Fennoscandia and the boreal zone making propagation protocols and restoration methods relevant to a wider audience as well.

O 63

Ecological restoration: does site-selection follow ecological criteria?

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The speed with which restoration will or can be accomplished depends on the initial state and location of the sites. However, many factors can undermine choosing sites that are deemed ecologically the best choice for restoration. Little attention has been paid to whether site selection follows ecological criteria and how this may affect restoration accomplishment. We use habitat inventory data to investigate whether ecological criteria for site selection and restoration have been followed, focusing on restoration for conservation of the white-backed woodpecker (Dendrocopos leucotos) in Sweden. Purely ecological criteria would entail that sites 1) would initially comprise of older trees and more deciduous trees than the surrounding landscape, 2) would become less dense and less dominated by coniferous trees after restoration, and 3) would be at a scale relevant for the species. We show that although the first criterion was largely met, the other two were not, which implies that other factors may have partly influenced the misalignment between site selection, and thus restoration outcomes, and white-backed woodpecker habitat needs. More research is needed to assess motivations of private companies to take part in restoration efforts. This would allow us to identify possible synergies which could strengthen restoration efforts and eventually increase the swiftness of restoration accomplishment.

O 64

LIFE murerleben, inneralpine river basin management – upper Mur

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The LIFE+ project "murerleben, inner alpine river basin management – Upper Mur" – LIFE08 NAT/A/000614 – has a duration from 2010 to 2015. The overall costs of EUR 2.8 Mio are designed for measures to improve the aquatic habitat of the river Mur.

The main goal is the restoration of sidearms and river-widenings to regain the formerly typical braided river system. Additionally, river habitats and alluvial forests shall be restored by connecting existing ones with the dynamic river-system. Ponds on the floodplains shall also be re-established or improved.

In accordance with the objectives of the Natural Habitats Directive and the requirements of the EU Water Framework Directive on 8 water segments of the river Mur, up to 90 km in length, relevant steps are planned and are implemented in a large part that regards the preserving of the biodiversity, the dynamic river development as well as the improvement of the passive flood protection.

The restoration, improvement and long-term protection of the alluvial forests and river landscapes are a condition for the preservation, especially of aquatic, rare and endangered species of animals and plants. In order to document and to protect the success of the projects, the measures, but also the synergy effects of the measures, are scientifically examined in a monitoring programme based on the total length. The programme is going to be continued until the year 2015.

The public relations are an integral part of the project. The population is informed about the project by regular press releases, folders and the project homepage. Additionally, school projects, events and the production of a film for the documentation of the results take place.

Until now great success could be achieved by the realized measures in order to ameliorate the variety structures on the river Mur. Buying more land and reactivating flood plains provide passive flood protection. By means of intensive public relations the project is present in the people's minds and the awareness and appreciation for the habitat river Mur was increased.

O 65

Monitoring and evaluation of projects that take an open-ended approach to restoration

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Peter Stroh, William Adams

Aim: When ecological restoration is conceived of as a trajectory of ecosystem change, it can be described as 'open-ended' restoration. It is an approach that recognizes that long-term ecosystem behavior involves continual change at small and large spatial and temporal scales. We suggest that in open-ended projects, restoration goals should be framed in terms of promoting natural processes, changing landscape mosaics and improving ecosystem services. The design of monitoring and evaluation activities also needs to acknowledge that restoration is an ecological journey rather than a habitat or species destination.

Method: We consider the challenges posed by this approach at a landscape-scale restoration project based around Wicken Fen National Nature Reserve in the UK. Agricultural land purchased around the historic reserve is being allowed to convert to wetland habitat using natural processes and low-intensity management over a 100-year timescale.

Result: Monitoring and evaluation have focussed on 1) the biophysical processes that underpin the development of habitat mosaics and the provision of ecosystem services, 2) the way habitat mosaics change through time and on 3) species that can indicate the changing landscape attributes of connectivity and scale.

Conclusion: We suggest that evaluation should focus on reporting changing restoration impacts and benefits rather than on achieving a pre-defined concept of ecological success.

O 66

Restoration of spatio-temporal heterogeneity in extensively managed lowland meadows

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Semi-natural grasslands are widely recognized for their high ecological value. Maintaining and/or restoring them is a top priority, but nevertheless represents a real challenge, especially regarding their invertebrate assemblages. Accordingly, we launched in 2010 a research programme whose main objective is to develop and evaluate meadowland management practices that can increase farmland biodiversity for sustaining fundamental agro-ecosystem processes. In this research programme we experimentally manipulate mowing regimes at the field scale among Swiss lowland extensively managed meadows in order to increase spatio-temporal and ecological heterogeneity, which is a key to restore biodiversity. Mowing regimes are: 1) control regime: according to extensively managed meadows declared as agri-environment schemes (AES), i.e. first cut not before 15 June; 2) first cut not before 15 July (delayed regime); 3) first cut not before 15 June and second cut not earlier than 8 weeks from the first

cut; 4) refuges left uncut on 10–20% of the meadow area. Data on multiple invertebrate taxa were collected in 2010–2014, i.e. before and up to four years after the introduction of these mowing regimes. So far we could show, firstly, that herbivores (orthopterans, plant- and leafhoppers) and pollinators (bees and butterflies) increased in diversity and abundance, sometimes massively, when mowing is delayed and when an uncut grass refuge is left over; secondly, that some taxa do not benefit from alternative mowing regimes (e.g. ground-dwelling spiders). Provided that farmers were given the appropriate financial incentives, the delayed and refuge regimes could be relatively easy to implement within today European AES.

O 67

Rehabilitating cut-away peatlands to downy birch thickets

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Introduction
At present, peat is harvested on an area of about 60,000 hectares in Finland, and annually approximately 2,500 ha are released for after-use. Besides rehabilitating these areas to wetlands, lakes or grasslands also forestry is an interesting alternative. One option is growing of native downy birch adapted to peatlands. However, since the cut-away peatlands differ considerably from peatland forests in regard to their soil properties and hydrology, forestry practices have to be adapted to the site characteristics. Downy birch energy biomass could be the main product of the thickets established on former peat production areas. In particular former peat bogs with high residual peat nitrogen content could have high potential for biomass production. Sequestration of atmospheric CO_2 into energy crops could also offset CO_2 emissions from soil.

Aim
The effect of stand establishment method on stand density, biomass production, and on the cost-efficiency of reforestation was studied based on field experiments. The treatments included broadcast seeding, natural regeneration, ash fertilization, and various soil preparation methods.

Results and conclusions
The highest number of downy birch seedlings was obtained by broadcast seeding combined with wood ash fertilization, producing up to 100,000 seedlings per ha. We also located naturally regenerated downy birch thickets on cut-away peatlands and measured their biomass production and calculated the profitability of forest chip production on these sites. The leafless above-ground biomass production of these 10–27 year old stands was 3–4 t ha^{-1} a^{-1}, which could be further increased by fertilization. Several thickets were cut down, and the sprouting ability and subsequent biomass production were studied based on three-year follow-up. Birches sprouted well, and the best stands produced biomass 2–4 t ha^{-1} a^{-1} in two years. Our results showed that rehabilitating cutaway peatlands to dense downy birch growing forest ecosystems is a viable way to increase carbon sequestration and biomass production.

O 68

Is 30 years sufficient timeframe to assure the abandoned peat-field is restored?

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The study was aimed to understand about age-related differences in the plant cover structure and acrotelm properties as potemtial indicators for system stability assessment. How long it takes that on an abandoned peat-field the Sphagnum-dominated plant cover is well recovered and functioning properly? This is frequently asked question. Plant cover and acrotelm on two abandoned ca 30 years ago and successively self-revegetated and well-developed Sphagnum cover peat-fields were studied and compared with the vegetation and acrotelm formation of a Calluna-Sphagnum moor (ca 300 years old and peat depth of ca 40 cm) and hummock habitats of 4,000 years old bog. Patterns of plant species richness (β-diversity) in and between sites demonstarted that species composition on Calluna-Sphagnum moor and old bog is more stable than on self-restored sites. The vertical distributional pattern of dead biomass in the acrotelm on self-restored sites is weakly developed. This indicates about hydrological unstability of self-restored sites. It can be concluded that the hydrological stability should be maintained for a long time before the system will reach the stable, self-sustained stage.

O 69

How environmental conditions influence hay transfer for the restoration of two types of Mediterranean grasslands?

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The reintroduction of propagules gathered on the reference ecosystem can be an excellent alternative to sowing commercial seed mixtures. Hay transfer is now commonly used for the restoration of various grassland types, particularly those with high diversity but limited species dispersal capacity. Optimization is needed to ensure the success of this method.

The objective of our study is to determine how environmental conditions influence hay transfer success. Our hypothesis is that the higher the competition from non-target species, the lower the establishment of target species. This competition can be lowered by decreasing nutrient content and/or by removing the soil seed bank on degraded sites before hay transfer.

We thus synthesized the results from several hay transfer experiments carried out between 2007 and 2013 in south-eastern France. Among these experiments, there were two reference plant communities: Camargue meso-xeric grasslands and La Crau steppe. Experiments were carried out from small-scale (0.16m²) to large scale (20ha). Hay was always gathered by air-vacuum and was transferred on three different substrates: i) previously cultivated, nutrient improved soils, ii) previously cultivated, after topsoil removal or iii) low nutrient content disturbed soil.

Our hypothesis was confirmed, the closest communities to the references were those where hay was transferred on soil with no non-target seed bank and low nutrient content.

O 70

Minerals industry and environmental sector collaboration in North West Europe to achieve targets of the EU 2020 Biodiversity Strategy

Carolyn Jewell, Species and Habitats, RSPB, UNITED KINGDOM
Nigel Symes

Biodiversity is in trouble globally, with current rates of species extinction reaching new highs and habitats under increasing threat from degradation and fragmentation, further confounded by the effects of climate change. This is recognised by governments, and by the EU which has a range of policies, underpinned by regulations, to address these problems at a Europe scale. Could mineral site restoration offer a biodiversity lifeline, and play a significant role in achieving biodiversity conservation aims? There are approximately 7,200 quarries across North West Europe, equating to over 250,000ha. These have real potential to be restored as ecosystems, and so to enhance biodiversity and to provide public benefits at the end of their working lives through restoration. Using the UK as a case study, we will demonstrate the scope to restore priority habitats, how minerals restoration is currently contributing to the 2020 priority habitat creation targets, and explore barriers that are currently curtailing their full potential. We will also present some species-specific enhancements being realised through an ongoing multi-partner project, along with examples of industry and environmental NGO working collaboratively in a prioritised manner, to enhance biodiversity in the UK and globally.

O 71

Re-introduction of target species into degraded lowland hay meadows: How to manage the crucial first year?

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In grassland restoration, the first year after species introduction by sowing is the crucial period for germination and establishment. In the Elbe lowland (Saxony-Anhalt, Germany), we tested the effect of different nitrogen fertilisation, mowing regime and rolling on target species establishment in a periodically wet, species-poor, grass-dominated hay meadow (6510) by using a split-split-plot design. In September 2011, 18 target species were sown in ploughed and grubbed stripes.

In 2012, stripes were mown once (June), twice (May/August) or thrice (May/July/September), fertilised with 0, 60 or 120 kg N ha^{-1} yr^{-1} (4 weeks before mowing) and rolled (April) or not (18 treatments, 4 replicates). Before the first mowing in 2012, individuals of sown species

were counted on 72 permanent plots of 0.5 m x 0.5 m size. The counting was repeated after the third mowing in autumn 2012 and in spring 2013.

Target species establishment was significantly affected by different treatments. In September 2012, the number of target species was significantly higher on plots mown thrice compared to plots mown once. Fertilisation with 120 kg N resulted in a significantly lower number of target species and individuals compared to unfertilised plots. In April 2013, the number of species and individuals was now highest on plots mown twice and significantly higher on not and moderately fertilised plots compared to heavily fertilised plots. Rolling did not have a significant effect which may change during vegetation development. In conclusion, mowing thrice without fertilisation enhances target species establishment in the first year due to decreased competition. However, mowing only twice seems to increase the chance to survive the first winter.

O 72

Large-scale restoration of species rich grasslands in the White Carpathian Mts.: restoration proceeds after sowing seed mixtures

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Restoration of species-rich grasslands has recently become an important issue across Europe. It is therefore not only necessary to find effective methods of grassland restoration but also to study the development of restored sites after initial sowing. The role of the landscape context herein is particularly relevant.

Spontaneous colonisation by 106 selected unsown target species was studied, using vegetation records, in dry grasslands created at 82 sites of arable land in the White Carpathian Mts., eastern Czech Republic. These sites had 1–31 years ago either been sown with a regional seed mixture (35) or commercial seed mixtures (31), or had been left to spontaneous succession (16). In order to assess the species pool of the surrounding landscape, we evaluated occurrences of target species in grid cells in which the restored sites were situated.

As a whole, the sites – although restored in different ways – converged in their species composition towards species-rich grasslands preserved in the area. The numbers of target species at the restored sites were found to increase significantly with time elapsed since restoration started and with the number of target species occurring in the surroundings. This was confirmed also by a partial study, in which the distribution of 11 target species was assessed in grasslands restored with regional seed mixtures and their surroundings.

O 73

A policy history view of the ecological restoration target in the Convention for Biological Diversity

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Ecological restoration has been incorporated into several Multilateral Environmental Agreements (MEAs), including the United Nations Convention on Biological Diversity (CBD). Target 15 of the Aichi Targets for 2020 sets a numerical goal of restoration of 15 percent of degraded ecosystems, and this target has been picked up by the EU in its biodiversity strategy. In this paper, I explore the historical context and development of the 15% target within the CBD policy arena. This is done through a historical analysis of policy documents. In particular, I focus on how the CBD has established the target without including a clear statement defining restoration within this context. I argue that without such a definition, the CBD will be unable to measure progress against the goal. Without a definition prior to the target development, CBD and other institutions like the EU that have adopted the same target have a dilemma about what to count toward biodiversity conservation goals. The adopted definition of ecological restoration would have to allow for measurement against the numerical target, or the target should be modified to match the chosen definition.

O 74

How specific is site specific? Using molecular markers to define seed zones for ecological restoration in Norway

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Aim: In Norway, the use of seed for ecological restoration and landscape management in compliance with the new Nature Diversity Act of 2009 is hampered by uncertainties about the question what is site-specific, and hence the lack of site-specific seed mixtures. Here we suggest a protocol for analysis of genetic diversity with the aim of providing a scientific base for choosing local material to be used in development of site-specific seed mixtures.

Methods: We collected eight species commonly used in commersial seed production from 20 localities covering Norway, 15 specimens per species per site. To assess the genetic variation and diversity, we used AFLPs, allowing to create large datasets without prior knowledge of the genome.

Results: Most species show different spatio-genetic patterns. Mostly rather shallow structure is observed on a national scale. For example: In Agrostis mertensii, populations from N Norway are separated from the remaining, suggesting a seed transfer split in Troms. In Festuca ovina, we detected a boarder south of Hardanger in S Norway. Whereas in Scorzoneroides autumnalis and Avenella flexuosa, there was a clear N-S gradient, but the populations were overlapping.

Conclusions: The results suggest that different species have different seed transfer zones, increasing the number of different seed mixtures that have to be developed. Though neutral markers may not reflect the distribution of adaptive traits, they do reflect historic gene flow among populations, the conservationof which may be important in its own right, and can be used to inform further studies of adaptation within regions. We propose four seed zones for alpine plants in Norway, corresponding to the patterns observed in the included taxa.

O 75

Monitoring of restoration in protected areas of Finland

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In protected areas of Finland, planning, implementation and monitoring of ecological management and restoration is coordinated by one administrative body, Metsähallitus Natural Heritage Services. Since 2003, over 19,000 ha of forests, 22,000 ha of peatlands and 4,100 ha of seminatural grasslands have been treated with restoration measures. These activities include, for example, controlled burning and artificial creation of dead wood in forests, filling ditches on peatlands, and cattle keeping on seminatural grasslands. For all major measures, monitoring schemes have been implemented to assess how well the restoration objectives have been realised. For example, in forests, the impacts of restoration on living and dead trees as well as on diversity of beetles and polypore fungi are monitored within a network of 31 restored sites and their control sites set up around the country. Monitoring is designed and supervised by habitat-specific expert groups of the Finnish Board on Ecological Restoration FBER. Members in these groups include not only managers of Metsähallitus but also researchers and representatives from relevant ministries and from private forest sector. Recently the first results from restoration monitoring have been published in scientific journals, including impacts of controlled burning on rare wood-decaying fungi, impacts of artificial dead wood on biodiversity, and impacts of peatland restoration on carbon accumulation.

O 76

GIS based socio-ecological tools for landuse planning

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The increasing awareness of the non-economic benefits of forests, such as biodiversity and recreation, has challenged the land-use planning of tourism areas. Authorities need new means to use and benefit from existing ecological information and knowledge of people's value, in land-use planning. Our aim is to develop a new GIS-based operations model, which increases social acceptability and ecological sustainability of land-use planning. The project's pilot areas are tourism resorts, which are located close to protected areas. We compiled existing spatial ecological data (e.g. endangered species, habitats) into new socio-cultural data to get socio-ecological knowledge with geographic information from the study area. Ecological

data was provided by local authorities. Socio-cultural knowledge of different areas and values related to different land-uses was collected from stakeholders through internet-based SoftGIS -surveys. We examined how ecological and sociocultural information are distributed in the map. Through spatial data analysis we pinpointed ecologically and socially valuable areas with possibly conflicting land-use pressures. Based on the new socio-ecological knowledge, we created a classification system which can be used to rate different areas into different use classes based on their suitability.

O 77

From one aim to multiple values: Impacts of in-stream restoration on ecosystem services and users' well-being

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Restoration is a value-driven process where different expectations towards the restored ecosystems provide the societal framework for restoration project. However, social, cultural and economic aspects are often insufficiently evaluated in the context of ecological restoration. In-stream restoration provides an opportunity to enhance biodiversity and the sustainable use of aquatic ecosystems through recovering ecosystem services and benefits. The main goal of stream restorations in Finland has been to enhance fishery by improving habitats for salmonids. Other societal benefits may include improved opportunities for recreation and nature tourism including the aesthetic appeal and attractiveness of the environment and job creation, for example. In this study, we assessed socioeconomic success of in-stream restoration in three rivers of northern Finland. The data were gathered by conducting interviews among canoeists (N= 10) and postal as well as online surveys among local dwellers and recreational fishers (682 returns of a total of 2184 questionnaires, a response rate of 31%). Our results show that restoration had positive effects on most ecosystem services and opportunities for different river use had improved. However, respondents had not always observed the desired improvements in the target fish species and in some cases newly-restored sites were considered too challenging or even dangerous from the users' perspective. Respondents had used the river a little more often after than before restoration.

O 78

Re-vegetation dynamic on restored Tässi extracted peatland

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In Estonia there are ~ 9880 ha of extracted peatlands abandoned during or after the end of Soviet period. Since then they have spontaneously re-vegetated very sparsely and only a few areas have been used for berry plantation or restored. In May 2012 we started the restoration experiment in Central Estonia on Tässi extracted peatland, abandoned ~ 30 years ago, using the "Moss layer transfer method". The bare peat surface was only sparsely vegetated with sin-

gle Pinus sylvestris and Betula pubescens trees and tussocks of Eriophorum vaginatum, with total plant cover <1%. The experiment was set up on 0.3 ha with six different combinations of peat surface preparation, water-table depth and spreading density of plant fragments. During the vegetation period the water-table depth was mostly 15–25 cm, in wet periods some areas become flooded. Since the second year the re-vegetation process has been studied on permanent plots (n=6x10) in each spring and autumn. By the end of the second vegetation period the total plant cover had reached 60–70%; 14 vascular plant and 29 Bryophyte species (incl. five Sphagnum species) were recorded. The majority of the total cover is formed by Sphagnum fuscum and S. magellanicum. Plant cover has increased more on areas with a higher water table and lower spreading density of plant fragments. The number of bryophyte species has doubled compared to the donor site in the natural bog (29 vs 14 species). The re-vegetation dependent on water-table depth and different combinations of restoration treatments until the third year will be discussed in more detail in the presentation.

O 79

Restoration of peatland game habitats in state-owned commercial forests

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A significant proportion of Finnish peatlands has been drained for forestry, farming or peat collection which has diminished the area of natural peatlands from 10,4 million ha to 4,6 million ha. Most of the drainages were made in the 1960´s and 1970´s. About 15% of the drainages have turned out to be non-profitable. This concerns especially sparsely wooded bogs suitable for willow grouse (Lagopus lagopus).

About one third of Finland's commercial forests are owned by the state. The government runs business activities through a state-owned enterprise that also fulfils many public administration duties concerning state-owned land and water areas. The managed forests are not used only for wood production, but they also provide the society and citizens with a variety of ecosystem services.

Restoration of wetland and peatland game habitats on state-owned land started as a project in 2008 but was soon integrated into daily forestry practices. The focus of wetland habitat restoration has mainly been on restoring bogs for willow grouse and bean goose (Anser fabalis) but also on restoring and creating waterfowl habitats.

The method in restoring game habitats in commercial forests is the same as in restoring conservation areas: most of the trees are removed and in most cases also the ditches are filled in to restore the water level. Filling in the ditches is financed from the funds collected by selling licences for hunting on state-owned land.

About 3,000 ha of peatland and wetland habitats have been restored in state-owned multiple-use (non-protected) areas in 2008–2013, most of them for willow grouse habitats. The restored areas have been monitored in co-operation with Finnish universities and the results show that willow grouse accepts restored pine bogs as its territory.

O 80

LIFE+ improving the conservation status of species-rich habitats in Southern Finland

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Aim
Species-Rich LIFE is an EC funded 5-year project, which targets the most species-rich habitats in Southern Finland, e.g. herb-rich forests and traditional rural biotopes. It is implemented by Metsähallitus, Finnish Environment Centre and WWF Finland. The project focuses on restoration of valuable habitat sites and also on improving the conservation status of selected endangered species, e.g. White-backed Woodpecker and Clouded apollo. Restoration sites are located in 59 Natura2000 –areas. The sites were selected based on present occurrence and restoration potential of Habitats Directive Annex I habitats that currently have unfavourable conservation status in Finland. Target habitats are restored to improve their representativeness and to maintain suitable conditions for the endangered species found at the sites.

Methods
Restoration methods include e.g. restoration of traditional rural biotopes by grazing, management of tree species composition, removal of invasive alian species and species reintroduction. An important part of the project is detailed site-by-site restoration planning, which also includes species inventories and cultural heritage inventorying. Various types of communication actions, targeted especially to the general public, are also an essential part of the project, as is the involvement of volunteers in various restoration actions.

Results and conclusions
We present the results gained during the first three years of the LIFE+ project and discuss the lessons learned until now. The objective is to restore over 900 ha of species-rich habitats and so far restoration actions have been completed in ca 400 ha.

O 81

Evaluating variable-retention cutting and broadcast burning as tools for restoring complexity to Lodgepole Pine (*Pinus contorta*) stands

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Severe and spatially extensive levels of mortality by mountain pine beetle (Dendroctonus ponderosae) has prompted a growing interest in the potential of silvicultural treatments to help restore complexity to structurally uniform, even-aged lodgepole pine (Pinus contorta) stands in the northern Rocky Mountains. By simulating mixed-severity disturbances, silvicultural treatments can create multi-aged stands that help mitigate susceptibility to bark beetles and wildfire. We analyzed an experiment established in 1999 at the Tenderfoot Creek Experimental Forest (Montana, USA) with variable-retention cutting and broadcast burning treatments designed to replicate natural mixed-severity disturbances. Prescriptions specified

removal of 50% of the basal area in all of 16 treatment units, with retention trees evenly distributed in eight of the units, and aggregated in irregularly shaped patches in the remaining eight. Half of the treated units were subsequently broadcast burned with low-intensity fires in 2002 and 2003. The present study revisits permanent plots in all 20 units (16 treatment plus 4 control units) and analyzes treatment-associated stand responses, including: 1) structural development (regeneration and growth), 2) extent and intensity of bark beetle mortality, and (3) post-treatment fuel dynamics and modeled wildfire behavior potential. This paper presents findings from that study within the context of existing knowledge of lodgepole pine stand dynamics, and evaluates variable-retention harvesting as a tool for restoring complexity to lodgepole pine stands.

O 82

Near-natural restoration of species-rich field margins to enhance ecosystem services in intensively used agricultural landscapes

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Daniel Jeschke

Ancient species-rich field margins and mesophilous fringe communities are important elements of cultural landscapes providing habitats for many species groups including dry and mesic grassland species, forest-margin and fringe species. In intensively used agricultural landscapes, many grassland species are restricted to field margins and fringes due to increasing land-use intensity. Today, however, these linear habitats with high importance for landscape connectivity are often degraded or destroyed.

A literature review about the effiency of agri-environmental schemes indicated that the creation of perennial field margins by sowing seed mixtures containing cultivars of native plants (including competitive grassses) and non-native flowering plants was often not successful concerning establishment rates of habitat-specific species and long-term flowering aspects.

In our study we used carefully selected native plant species of regional propagation to develop site-specific seed mixtures for the establishment of field margins in agricultural and suburban landscapes of Northwestern Germany. We established field margins by seeding a high diversity seed mixture (37 habitat-specific species) in autumn 2010 and tested the effects of different soil disturbance and management treatments. Since 2011 we carried out additional experiments with seed mixtures of lower diversity (27 species) in order to analyse effects of different soil conditions and adjacent habitats on species establishment. Evaluation of restoration success included both ecological and aesthetic criteria. In all experiments establishment rates of sown target species were between 84% and 100% after two years. Species persistence will be analysed by further monitoring.

O 83

Optimisation of seed mix efficiency and adaptation of management to enhance species diversity in farmland ecosystems

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Sabine Tischew

In intensively used agricultural regions in Saxony-Anhalt/Germany, field margins are scarce consisting mostly of species-poor grass swards as a consequence of frequent mulching and/or spraying with herbicides. Since the regional species pool is depleted and dispersal vectors are insufficient, target species must be introduced after destruction of the grass sward. For successful restoration, a careful selection of species adapted to highly altered sites conditions (high nutrient status, wind exposure, summer draught) is challenging. After analysing remnant field margins, we choose 49 perennial species (5 grasses/44 forbs) belonging to mesic and dry grasslands, fringe and dry ruderal communities. Selection criteria were e.g. a long-lasting flowering aspect and at least moderate competitiveness under nutrient-rich conditions. Begin of October 2010 we implemented a trial in complete block design with 5 repetitions and different variants: tilling 0/1/3, sowing 0/1, mowing June/September. From 2011 to 2014, we analysed how species introduction, tilling intensity, and mowing time is influencing the development of functional groups and species traits. In the past, field margin restoration often failed due to unsuitable seed mixtures and management whereas a careful selection of a high variety of regional species and an adapted site management led to the development of attractive species-rich field margins that are able to fulfil important regulating, supporting, and cultural ecosystem services.

O 84

Restoring plant species richness in urban and agricultural grassland to support biodiversity and ecosystem functioning

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Till Kleinebecker, Norbert Hoelzel

Grassland biodiversity still drastically declines in many European countries. Intensive land use and the use of commercial seed mixtures generate species-poor, monotonous grasslands. This reduced plant diversity is not only a biodiversity concern, but it may also decrease certain ecosystem services which often rely on plant diversity. For example, in agricultural grasslands, plant diversity can help to improve the quantity and quality of the yield, while in cities, the aesthetic value of higher plant and thus flower richness of urban grasslands is of interest for the resident population. During the recent past, the management intensity of several grasslands has been significantly reduced either for economical or ecological reasons. However, due to seed and dispersal limitation, such nowadays low-intensively used grasslands remain species-poor over decades. Nevertheless, these grasslands hold a vast but untapped biodiversity potential. As this mechanism applies to agricultural but also urban grasslands, we give examples of two ongoing projects focusing on the floristic enrichment of species-poor grassland by sward disturbance and oversowing with regional seed mixtures. In both projects,

we test whether pre-sowing disturbance is a mandatory precondition for floristic enrichment. First results show experimental seed addition of locally absent species in the Biodiversity Exploratories project significantly increasing the yield of agricultural grasslands in different regions in Germany. Meanwhile, the floristic enrichment of urban grasslands has to cope with the specific urban setting such as the intensive use by residents and the high grazing pressure by large populations of rabbits.

O 85

Lower nitrogen losses in diverse grasslands; implications for restoration

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Natural abundances of nitrogen (N) stable isotopes can be used to trace the ecosystem response to abiotic and biotic factors, providing insights into biodiversity effects for ecosystem functioning. However, in grasslands studies on stable isotopes have been mostly restricted to experiments and only few analyzed stable isotopes in community biomass present in the field. Here, we present 15N values in soil and plants, community biomass and 3 single species (herb, grass, legume), from 150 grasslands in 3 German regions. Grasslands were arranged along a gradient of land-use intensity, ranging from dry calcareous grasslands to intensively managed silage meadows. To explore drivers of ecosystem N dynamics, we performed several analyses of covariance treating 15N signals as a function of plant diversity and a large set of covariates including land use, plant functional group cover and soil types. Results showed increasing plant diversity to be consistently linked to 15N depletion. Even after accounting for multiple covariates, plant diversity remained the strongest predictor of δ15N values suggesting that higher plant diversity leads to a more closed N cycle due to more efficient complementary N uptake. Factors linked 15N enrichment included the amount of N taken up, soil moisture and land-use intensity and indicate a more open N cycle due to enhanced turnover and subsequent losses. We provide evidence that the mechanism of complementary resource use operates in real-world grasslands where multiple factors affect N dynamics. Although species differ in effect size, restoration measures that actively increase plant diversity could be an option to reduce negative environmental impacts of N losses. Thus, we provide a strong argument to restore plant diversity in grasslands.

O 86

Long-term effects of topsoil removal in fen meadow restoration: a delay in fen meadows recovery

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Ab Grootjans

We examined the long-term monitoring data and studied the results of fen meadow restoration with topsoil removal. We observed a delay in fen meadow vegetation recovery in peat-

land restored by topsoil removal and explored the causes of this phenomenon. Restoration took place on degraded meadows in the North-Eastern part of the Netherlands. The site was restored by removing an acidified and fertilized topsoil and by improving of local hydrology. The effects of shallow (20 cm) and deep (40 cm) topsoil removal were compared. We explored the vegetation change over time, using ordination techniques. Also soil conditions over time were monitored. The vegetation and environment changed over time in response to restoration. At first the vegetation recovery was delayed, but eventually fen-meadow species re-established. We found a poor re-establishment of fen meadow vegetation and persistence of species-poor communities in the first 5 years after top soil removal, probably resulting from soil acidification. Data on soil chemistry confirmed the soil acidification right after topsoil removal (within first 2–3 years), due to the pyrite oxidation after the site was excavated and when the site was temporary desiccated. A delay in vegetation recovery, associated with soil acidification, occurred mainly after deep removal. After further improving the abiotic conditions, a recovery in vegetation was observed. The positive shift in fen meadow vegetation development occurred after successful increase of groundwater discharge. After 14 years, the vegetation after shallow and deep removal were similar. Restoring appropriate hydrological regimes and strong discharge of groundwater is of the utmost importance for success of restoration in fen meadows, especially if pyrite is present in a shallow soil.

O 87

Do we restore fen ecosystem services by restoring fen biodiversity? A revision of current practices

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The majority of fens in Europe has been lost or largely transformed. Their restoration primarily aims at protecting characteristic species of plants or birds. This species-oriented approach required short-term conservation aiming at maximum numbers of target species rather than process-oriented approaches aiming at long-term ecosystem resilience. Such short-term approach does not require re-establishment of peat-formation and, in fact, many "fen" projects aimed at fen meadows, with relatively high botanical richness and good prospects for mowing. Similarly, in bird-oriented projects, management requires temporarily lowering water levels to allow mowing, which counteracts natural mire processes. Such approaches are limited to small areas because of high costs, whereas climate change mitigation requires up-scaling of peatland restoration. Several approaches can help to overcome this trade-off, for example multifunctional approach to maximize multiple gains from restored land, or alternatively, a process-oriented restoration aiming at redevelopment of resilient and more natural mire ecosystems in the future. We argue that the time-scale of restoration has to be re-considered in an ecosystem approach: restoring key functions may require decades or even millennia, whereas biodiversity targets are traditionally evaluated within a few years after restoration. Ecosystem services context puts restoration more firmly in the sustainability context, which calls for approaches that would employ time and succession in mire restoration. This approach is, after all, also the most appealing for the long-term survival of threatened species.

O 88

Effects of salinity on the growth of plant species typical for fresh water fens

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Lowland fens in the Netherlands can be exposed to temporary increased salinity, due to indirect effects of climate change: river water becomes temporarily more brackish due to more frequent seasonal droughts. There is also a necessity to supply river water to maintain constant water levels in fen wetlands. Part of Dutch lowland fens, protected as Natura 2000 habitats, have developed under fresh water conditions. They are characterized by a pattern of ponds with expanding root mats, recent peat accumulation and a high species richness. Little is known about the response of plant species from fresh water fens to a temporary increase in salinity. In an experimental study we selected five species, some that build the root mats ('ecosystem-engineers') and other, associated with high species richness. In controlled greenhouse conditions, we manipulated the concentration of NaCl and exposed these species to a range of (low) salinity levels from 70 to 3,000 mg Cl-/L. Four out of five species showed a significant reduction in biomass compared to control. A reduced growth and wilting of leaves were observed in relatively low salt concentrations. The sensitivity differed strongly between species. Reduced growth may result in a change of competitive interactions and lead to a shift in vegetation composition and a loss of protected habitats. Our results indicated that even low salinity levels may negatively affect fen species, although the results may differ between species and the effects may take longer to become visible.

O 89

Do non-native plant species turn 'bad' in species-rich subtropical grasslands- and what is 'bad'

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Non-native plants are deliberately introduced to grasslands worldwide in order to provide a forage source for livestock. There is a growing concern that these introductions might also have negative effects, e.g. on native species richness. This concern is fuelled by species that turn out to be 'bad', although there are no standards so far for an adequate classification, and it depends on the point of view whether a species is to be considered 'bad' or not. As introductions and effects are not uniform in space, regional studies are necessary to improve our knowledge on the introduced non-natives to identify those with unwanted effects.

We examined the occurrence of non-native plants in natural grasslands of southern Brazil, with the aim to detect whether their deliberate introduction has (1)led to their further spread, (2)has caused negative feedbacks, and (3)whether this would call for classifying them as unwanted. We compared vegetation composition and aboveground biomass of natural grasslands with (i)sites that were overseeded with non-natives, (ii)ex-arable sites and (iii)logged pine plantations. In overseeded areas, native species richness was strongly reduced, but a high

number of natives persisted in a matrix of non-native plants. While deliberately introduced herbaceous species rarely occurred outside their introduction area, woody species like Pinus sp. or Ulex europaeus were encountered far from introduction sites. Our results are a first indication which species might need to be considered hazardous and should not be introduced in natural subtropical grasslands.

O 90

All-year megaherbivore grazing in large-scale calcareous grasslands with orchids (Tote Täler)

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Georg Hiller, Sabine Tischew

Positive effects on species and structural diversity are well studied in large-scale wet to mesic all-year megaherbivore pastures. However, little is known about effects on dry grasslands where negative impacts due to an uneven use of the pasture and trampling of sensitive species are suspected. By example of the Natura 2000-site "Tote Täler" we studied the effects of a megaherbivore pasture on degraded orchid-rich calcareous grasslands. From 2009–2013 vegetation structure, frequency of orchids and birds, and megaherbivore activity (telemetry) were studied on 450 50 x 50 m plots within a 87 ha Konik pasture. Parameters for habitat quality and vegetation composition were sampled in ten 75 x 75 m resp. 5 x 5 m plots in both grazed and ungrazed sites. Our results showed that the horses used the entire pasture in evenly distributed patterns and, thus, initiated a dynamic development of mosaic-like vegetation. Due to winter browsing scrub encroachment was restricted to max. 13%. Parameters for habitat quality, especially vegetation litter and forb layer and typical plant species composition improved significantly. The studied orchid species (Ophrys apifera) showed no difference in occurrence between sites with high and low grazing frequency. Target bird populations for semi-open landscapes increased on plots with medium to high grazing frequency, where habitat structures and food availability were improved by the grazers. Altogether, we conclude that large-scale all-year megaherbivore grazing is suitable for improving degraded dry calcareous grasslands.

O 91

Re-introduction of rare arable weeds: Density effects, competition with other weeds and effects on crop yield

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Most arable weeds have markedly declined due to intensification of farming practices, and some are close to extinction in large parts of Europe. Organic farming may offer suitable conditions for conservation of rare arable weeds, but these species are largely absent from the seed bank and thus need to be re-introduced. However, little is known about optimal seed-

ing densities, competition with other weeds and effects on crop yield. These aspects were investigated for three species (Consolida regalis, Legousia speculum-veneris, Lithospermum arvense), with pure and mixed sowing of the rare weeds (5–10,000 seeds m^2), both with and without spontaneous common weeds, with winter rye as crop. Performance of the rare weeds was measured in terms of establishment, biomass, flower density, seed production and germination; crop effects were assessed as grain yield, thousand grain mass and ear density. Opportunity costs of the different re-introduction methods were calculated in cost-benefit analyses based on marginal costs. While the study species established and reproduced at all sowing densities, optimal performance was found at 50–1,000 seeds m^2; densities <25 seeds m^2 caused low seedling establishment, and >1,000 seeds m^2 showed negative density effects. The impact on crop yield followed sigmoidal or hyperbolic functions, depending on weed species, and yield losses were detected >100–1,000 seeds m^2. For successful re-introduction we recommend densities of 100 seeds m^2 for C. regalis and L. arvense, and 50 seeds m^2 for L. speculum-veneris; this leads to management costs of <1,000 € ha 1, and crop yield losses <7%. We conclude that re-introduction of rare arable weeds by sowing in organic fields is a feasible method for restoring agro-biodiversity.

O 92

Methane fluxes from pristine, drained and restored boreal spruce swamps

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Successful restoration of drained peatlands means that all the processes of pristine mires are present in the restored peatlands. Methanogen communities are usually disturbed by the lowering of water table. Existing studies have found slow recovery of methane emissions on restored peatlands.

We measured CH_4 flux on pristine, drained and restored boreal spruce swamps. The measurement plots on the drained and restored sites included mid-strip area, ditches and the soil beside the ditch. Water table was measured near the flux measurement plots. Seven sites were sampled twice per month for one growing season with eight sampling plots per site in total.

The highest mean water level was recorded on the restored sites, and the lowest on the drained sites.

The fluxes from the pristine and drained sites did not differ significantly, whereas the restored sites showed high fluxes from all measurement plots. The highest fluxes were measured from the drainage ditches on both the drained and restored sites. The spatio-temporal variation of the flux on pristine sites was partly explained by the water table level.

O 93

Ecologically valid implementation of the Aichi 15% habitat restoration target

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In this contribution, I will derive a procedure that answers the question: how can we achieve and document the achievement of the CBD Aichi target on restoration of 15% of degraded habitats within 2020 in a way that is scientifically and ecologically valid. Derivation is based on a 10 step procedure in which I i) empirically determine the current state of the habitats, ii) determine the degree of improvement in the state of the habitats that each of the restoration measures provides, iii) determine the cost of the restoration measures and finally iv) illustrate how we can achieve a prioritization of restoration actions based on the previous steps. The procedure is not based on threshold values or categorization of habitat statuses, but rather utilizes continuous measurable variables, and as such it relies less on expert opinion type of information.

O 94

The desert restoration hub arid lands restoration and combat of desertification: extending the action for the future

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Aims

COST Action ES1104, the Desert Restoration Hub was devised in response to the need to better understand the status quo in arid and drylands restoration and in particular regarding restoration techniques. Despite the numerous international, national and local groups working in combatting desertification and effecting drylands restoration, there is very little coordination and sharing of knowledge. In order to affect restoration there is great need for collaboration and a heterogeneous approach compared to the current situation.

Methods

Restoration in arid and dry lands requires the collaboration of various scientific fields: soils, hydrology, botany, ecology, landscape planning, agronomy, sustainable land management, landscape planning etc., as well as overcoming the disjointed nature of knowledge transfer and providing a comprehensive knowledge base. The Action will deliver an integrated database within a harmonized information hub of current and new methods and techniques of restoration, trials and field studies, assessment indicators, academic and practical publications, and tools to identify and support practical restoration projects and decision makers in planning and restoring drylands and the combat of desertification. The Action promotes open innovation in procedures and methods for improved restoration in dry lands.

Results
COST Action ES1104 is in year two of a four-year project and the interaction of these fields is producing interesting and novel scientific approaches and an extension of knowledge. Although there is a slow start to the accumulation of best practice, this knowledge will be harvested and also used to direct innovative ideas and solutions.

Conclusions
The four-year project brings together a great deal of knowledge and expertise, but this is not enough. It is important that the networking, collaborations created with the project continues into the future and the way forward needs to be found. This may well be with SERE. This will be discussed.

O 95

Topsoil removal as a method of fen restoration, which does not increase methane emission

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We studied methane emissions from severely drained fen peatland restored with topsoil removal to assess the influence of this restoration method on a global warming potential of peatlands. As a comparison we measured methane emissions also from experimentally rewetted, degraded and reference - fen meadow, areas. Gas was sampled monthly with the closed chamber method during two growing seasons. Additionally, we assessed the greenhouse potential of the removed topsoil to comprehensively compare both restoration methods.

Emissions from the areas restored with topsoil removal were lower by one order of magnitude compared to the experimentally rewetted areas. They were also significantly lower than those from reference areas and not different from control (degraded) plots. Seasonal emissions (estimated using a regression model based on meteoroligical data), compared with the global warming potential of the removed topsoil, indicate that topsoil removal does not cause larger GHG emissions than rewetting, even if we take into consideration total mineralisation of the removed layer.

The presented study is the first attempt to estimate the global warming effect of fen restoration with topsoil removal. The results allow us to conclude that topsoil removal can be an efficient method of fen restoration from the point of view of greenhouse gas balance assuming that without any restoration the aerated topsoil will anyway gradually lose its carbon.

O 96

Scarce Fritillary (*Euphydryas maturna*) Action Plan implementation as a response to changes in Central European forests

Antonín Krása, species protection, Nature Conservation Agency of the Czech Republic, CZECH REPUBLIC

In Central Europe, forests have changed a lot in last few centuries. The primary forests had been cut and recent forest stands have very different structure, even at sites where deciduous broadleaved forests have not been replaced by coniferous plantations yet. The changes culminated in the second half of the 20th century when traditional management as coppicing was totally abandoned. The main reason was an increase in high quality timber harvest instead of past firewood production. It has had a strong impact on the forest fauna and flora because of the changes in the light conditions. Subsequently, many species became rarer, which is also the case of the Scarce Fritillary.

The species is one of the most endangered butterfly species not only in the Czechia, where only one colony has left, but also in Central Europe as a whole. Thus, the Action Plan (AP) for the species was approved in 2011 to save it. The main activities of the AP aim at changes in forest composition and thus forest ecosystem management. We stopped using chemicals inside the forest and limited the size of clear-cuts from 1 ha to 0.25–0.5 ha as the first step, because it is more favourable for the target species. Our plan is also to shift management back from timber production to firewood and mixed production in coppice-with-standards forest. Several forest blocks have been thinned to different extent in different forest age-classes to diversify habitat structure and conditions. Coniferous forest stands are cut and replanted by oak and ash trees, because ash is a host plant of the target species.

At present, some positive results can be seen, although it has been only three years from the beginning of the active management. The population density was very low in 2009 and 2010, but it has been recently steadily growing and moving from the extinction zone.

O 97

LIFE project Active Protection of the Sites of Community Importance with Thermophilous Habitat Types and Species in Lounske Stredohori Hills

Antonín Krása, species protection, Nature Conservation Agency of the Czech Republic, CZECH REPUBLIC

Bohumil Fiser

Steppes are amongst the most endangered habitat types in the Czech Republic and it is especially the case of the short-grass steppes in the Louny region. The area has no direct connection to the East European primary steppe region, making it both more vulnerable and more valuable. Local steppes and the whole landscape of the Lounské stredohorí Hills (LSH) are currently threatened by the intensive farming and land use. Main problems include afforestation/reforestation, ploughing up and overexploitation by mass tourism at some sites. Lack

of management can result in successive changes leading to overgrowing by shrubs and trees within the above remarkable habitats. LIFE+ project Active Protection of the Sites of Community Importance with Thermophilous Habitat Types and Species in Lounské Stredohorí Hills is aiming to solve some of the problems. Its main goal is to improve the status of the steppe communities in the Louny region. Pursuant to the EU Habitats Directive, there are eight Sites of Community Importance as well as eight stepping stones which will be affected by project The target species include Stippa zalesski, two insect species as well as the European souslik, also known as the European ground squirrel (Spermophilus citellus). The latter species has disappeared from most of the Czech Republic and there are only 33 sites left, inhabited by the species today. However LSH is an area where it is possible to establish a ground squirrel´s viable metapopulation. Most of the management measures of the LIFE+ project, which will finally influence about 250 hectares, are aiming at removal of unwanted shrub overgrowth, invasive alien species eradication and introduction of regular mowing or grazing.

O 98

Community education for land restoration: case studies from North Bohemia and the southern UK

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Martin Haigh

While it is accepted that successful land restoration depends upon political will, the necessity of creating community interest and awareness sufficient to make land restoration an issue of political concern is often neglected by land restoration professionals. Land restoration, like all aspects of sustainable development, requires community awareness and engagement, willpower, great enough to drive habitat improvement and overcome the easy notion that such matters are 'someone-else's problem'. This paper explores three land restoration research projects. Two engage participation from non-professional volunteers in the scientific process but, more importantly, in changing attitudes to land restoration in the wider community. The third is about building enthusiasm for environmental restoration among young people. All three projects spread the message that land restoration is something that concerns everybody and something where everybody can make a contribution. It is a means by which communities can enhance both the environmental and social capital of their own habitat and also develop the critical understanding needed to drive and critique the activities of both commercial and Government agencies. The two science-based case studies explored concern the works done by volunteers in a project designed to monitor the post-Acid Rain recovery of forest lands in the Jizera Mountains of Northern Bohemia and in a project designed to correct the post-project deterioration of soils and vegetation on land reclaimed after surface coal-mining in South Wales. The third concerns reconstruction of the ecological and social capital of the Wychwood Forest in southern England.

O 99

Conservation of oak woods, bogs and heaths in the Lower Rhine Region nearby Wesel (Germany)

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300,000 to 130,000 years ago the glaciers of the Wolstonian Stage covered wide parts of Europe and formed the North German Plain. Later the rivers Rhine and Lippe found their way along this post-glacial landscape. Along the rivers inland dunes emerged by windblown sand. Today we found acidophilous oak woods with bogs and heaths in 6 Natura2000 sites (1,762 hectares), located in north-west Germany, as a part of a 2,500 years old cultured landscape.

From 2012 to 2016 it is the objective to improve this European natural heritage by 16 nature conservation actions, preparatory studies, purchase of land and public relations. In addition to the EU-Commission the project is supported by the federal state North Rhine-Westphalia, a local authority and a municipal water supply companies. 4 partners (NGO, Forest Agency, Regional Association, NRW-Foundation) supported by an interdisciplinary team, set the following objectives: Development of new acidophilous oak woods; removal of invasive alien species Prunus serotina from all Natura2000-habitats; restoration of original water levels in bogs and wet heaths; restoration of dry heaths and inland dunes with open grasslands; creation of new heath areas bordering the banks of a dystrophic lake and development of wet heaths with Erica tetralix.

Furthermore the project comprises measures for the keystone-species of acidophilous oak woods, bogs and heaths like Lucanus cervus, Leucorrhinia pectoralis, Rana arvalis, Luronium natans and Coronella austriaca.

In addition to the conservation measures a lot of PR work is done to involve local people. Circular routes, a website, excursions, lectures, a regular newsletter, a touring exhibition and a leaflet inform about the project and help to discover the locale natural heritage.

This report cover the practical experience and results of the first two years of implementation.

O 100

Spontaneous and assisted grassland recovery following the removal of exotic pine plantations

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Aims: Many grasslands were converted to pine plantations in the 20th century, resulting in negative consequences for biodiversity. Changing economic or conservation priorities are increasingly leading to the removal of these plantations, but the ability of these stands to recover into grasslands is poorly known. Our objective was to investigate the spontaneous

recovery and experimentally test the effects of key factors that may limit the recovery of sand grasslands following the removal of a pine plantation in central Hungary.

Methods: We monitored the spontaneous recovery in permanent plots, and investigated the effects of (1) seed addition of the dominant grasses, (2) pine needle litter removal, and (3) the presence of invasive milkweed (Asclepias syriaca) on grassland recovery in a field experiment between 2008 and 2013.

Results: We found that spontaneously recovering plots became similar to control plots in terms of grassland species richness, but not in the cover of the dominant grasses. Milkweed had significant cover, but it did not change much through time and did not affect the colonisation of grassland species. Seed addition led to high cover of grassland dominants, and this was unaffected by litter removal or milkweed presence.

Conclusions: We conclude that (1) sand grasslands have high recovery potential following the removal of pine plantations, which can be facilitated by seed addition of the dominant grasses, and (2) exotic milkweed is expected to be a permanent component of the emerging secondary grasslands, but it does not seem to affect recovery.

O 101

Field courses for environmental and practical education in the boreal forest environment

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Jarmo Poikolainen

Finland is the most extensively forested country in Europe situated between the latitudes 60°N and 70°N. The boreal forest is the largest natural region between boreonemoral and subarctic areas and it is divided into southern, middle and northern boreal subzones. Up to the 1950s forestry was not very intensive in the Northern Finland although there were great wood resources. When more intensive forestry turned round in the Northern Finland, there were many differences related to site and climate conditions compared to the forestry in the Southern Finland. For this reason special Northern Finland Forest Course was started by the Faculty of Forestry in the Helsinki University since the 1950s. The authors of this paper organized and directed the course for forest students for 20 successive years since 1988.

The objective of the course was to give the students a broad knowledge about forestry and forest ecology in northern environmental conditions from the coastal area of Northern Ostrobothnia to the timberline with respect to high latitude and altitude. The course was arranged by visiting different destinations in northern Finland and neighbor countries. After the course students were also familiar with the importance of other livelihoods, like reindeer farming and tourism, to the local economy. Meeting Sami people gave also a wider perspective to the traditional way of living in the Northern Finland. The threats of air pollution to the sensitive northern nature, recovery of failed regeneration areas and the importance of nature conservation were also discussed. By visiting the neighboring countries, Sweden, Norway and Russia, the students achieved understanding how other countries managed sustainability and took

care of the environment. Visiting nature centers was an essential part of the course. One of the most important was Siida, the Sami Museum and Northern Lapland Nature Centre.

In the conference development of mechanized harvesting and restocking methods in the northern boreal forests will be introduced. In addition the educational aims and the feedback of the students will be discussed.

O 102

Developing ecological restoration and management of forests in the METSO Programme

Saija Kuusela, Natural Environment Centre, Finnish Environment Institute, FINLAND

Launched by the Finnish Government in 2008, The Forest Biodiversity Programme METSO aims to halt the ongoing decline in forest species and habitats, and establish favourable trends in Finnish forest biodiversity by 2020. The program is financed through the state budget by the Ministry of the Environment and the Ministry of Agriculture and Forestry with approx. 40 million euros annually. Funding is mostly used for improving the network of protected forests through voluntary conservation agreements with private forest owners, and for increasing the use of biodiversity-friendly forest management practices including ecological restoration. Total aim is to affect approx. 200 000 hectares of privately owned forests.

In the METSO programme, several research and development projects are developing methods for biodiversity-friendly forest management and restoration. Commonly these projects concentrate on specific habitat types (e.g. esker ridges or wood pastures) or on specific species (e.g. the Siberian jay, the Northern crested newt). The aim of this presentation is to share knowledge on the best practices developed in METSO projects and to show how these projects enhance collaboration and mutual learning between forest owners, forest experts, researchers and policy makers. I will also introduce new projects which will mainstream ecological restoration and nature management through collaboration with hunters and nature tourism businesses. Even though there are some future challenges, e.g. budget cuts and organizational changes, that may slow down the progress, we can conclude that the basis of METSO Programme – bottom-up, voluntary approach to conservation and biodiversity-friendly forest management – has been the key to success in advancing ecological restoration in privately owned commercial forests.

O 103

Seasonal variations in photosynthetic activity of two calcareous fen moss species: fen restoration perspectives

Martin Küttim, Institute of Ecology, Tallinn University, ESTONIA

Tufa-forming spring fens are among the rarest mire types worldwide. Therefore, the protection and restoration of disturbed habitats has a great importance. The moss layer is diverse

and ecologically important: widespread moss patches ensure the open tufa-saturated peat, and are a fine substrate for the seedlings of several plant species. Thus, establishing the moss layer is a crucial task among other restoration activities.

The aim of the study was to understand the seasonal variations in the photosynthesis of two characteristic moss species for this habitat – Campylium stellatum and Scorpidium scorpioides – and to estimate the effect of the water table, ground frost, snow cover and distance from the springs on the stress level of the mosses. The chlorophyll fluorescence (Fm & Fv/Fm) of the chosen moss species was measured after every three weeks in the Paraspõllu calcareous spring fen (Northern Estonia) throughout the winter (from October to May) and compared with environmental parameters.

The springs kept the hollows unfrozen within few meters about a month after the surrounding area was frozen and also started to melt earlier in the spring, decreasing the cold stress. Scorpidium, which inhabits the flooded hollows, was more stressed by the freezing than the hummock-forming Campylium. High light intensity increased the stress level of both species. The photosynthetic activity (Fm) of both species was mainly governed by the water table, but in the opposite directions (correlations 0.558 with Scorpidium and -0.400 with Campylium). Snow has a protective and heat-keeping function in the autumn, but hinders the penetration of light and heat in the spring. The springs as a source of heat and calcium prolong the growing season and extenuate the freeze-thaw cycles. Therefore, it is essential to maintain the functioning of the springs.

O 104

Vegetation succession on ex-arable land in the Western Siberian Forest-steppe Zone

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Kathrin Kiehl

In contrast to grassland abandonment the abandonment of arable fields has many positive effects, e.g. carbon sequestration, vegetation recovery and species conservation. It is estimated that after the dissolution of the Soviet Union about 40 million hectares of arable land were abandoned in Russia, from which a large proportion is situated in the Western Siberian corn belt. Up to now only little information exists about the reestablishment of natural vegetation on these areas and about the factors driving vegetation succession. Because of its low relief energy farmland in Western Siberia is poorly drained and soil humidity was the major determinant for cropland abandonment. While arable fields cover the more elevated parts of the landscape, mostly following the naturally drained uplands of the fluvial terraces, ex-arable land can be found in the lower regions. Since 2012 we study the effects of land use change on vegetation diversity and species composition in arable ecosystems in the framework of the interdisciplinary Russian-German research project “SASCHA”. Our results emphasize the importance of ex-arable land for biodiversity especially at the landscape scale. With an average of 27 species per 100 m² the species richness of vascular plants was similar to near-natural grasslands. However, the establishment success of meadow steppe species was comparatively low. The successional pathway is mainly affected by land-use intensity at landscape

scale. In more intensively used landscapes ex-arable land is used for livestock feeding and vegetation development is partly influenced by sowing of competitive grass species. In marginal areas, where ex-arable fields are used sporadically or not at all, species richness and the proportion of steppe species are higher.

O 105

Young fen restoration, impacts on vegetation and greenhouse gas fluxes

Anna Laine, Department of Forest Sciences, University of Helsinki, FINLAND
Eeva-Stiina Tuittila, Anne Tolvanen

Primary mire formation is an on-going phenomena in the land uplift coast of Gulf of Bothnia. Mire succession series are classified as Critically Endangered (CR) in Finland and the young fens occurring in the region are unique ecosystems world-wide. Still, they are extensively drained for forestry purposes. In our study we investigate impacts of land-use change (drainage, restoration) on vegetation composition and GHG fluxes in young fens.

We selected six fens, which are estimated to be approximately 200 years old and represent the same successional stage. Two fens are undrained, two had been drained during the 1960's, and two were drained in the 1960's and restored in 2008 by blocking ditches and removing trees. Vegetation composition was studied before the start of the experiment and regularly afterwards. CO_2, CH_4 and N_2O flux measurements were made during growing season 2011 and 2013 using the closed chamber method.

Based on the NMDS ordination, the vegetation composition of the four drained sites differed from each other, and could be divided into two classes, namely open and trees. After restoration vegetation started to change towards pristine reference sites. Especially the cover of sedges increased. Photosynthesis was at lower level and ecosystem respiration at higher level at drained sites than in pristine sites, while restoration had returned the functions close to the pristine level. Our results indicate that five years after restoration the initial steps towards the successional pathway of peatland development have been taken, when considering both ecosystem functions and structure.

O 106

Restoration of threatened metallophyte populations in Katanga (D.R. Congo): lessons learnt

Soizig Le Stradic, Biodiversity and Landscape, Gembloux Agro-Bio Tech, University of Liege, BELGIUM

Maxime Séleck, Julie Lebrun, Sylvain Boisson, Guylain Handjila, Grégory Mahy

One of the current major challenges consists in integrating economic activities with environmental integrity. One of the world's largest concentrations of copper and cobalt deposits is located in Katanga (Democratic Republic of Congo) and represents an important source of income for the country. Unique communities and several endemic species are hosted on copper outcrops and are threatened by the extension of mining activities in the area. In theory, translocation or transplantation of structuring and/or endemic species is a suitable substitute to spontaneous succession and a good mean to rescue and conserve the more threatened species. Here we present the global framework developed with a mining company in order to conserve and restore the biodiversity of Cu-Co communities, including, translocation and transplantation of highly threatened species. We recorded low survival of translocated individuals. An alternative was then to produce seedlings of native species under nursery conditions for their later transplantation in degraded areas or for conservation purposes. However, we highlighted that the diversity of plant forms found in such tropical area limited the production of many species and poor understanding of many of these tropical plants often hampered their regeneration and their use in restoration. Transplantation results are not always reported, especially in case of failure, while such results appear as even more important than successes and have to be presented.

O 107

Is it worth the money? – Evaluating wetland management actions for waterbirds in South Finland

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Aleksi Lehikoinen, Kim Jaatinen

The value of ecosystem services provided by wetlands and waterbirds has been realized quite recently. In contrast half of the world's wetlands have been lost in the past century while ones remaining have degraded. In Finland it's suggested that declining trends of waterbirds favoring eutrophic waters result from general degradation of habitat quality. It is supported by the avian conservation values of nationally important wetlands which have declined less on sites where notable management has taken place. Yet only little evidence based knowledge is available on natural wetland management for waterbirds. In South Finland 18 wetlands were managed in years 2004–2012 to enhance the conditions of migrating and breeding birds. Management actions were to reduce vegetation by cutting, cattle grazing and dredging. To evaluate the actions for different bird guilds we used linear mixed models. Every guild benefitted on some of the actions whereas only piscivores showed negative effects. The total costs revealed overall actions to be favorable for dabbling ducks, geese, black-headed gull and especially waders. Separate analysis on endangered species revealed that not only common species were

to benefit from the actions. Only cattle grazing increased the presence of endangered species and in general showed best results. The beneficial results were crucial socioeconomically by showing that general funds were not wasted. The results suggest that the management should be sustained as otherwise the achieved results will be lost. We highlight the importance of management planning in a way that the effects could be properly assessed to provide evidence based information for the best local actions.

O 108

How much do alien species participate in contemporary human-made habitats? With special attention to archaeophytes.

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Human-disturbed sites can serve as refugia for some rare species but on the other hand can be vulnerable to be invaded by alien species. We have available a database which contains nearly 3000 vegetation samples, over 1,100 species and represents 22 main and 37 particular successional series running in various disturbed sites. The database involves extracted peatlands, sand pits, bulldozed sites in forests destroyed by air pollution, emerged bottoms of water bodies, corridors of former iron curtain, artificial fishpond islands and barriers, sedimentary basins, various spoil heaps from mining, stone quarries, forest clearings, road verges, ruderal urban sites, river gravel bars, and abandoned arable fields, located in various parts of the Czech Republic in central Europe. Phytosociological relevés were located in successional stages defined by their age ranging from 1 to 100 years.

How much do alien plants participate in the seres and how does their participation change in time? Are any relationships between the success and the residence time and origin of the alien species? In total, 219 non-native species were recorded in 1918 relevés. At least one of the non-native species occurred in 68% of the vegetation samples. There were 144 archaeophytes and 75 neophytes. Only 35 species are considered as invasive species. Numbers of all non-natives and numbers of archaeophytes significantly decreased with successional age. The most of non-natives originate from the Mediterranean area.

O 109

Urgent actions for the conservation of grasslans and pastures in the Gran Sasso -Laga National Park, Italy

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Pina Leone

The Southern slope of the Gran Sasso mountain is characterized by the landscapes of the high plain of Campo Imperatore and the higher alpine regions. This is a unique environment in Central Italy, due to the alpine features and due to the vast extensions of grasslands and pas-

tures. This area is home to a several habitats listed in the HD, also present also in the area of the Monti della Laga.

The wellbeing of the grasslands and of important animal species found there, is endangered by two main types of threats:

1. The extensive and improper livestock raising practices.

2. The unregulated presence of tourists. Many habitats are affected by this problem, all included in the HD. In addition, the Orsini viper (Vipera ursinii) and the chamois (*Rupicapra pyrenaica ornata - priority species) suffer from this problem.

Due to this situation the objectives of the project are:

- The long-term conservation of pastures through the application of correct pasturing practices.
- The management of tourism in order to limit indiscriminated access to high conservation value sites.

Actions and means involved:

- Collection and analysis of the community regulations for pasture management.
- Geo and photo database of the land use and the spoiled areas.
- Evaluation of the main livestock management problems for livestock breeders.
- Fencing mountain lakes to prevent access of livestock and construction of alternative water troughs.
- Structural interventions to improve extensive livestock raising.
- Negotiation between local Administrations, livestock raisers and Park management.
- Structural interventions to control the movements of tourism
- Itinerant dissemination of good practice to livestock raisers
- General information activities, a website and networking with other LIFE projects will aim to disseminate the project and to exchange experience with other similar initiatives.
- General project monitoring the success of the project through a post-hoc analysis.

O 110

Semi-natural dry-grassland conservation and restoration in Valle Susa (NW Italy) through grazing management

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Consolata Siniscalco, Laura Castagneri

The purpose of LIFE12 Xero-grazing project is the conservation and restoration of EC priority habitat 6210* “semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)”, within a representative area of SCI “Valle Susa xerothermic oases”.

Today the area is affected by a progressive encroachment by trees and shrubs resulting in changes of the habitat vegetation composition and structure. The main threats to habitat conservation are: lack of agricultural exploitation, due to the abandonment of traditional agro-pastoral activities; large amount of dead herbage mass; widespread shrub-tree invasion;

fire, occurring frequently because of dry climatic conditions; lack of conservation policies, although the site is located inside a protected area.

Nowadays the habitat still extends throughout large areas within the SCI and the last monitoring (2003) report a remarkable richness of orchids and rare, steno-Mediterranean species. Nevertheless urgent actions for its conservation and restoration are needed. The project aims at defining such actions and implementing them over 83 ha. In particular, sheep grazing by a service flock owned the SCI management authority will be used to restore and manage the dry grasslands after an appropriate adaptation of stocking-rates, stocking density, and the choice of the period more suitable for exploitation. The effects of soil fertility restoration and dead phytomass removal on the habitat will be monitored over a five year period. Moreover, encroached areas (20 ha) will be clear-cut, grazed, and the effects of vegetation clearing especially on orchids and other characteristic species will be assessed.

O 111

Rigorous long-term monitoring reveals the success of salmonid habitat rehabilitation

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Teppo Vehanen, Ari Huusko, Aki Mäki-Petäys, Timo Muotka

We used a spatially and temporally replicated design to assess the impact of in-stream habitat rehabilitation on the densities of three age-classes of brown trout in northern Finnish forest streams. Our design was based on three treatments: (i) boulder additions; (ii) boulders + large wood; (ii) unmodified controls, each in a separate section. The whole set-up was replicated across six streams. Annual monitoring was conducted during four periods: (i) before (3 yrs.) restoration, (ii) shortly after (<4 yrs.), (iii) 4–8 yrs. after, and (iv) long after (8–13 yrs.) restoration. Densities of all age classes collapsed because of a drought soon after restoration in all treatments, then started to increase, but only in the restored reaches. The positive density response was initially stronger in streams with added wood but this difference faded with time as densities in boulder-addition reaches also started to increase. Our study highlights the importance of long-term monitoring to detect the impacts of in-stream restoration on juvenile salmonid densities.

O 112

Restoration of ecosystem structure and functions for ecosystem services: the case of boreal spruce swamp forests

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Drainage to increase timber production has drastically decreased the area of pristine spruce swamp forests in northern Europe. In restoration, drainage ditches are blocked to restore the original hydrology and, ultimately, the structure, functions and ecosystem services of pris-

tine spruce swamp forests. We measured the effects of drainage and restoration on vegetation structure, Sphagnum growth and surface peat biogeochemical properties in undrained, drained and hydrologically restored spruce swamp forests in southern Finland. Drainage had taken place decades prior; the restored sites varied in their restoration age from 1 to 14 years.

As a result of favourable conditions and good growth capacities of the dominant Sphagnum species, Sphagnum mosses recovered in cover and biomass production rapidly in successfully rewetted sites. Species diversity was lower in the undrained sites than in the drained and restored sites: the competitively dominant Sphagna allowed less space for other species. The rapid accumulation of the Sphagnum biomass in restored sites predicts increasing CO_2 sink strength for the ecosystem. Due to the accumulation of the new organic matter, surface peat (top 30 cm) microbial activity of the restored sites recovered towards undrained levels over time. Meanwhile, rewetting increased NH_4-N mobilization and potential CH_4 production.

O 113

Ecosystem services of managed realignment at two UK sites

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Managed realignment is undertaken in response to the threats to coastal areas from flooding and to restore valuable intertidal habitat for biodiversity. The number of realignments is likely to increase in the face of sea level rise. Restoration of intertidal habitats also alters the balance of ecosystem services that sites provide: some, such as agricultural production, may be reduced, while others, such as recreation, may increase. It is important to quantify these differences so that the benefits and limitations of carrying out realignment can be understood, and to inform decision-making about realignment. Using TESSA (Toolkit for Ecosystem Service Site-based Assessment), the net provision of ecosystem services were assessed at two managed realignment sites in the United Kingdom. Ecosystem services (including carbon storage and sequestration, recreation, and agricultural production) were compared between the restored (realigned) state and the alternative of maintaining agricultural land behind hard sea defences. Preliminary results are presented, and the consequences of realignment for ecosystem services are discussed.

O 114

Discussion forums: a useful tool to bridge the gap between theory and practice in Restoration Ecology

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Ignacio Mola, Luis Balaguer

Restoration Ecology is an emergent and promising niche of work and economy development in Spain. Although this practical science has reached a degree of maturity that could guide practitioners in order to significantly improve their decision making, the truth is that there

some gaps in the knowledge transference chain that usually imped restoration ecology application. On the one hand, the governments and companies have a strong inertia in the way they interpret and compensate degradation associated with industrial development. Non-specific guidelines, coupled with a lack of ecological knowledge on ecosystem functioning and the importance of environmental service for human welfare, give rise to inefficient budget allocation that usually leads on to big waste of money long term and, what is worse, the absence of natural capital recovery. On the other hand, the difficult access of citizens to an understandable scientific knowledge in the context of ecosystem restoration and the benefits derived from it also complicates new solution demanding. In this sense, to generate multidisciplinary encounters oriented to scientific knowledge transference among different stakeholders may facilitate communication of ideas, identification of common problems and the establishment of synergetic relationships that give rise to efficient solutions that result in the practical application of restoration ecology concepts. In the present communication we introduce our experience with the development of discussion forums and main conclusions derived from them.

O 115

Towards a sustainable management of transport infrastructure: disentangling predator-prey interactions around motorways

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The 4-year CENIT-OASIS project (Sustainable, intelligent and safe motorway operation) funded by a consortium of companies and a Research agency had one action devoted to disentangling predator-prey interactions around motorways. The objective was to improve the knowledge of the ecosystem function around motorway in order to understand the effects of roads on wildlife. Thus, changes in relative abundances of small mammals, lagomorphs and carnivores around motorways were analyzed through sampling at regional (750x500km), county (60x60km) and local (5x1km) scales. The experiments show a cross-scale increase of small mammal abundance and a decrease in lagomorphs close to motorways. Moreover, other environmental factors driving the abundance of the former (mainly vegetation structure) and the latter (extent of right-of-way, vegetation structure and productivity) in road verges have been detected, with a potential application for impact prediction and to improve restoration and active management of transport infrastructure. In parallel, carnivores change their activity patterns around motorways with an increase in use by scavenger and anthropophilous species like red fox. Raptor communities are also altered close to roads, with a general increase in use and some species displacement. In all, our results show that vertebrate communities change near transport infrastructure with cascading effects from prey species to carnivores feeding on them. From an applied perspective, results call the attention to the potential of a proper infrastructure design, restoration and management of and their surroundings aimed to minimize changes in vertebrate populations to reduce the spread of edge effects from roads over the ecosystems they cross.

O 116

Long term monitoring of ecological restoration sites

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Aim

This paper reports on a study of the long term monitoring of marine and freshwater ecosystem ecological restoration projects which have been in place for more than 10 years in the Northeast region of the USA. The aim of this study was to determine what types ecological restoration projects were successful, or failed, and to determine restoration techniques which have been proven over time to be the most successful.

Methods

Over 40 wetland ecological restoration sites were visited which had been constructed between 10 and 50 years previously to determine the success or failure of the project. Criteria for a successful project included: whether the project met the restoration objectives; establishment of native vs. invasive vegetation; creation of proper hydrology; creation of wildlife habitat; and ecological stability. Types of ecological restoration sites evaluated were riverbank stabilization; freshwater wetland restoration; and marine restorations including salt marsh, coastal bank, and dune ecosystems.

Results

Restoration projects that had a specific design objective (e.g. creation of turtle nesting habitat, waterfowl habitat, rare species habitat, erosion control) were the most successful. Larger ecological restoration sites were generally more successful than smaller sites, probably due to higher construction and planning budgets, and post construction maintenance activities. Small ecological restoration sites which had little or no post-construction monitoring or maintenance had higher percentages of invasive plant species, or did not meet the original restoration goals. Ecological restoration sites with improper hydrology, was the most significant reason for failure of wetland restoration projects. The primary failures observed in riverbank restoration and riverbank stabilization was designs that did not include fluvial geomorphic assessments. The primary failure observed in marine ecosystems was severe storm events. Despite observed project failures, most ecological restoration projects were successful, or largely successful, in establishing native vegetation, wildlife habitat, and repairing erosion prone habitat.

Conclusions

Permitting conditions in the USA typically require post-construction monitoring for between two and five years which is not a sufficient time period for freshwater and marine ecosystems to become fully established with new hydrology and native vegetation. Invasive species management for at least 10 years after construction may be required to ensure the establishment of native vegetation, and the stabilization of the new ecosystem. Restoration sites not built for resiliency against tropical storms, hurricanes, and significant flood events experienced damage or complete failure whereas sites which were designed and constructed for extreme weather conditions showed little storm damage.

O 117

Quantifying impacts of in-stream habitat restoration on salmonid populations and stream fish communities

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In-stream restoration studies have reported inconsistent results on biological effectiveness. There is a clear need to summarize both positive and unsatisfactory outcomes of restorations. To address this need, we carried out a meta-analysis of restoration impacts on fish species in Finnish streams channelized for timber floating and restored during the last three decades. The main goal of restorations has been to increase nursery areas for salmonids. Our data consisted of two extensive electrofishing data sets: 1) data collected for the establishment of EU's Water Framework Directive (WFD) from natural, restored and degraded sites (n=1200), and 2) before-after data gathered in different restoration projects (n=95). Presentation includes results on 1) whether restoration had a short-term and/or long-term impact on the abundance of Atlantic salmon and brown trout juveniles; 2) whether the structure of fish communities and the natural reproduction of salmonids could be explained by differences in habitat structure, and 3) which factors (e.g. geographical location, water quality, geology, river basin size, watershed land cover and land use) best explained restoration success. Preliminary analysis indicates that young-of-the-year salmonid abundances were higher in restored and natural study sites than in degraded sites. We will discuss our results in relation to WFD, particularly if restoration measures may cause a shift in ecological status from "impaired" to "good".

O 118

Functional recovery and dynamic monitoring of degraded soils: BIOREM experience

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The BIOREM project (LIFE11/ENV/IT/000113) will demonstrate an innovative integrated methodology for the restoration and the biochemical monitoring of degraded soils. In terms of soil remediation, the project objective is to evaluate that the BIOREM restoration strategy can successfully restore degraded soils, enhancing physical-chemical properties and biochemical activity and increasing soil fertility. This result will be obtained by integrating addition of exogenous organic matter, autochthonous plants (Pino halepensis and Pistacia lentiscus) and spontaneously plant cover that will be expected to develop on the soil in a short time due to the organic matter addition. In terms of soil monitoring, the project objective is to demonstrate that the BIOREM innovative monitoring system can provide a faster, more thorough, dynamic monitoring of soil conditions and processes, extremely useful for the development and planning of precisely targeted, long-term restoration strategies and policies. The LIFE program is key to the development of better environmental policy and provides support to all the people and organizations working to make sure that legislation results in an improvement of the environmental situation in Europe. The LIFE program promotes the sharing of knowl-

edge, the dissemination of best practices and a better compliance with the regulations as well as public awareness campaigns. The LIFE program has a significant role in the implementation of major legislative initiatives of the European Union in the environmental field. In particular, the LIFE projects in the fields of soil are extremely incisors to achieve direct environmental benefits.

O 119

Restoring landscape connectivity for Vicugnas in a mining operation in Northern Chile

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Wildlife roadkills are a frequent outcome of traffic increase in remote areas where mining takes place and it is an issue of special concern when species involved are of conservation interest. We present the case from one of the country's largest copper mines operating in Tarapacá Region, Northern Chile. The company starrs an interesting example in the dealing with this problem and aims as final objective the restoration of ecological connectivity of the protected Vicugna vicugna. At the first stage when confronted with a growing number of this camelid roadkills, the company conducted an awareness campaign among workers. The campaign was relatively successful and reduced the number of collisions by 55%. In a second phase, a scientific assessment has been carried to better understand the problem and to propose mitigation measures. The spatial and temporal distribution of roadkills was analyzed so that 5 conflictive sectors of roads (total 9.9 km) were detected as well as the most dangerous moments of the day and the year. Vicugna habitat and movements were also characterized through two sampling campaigns (august and december 2013). The data have been used to determine the environmental variables leading habitat selection and displacements of the species and overlapped with roads. Thus, potential corrective measures and optimum locations have been identified. In a third stage to be started in the near future, new improved seminars for the personnel will be held to provide them with specific protocols, and the corrective measures to restore the connectivity of the landscape for vicugna will be implemented.

O 120

Restoring a flooded meadow in Central Estonia. Can we aim at benefits for fish and plant communities at the same time?

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Ott Luuk, Martin Zobel

In 2011, two EU funded projects aimed at two restoration targets on the same area – a floodplain grassland of >300 ha and a re-connection of ten river meanders (oxbows) to the River Emajõgi in Alam-Pedja NR, Estonia. For the first target, simple means of clear cutting the shrub overgrowth and re-initiating mowing were used. For opening the oxbows, sediments were excavated and deposited on adjacent flooded meadows.

Our research focused on the vegetation recovery on the sediment deposition sites, targeting two questions: 1) Do these areas pose a threat to adjacent flooded meadow vegetation, e.g. through possible invasions? and 2) How does the plant community assembly change within time? We monitored the vegetation before (0-yr) and after (1–3 yr) sediment deposition. The 0-yr vegetation was species poor and dominated by tall Cyperaceae and Poaceae. By 1-yr, the average richness increased from 6 to 22 species per plot, and did not increase thereafter. There was a significant influx of both ruderal and non-floodplain species - species either not present in the vegetation of the same floodplain or not marked as characteristic to flooded meadows of Estonia in the list of characteristic semi-natural grassland species. Nevertheless, none of these "unwanted" species started dominating on the deposit sites which could pose a threat to adjacent meadows. Studying different species traits, we discovered that community assembly is mainly driven by competition, and not environmental filtering (annual flooding).

The ichtyological research revealed that fish abundance and species richness in the oxbows increased. Most likely, this can be attributed both to free passage from main river to the oxbows and improved gas exchange.

In conclusion both projects were successful and did not have contradicting goals.

O 121

Terrestrial ecosystem restoration in Arctic for carbon protection and GHG reduction: approaches and perspectives

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The project Clima East: "Supporting Climate Change Mitigation and Adaptation in Neighbourhood East and Russia" is a European Union funded project package assisting the Eastern Neighbourhood Partnership Countries and Russia in approaches to climate change mitigation and adaptation.

The UNDP-Komi project office is implementing the component "Protection and restoration of forest and peatland permafrost carbon pools in Komi Republic and Nenetsky Autonomous Okrug". The project team is aiming to develop, test and integrate ecosystem based methods into existing routine practice of land rehabilitation related to the different stages of oil and gas development projects' decommission. To successfully apply ecosystem based methods and practices for restoration the following principles should be applied: rehabilitation should be aimed on restoration and maintenance of ecosystem functions; clear understanding of the ecosystem functions and structure is required; principles of Green engineering should be applied, enhancing and ruling the natural processes; the methods of indication and modelling the long term successions should be used; the adaptive management principles based on detailed monitoring and assessments should be applied. The pilots in the Nenetsky Authonomus Okrug (North-West European Russia) included rehabilitation activities in the permafrost peatlands and shallow peat tundra habitats and different types of the transformed landscapes such as: drilling pads, temporary roads, winter roads and sand pits. The applied 'Green Engineering' or 'landscape engineering' rehabilitation approaches were based on hydrology, soil temperature and vegetation dynamic succession models. The first practical restoration results based

on the monitoring of the basic ecosystem parameters were obtained. For assessing the project performance, a base line study was performed. The baseline study included the descriptions of pre-project natural and transformed ecosystem characteristics, including an assessment of the relation of structural and functional parameters within the characteristics of hydrology, temperature, carbon storage, GHG fluxes and biodiversity. Losses of ecosystem functionality were estimated for the transformed ecosystems. To determine the overall project performance in the longer term, the base line will be compared to the project results.

O 122

The experience of a large scale rewetting project for climate change mitigation and adaptation

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The project "Restoring Peatlands in Russia – for fire prevention and climate change mitigation" financed under the International Climate Initiative (ICI) by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) is aimed at restoring thousands of hectares of abandoned drained peatlands in Russia. The project applies innovative ecological approaches and international experience of rewetting, particularly from Germany. The project activities complement the governmental programme of rewetting of more than 70 thousand hectares of fire vulnerable transformed peatlands, which Moscow Province started after severe fires in 2010. Hence, project task was also to assess the effectiveness of hydro-technical measures for large-scale rewetting. Main questions to be answered while implementing a number of pilot projects are: whether large scale peatland rewetting and restoration activities are effective for GHG reduction; whether integrative goals could be achieved simultaneously, including habitat restoration for biodiversity conservation and climate change mitigation; whether ecological fine-tuning of implemented hydro-technical rewetting schemes is possible; whether integrated ecosystem-based approaches of peatland restoration could be reconciled with varied stakeholders' interests and national legislation in Russia; whether applied methods of GHG reduction evaluation are compatible with MRV methods and criteria; and whether economic incentives related to the voluntary carbon market are feasible in peatland restoration projects in Russia. Different methods of monitoring and evaluation of rewetting effectiveness, based on remote sensing techniques and regarding both fire prevention and GHG assessments, are under development,. In addition, direct monitoring of water level and GHG fluxes are carried out in the pilot areas, including impacts of landscape elements such as overburdens and ditches as well as carbon loss assessments after peat fires. The scientific and practical results of this large-scale project could be expanded to other restoration projects. Furthermore, this project supports development of methodologies for GHG inventories under UNFCCC and IPCC, and enhances integration of peatland restoration projects into national climate change mitigation and adaptation programmes.

O 123

Restoration of *Calluna vulgaris* on grass-dominated moorlands: the importance of disturbance, grazing and seeding

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Aim
Evaluation of restoration methods (disturbance, seeding treatments and grazing regime) to restore Calluna vulgaris on acid grassland after ten years of treatment.

Method
A replicated plot-scale experiment was set up to examine effects of disturbance and seed addition on C. vulgaris establishment in a Nardus stricta grassland under three grazing regimes: sheep only (1.5 ewes ha^{-1} for 10 months per year); cattle only (0.5 heifers ha^{-1} in summer only); and, the cattle regime combined with sheep (1.0 ewes ha^{-1} for 10 months per year).

Results
Disturbance to create bare ground increased Calluna establishment. In seeded plots, C. vulgaris plants had greatest above-ground height, dry weight and shoot length if grazing was excluded or the cattle-only regime was applied. C. vulgaris cover was greatest, and increased most, in plots that had been disturbed, seeded and ungrazed or subjected to the cattle-only regime. The vegetation in these plots also became more similar to reference sites with 50% or more cover of C. vulgaris. After eight years the grazing was removed. After two years of no grazing on all plots C. vulgaris cover was still greatest in plots that were previously only grazed by cattle or ungrazed but on plots that had previously been grazed the rate of increase in C. vulgaris cover was greater in this two year period than in the previous 8-years, indicating that grazing had been suppressing the spread of C. vulgaris.

Conclusion
Correct grazing regime, seeding and creation of bare ground is essential for restoration success.

O 124

Landscape scale restoration: the salvation of European dry grassland biodiversity?

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Species-rich dry grasslands in Europe have suffered losses in extent and diversity in the last 50 years. Their conservation requires maintenance of remaining grasslands and restoration of lost or damaged grasslands. We report on landscape-level restoration studies and case studies from dry grasslands in contrasting regions of Europe to discuss the strengths and weak-

nesses of the approaches, the results achieved and the costs and benefits. We conclude that landscape-level restoration offers exciting new opportunities to restore biodiversity and landscape connectivity in Europe's dry grasslands. There are now drivers for large-scale restoration written into the 2020 targets of the Convention on Biological Diversity and the European Biodiversity Strategy. However, a more integrated approach to large-scale ecological restoration is needed for the development of policy tools to achieve the greatest benefits from restoration at the landscape scale.

O 125

Native root-hemiparasitic plants can suppress expansive grass Calamagrostis epigejos: experimental evidence from different habitats using *Rhinanthus alectorolophus*

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Calamagrostis epigejos is a clonal grass with underground rhizomes. Due to its highly conservative resource use strategy and efficient nutrient resorption, it produces a thick layer of slowly decomposing litter, which prevents establishment of other species. Its recent expansion to both (semi)natural and restored grasslands is one of the main threats to plant diversity in Central Europe. Grazing and intense mowing are recommended to suppress its dominance. Grazing is difficult due to low fodder quality of C. epigejos and avoidance by livestock. Intense mowing (2–3 times a year) can have a negative impact also on co-occurring plants of high conservation value.

In a pilot experiment, we had demonstrated that C. epigejos is a very good host of root-hemiparasitic Rhinanthus species. Therefore, we designed a series of experiments aiming to test whether Rhinanthus alectorolophus is able to suppress C. epigejos dominance. The randomized block experiments were established in three different habitats.

R. alectorolophus significantly decreased biomass production and cover of C. epigejos, which suffered up to drastic damage at some plots. The hemiparasites had significantly more negative effect on C. epigejos than mowing.

Native root-hemiparasitic species of genus Rhinanthus seem to be a suitable tool of biological control of C. epigejos. Further research should aim on long-term effect of Rhinanthus and test its practical applicability in the landscape context.

O 126

REAGRITECH LIFE11_ENV/ES/579 – constructed wetlands for diffuse pollution control from agricultural water runoff

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In recent decades, the agricultural practices have increased their performance so significantly through intensification of production methods. The most significant impacts were water consumption and increased load of nutrients in aquifers.

The application of nitrogen fertilizers in agriculture has the purpose to increase crop production. Between 50 and 80% of nitrogen present in the water is contributed by the runoff from the cultures. This contamination has caused a sharp increase of nitrate vulnerable zones.

In order to minimize these impacts, a constructed wetland system was designed in order to control and treat the agricultural runoff. In order to decrease the diffuse pollution from nitrate fertilizers, a 100% of the treated effluent will be recirculated and reused for crop irrigation.

The biological sizing of the wetland was done with the PKC * method, based on the model of first order kC*. The system will be built in the 2014 spring, and the first results will be obtained during the fall. The design objective is to obtain effluents with a 95% reduction of the organic pollution (BOD5), and a decrease of 50% in the nitrogen content.

The use of constructed wetlands, where the 100% of the effluent recycled will be treated are effective to control diffuse pollution from runoff, in order to be reused for crop irrigation and, at the same time, to reduce agricultural water consumption.

O 127

What tell us initial species composition about the future progress in the spontaneous succession?

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In Central Europe, spontaneous succession is an effective way for the restoration of disturbed landscape such as post mining areas. The restoration schemes, however, often miss the spontaneous succession, because its outcome is unpredictable at sufficiently fine spatiotemporal scale. Exploration of restoration area prior the setting of the restoration scheme may overcome this disadvantage, but the predictions are still mainly based on the informal estimations of experts. Formalization of the expert knowledge may improve the applicability of spontaneous succession in the practice.

We tested whether plant traits may predict the progress in the succession in Sokolov Coal Mining District. We set up permanent plots at 5 post mining sites differing in age and moni-

tored vegetation for seven subsequent years. We focused on three early successional sites 4, 12, 17 years old (time since heaping in the year of first record in 2007). The two older sites (20 and 45 years old) were taken as the target stage. We described the vegetation changes by Bray-Curtis similarity index. We tested whether the functional traits of the initial plant community - expressed by community weighted means of 4 traits (woody/non woody growth form, annual/perennial life cycle, ability of clonal growth, presence/absence of taproot during whole life cycle) - predicts later successional changes.

We found that the development of the early successional vegetation towards the later successional stages was more dynamic when species with taproot were abundant. This indicates that simple plant traits can be good predictors of the succession.

O 128

Ecosystem services as a framework to determine costs and benefits associated with different restoration scenarios for Lake Rotorua, New Zealand

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Lake Rotorua (North Island, New Zealand) has a history of eutrophication as a result of increases in external nutrient loads from point-source and diffuse pollution. Management responses towards restoration efforts have focused on reduction of diffuse-source pollution from agricultural nutrient run-off and in-lake interventions using Alum dosing of inflows to flocculate and inactivate phosphorus. In this study ecosystem services provided by Lake Rotorua are identified to serve as a framework for a valuation of water quality and to allow comparisons against costs of different catchment remediation and in-lake treatment options. A hydrodynamic-ecological lake model (DYRESM-CAEDYM) was used to provide water quality scenarios for years 2031–39 in response to different management scenarios including Alum dosing and reductions in nutrient inputs from the catchment. The objective of the study was to evaluate what costs were associated with the different scenarios. Costs included social and ecological damage costs, and abatement costs. Social damage costs were assessed from loss of income from tourism, recreation and property values. Ecological damage included costs caused by algal blooms and decline in habitat quality for aquatic fauna. Abatement costs were associated with application of techniques to reverse eutrophication in the lake, wastewater treatment plant upgrades and land management change. Our comprehensive analysis of the relative costs and effectiveness of measures to reduce nutrient loads to the lake can inform management changes at the catchment scale. The scenarios can be used to help inform management subject to a collaborative consultation process proposed by central government as part of a national water reform process.

O 129

Improving the conservation of dehesa ecosystems by promoting management policies and tools through Life+ bioDEHESA

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Dehesas are considered types of open oak forests traditionally transformed by humans to obtain pastures for livestock, resulting in a high nature value agro-silvicultural system providing a number of ecosystem services to the society. However, they have recently been in decline because of abandonment, agricultural intensification or unsuitable practices. Hence the importance of developing specific regulations, policies and tools.

The European cofinanced project Life+ bioDEHESA (Life11BIO/ES/000726), involving most of the stakeholders, aims to enhance the sustainable and integrated management of dehesas in order to improve the situation of biodiversity through the dissemination of demonstrational actions that address the main challenges related to their conservation.

Amongst the vast Andalusian dehesa area, 42 properties have been selected according to concerted criteria. An Integrated Management Plan has been drawn up including every different approach involved in a dehesa farm, and was applied on those exploitations in order to be tested before legal approval. Cooperation agreements will then be signed with landowners, since concrete conservation measures will be implemented in this Pilot Dehesas Network dealing with woodland renovation, rational pruning, livestock and hunting species management, improved grazing, pastureland management, soil and water conservation, control of forest pests and diseases and habitat diversification. The effects of those actions will be monitored and evaluated through appropriate socio-economic and environmental indicators.

O 130

Research of the former brown coal mine Most flooding from the point of view hydrobiology and littoral zone ecosystem

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During flooding of the Lake Most, has proceeded monitoring of ecosystem and littoral zones with a target to formation and character of biocenosis. In littoral zones we provide botanical and zoological research. Samples for hydrobiological analyses are taken from forming lakeshores and different water heights in the Lake. Index of saprobity, biomass volume, chlorophyl-a, pH and conductivity are measured. In the surroundings of the lake, 340 species of vascular plants were found. There are artificial grasslands and plantings of bushes and trees above all; but some valuable vegetation types such as halophytic communities or small springs with rare wetland species also appear. Relative diversity of the area is conditioned also by a presence of different stages of succession and low-nutrient patches. In the observed period 2011–2014, it was found a total of 146 species of birds. In terms of ornithology it is significant gath-

ering, especially of water and wetland birds, in the winter time and in the migrating period. It is also significant area of rare bird's species.

O 131

Arbuscular mycorrhizal fungi: key to successful grassland restoration?

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Arbuscular mycorrhizal fungi (AMF) are ubiquitous plant root symbionts and are known to have essential effects on plant community assembly in most terrestrial ecosystems. Especially during succession presence or absence of fungal symbionts can accelerate shifts in plant communities. Restoration of grasslands often aims to stop succession in favour of an early stage of the ecosystem i.e. open and species rich. Thus the question arises to which extent AMF influences success of grassland restoration. We investigated plant and AMF communities in three successional stages of calcarous grassland (I. open grassland, II. grassland partly overgrown and III. completely overgrown by pine) and in one heavily disturbed ecosystem (limestone quarry) in West Estonia. AMF communities in soil and root samples were characterised by 454-sequencing of the SSU rRNA gene. Fungal taxa were identified by BLAST matches against a custom-made annotated sequence database (MaarjAM). AMF abundance was estimated from neutral and phospholipid acids. Our data allows us to understand patterns of successional change in AMF and plant communities as well as in AMF-plant associations. Based on this knowledge we are able to give implications for practical grassland restoration i.e. cost, benefits of AMF inoculation into restoration projects.

O 132

Policy issues in forest restoration efforts: lessons learnt from large-scale projects in the mountains of northern Vietnam

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Increasing rate of deforestation and concomitant land degradation affects livelihoods of millions of people in (sub)tropical regions, particularly in the ecologically fragile mountainous areas where shifting cultivation has traditionally been the major land use. Like many other SE Asian countries, Vietnam has, during the last 20 years, embarked on two ambitious nationwide reforestation programs which relied on active involvement of ethnic minority farmers in restoring the upland forests (contract-based allocation of user rights). Despite the resulting increase of net tree cover (mostly due to monospecific exotic plantations for industrial use), these efforts have had unsatisfactory impacts both on poverty alleviation and environment protection. Moreover, the ecological aspects of so-called "barren hills" (the keyword for degradation of mountainous forest land) have been largely ignored, what turned out to have important implications for the overall policy success.

Based on case studies in two provinces (ecological assessment of degraded sloping land with different secondary vegetation, and participatory surveys with local farmers) we shall discuss how top-down and arbitrary land allocation, failure to acknowledge the importance of secondary vegetation for the dominant land use system, and low participation of local communities, underpin the complex ecological changes - most prominently habitat xerophytization. We shall illustrate how land use policy failures at the microlevel can drive farmers into unsustainable investments which might arrest the fallow succession and additionally compromise the forest restoration efforts at larger scales.

O 133

Effect of flooding regime on spontaneous restoration of alluvial land degraded by fluvial deposition of mine tailings: to dam, or not to dam?

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The barren floodplain of the Timok river in Eastern Serbia, severely degraded by large-scale fluvial deposition of sulphidic Cu tailings over arable fields during 50 years and left on its own, provides an exciting "accidental experiment" site to study the possibilities and constraints of passive restoration. We have conducted soil and vegetation surveys on two types of localities there: sites where flooding was regulated by dam construction within a decade from the onset of pollution, and sites where natural flooding regime has been allowed during 70 years. Flooding had a major effect on restoration process: while natural flooding created a thick layer of waste deposits which irremediably changed the soil, it also drastically accelerated the vegetation succession once the pollution input finally ceased (about 20 years ago).

The primary succession had very different patterns. Sites with natural flooding supported denser poplar alluvial forests, ruderal and nitrophilous undergrowth with higher species number and increasing importance of local floral elements. On the other hand, revegetation of acidic, nutrient-poor sites where further flooding was eliminated was far slower (despite the less damaged soils), relying on novel, sparse aspen-birch formations atypical for the calcareous continental surrounding, with few accompanying non-ruderal, xerophytic species.

Our findings indicate that passive restoration can depend more on continuous nutrient input by flooding than on total pollution load in soils. We shall discuss its relevance also in the context of global climate change which currently affects revegetation of this locality.

O 134

Locating drained peat lands for restoration using Zonation spatial prioritization methods

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Locating drained peat lands for restoration can be seen as a typical conservation prioritization problem, where the aim is to allocate limited resources in the most effective way. Spatial prioritization methods that apply optimization and decision-theoretic techniques have been developed to find the best spatial allocations of effort from amongst numerous alternative candidates. We here present an approach that utilizes the Zonation software, multi-source data and co-operation with peat land experts.

This analysis is part of the EC-funded Life+ project, NATNET, one aim of which is to restore 750 ha of drained peat lands in South-West Lapland. The study area covers 126,619 ha drained peat lands in 57,936 patches and thus potential for restoration. Forest planning data on drainage, site type and growing tree stock volume were used as primary inputs. Additional ecological characteristics were derived from digital maps. Connectivity to alkaline fens and ecologically valuable undrained peat lands (as defined by Finnish Environment Institute) were set as the most important spatial goals.

By changing weights for different criteria we produced analysis variants that responded to different restoration objectives. The highest ranked 1% of the patches limits potential targets to some few thousands of hectares. By changing weighting it was possible to emphasize different ecological characteristics and connectivity to desired peat land types.

The Zonation framework provides an effective way to simultaneously balance many ecological factors to respond to varying planning objectives. Because of inevitable deficiencies in data and certain poorly measurable characteristic of peat lands prioritization analyses need to be developed, evaluated and used in close co-operation with experts on peat lands and habitat restoration.

O 135

The process of evaluating ecological restoration

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Evaluation of ecological restoration is not a single event but a continuous process that occurs throughout the planning, implementation and monitoring phases of a restoration project and even after its completion. Evaluation is an important tool for optimizing ecological restoration, and it should be made an integral part of every restoration project. In other words, people involved in the different restoration actions should be part of the evaluation. Documentation is a necessary part of any evaluation. If evaluation steps are properly described and justified, the lessons learned will then more easily be transferred to other projects and their evaluation will be facilitated. To make evaluation even easier, funding and legislation should be modified to ensure that a proportion of the funding for restoration projects is earmarked for evaluation. We do not propose that evaluation is the panacea to fixing all problems associated with restoration, at least not in the short term. Recent studies have provided examples of when evaluation of monitoring results has failed to demonstrate any effects of restoration. However, this does not necessarily mean that restoration is imperfect; it could also indicate that evaluation is inadequate and in need of improvement. Developing evaluation generally and at each of the steps identified in this paper would be an important first move in such a process.

O 136

The Science for Society Solutions (S4S) initiative: Bringing the tools of translational science into the mainstream of restoration ecology

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Susana Bautista

Despite significant scientific advances in restoration ecology, moving research to practice and educating the public on the environmental challenges of our time remain major challenges. Unfortunately the perceptions many scientists typically have concerning what constitutes effective educational outreach are frequently based on false assumptions regarding how and where we learn, how science is effectively communicated, how what is learned is interpreted and used, how ideas and technology spread, how decisions are made, and what leads to effective public participation. Scientists seeking to disseminate knowledge embrace outreach (without inreach) and awareness raising (without engagement), which are supply (rather than demand) driven processes. The flow of knowledge is primarily unidirectional, with limited consideration for the interests, needs, constraints or knowledge of the target audience. There have, however, been significant advances in bridging knowledge systems and the science-society gap through a "translational science" approach to the transfer, exchange and spread of ideas and technology. The facilitation and translation of information and meanings among stakeholders can lead to the co-production of knowledge, informed decision making and more effective use of the products of scientific discovery. The Science for Society Solu-

tions (S4S) initiative seeks to address this challenge by developing mutually beneficial access to the state-of-the-art approaches for effective science translation, knowledge transfer, stakeholder engagement, decision aiding and the diffusion of innovation. The intended outcome: empower scientists and practitioners (public & private) to make science more relevant and responsive to society.

O 137

Restored limestone quarry as a refuge of biodiversity and an attractive place for educational purposes

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Monika Wosik

After the material extraction, the area of Lipowka Limestone Quarry (Rudniki, Poland) was partly restored and for 24 years has been subject to natural succession. Once the biological and ecological investigation was carried out in 2011, the 50ha area revealed exceptional scenic qualities, both diversity and richness of nature.

Aim
The originally agricultural area was returned to the local community with a new function and ecological values. The plant, located in a densely populated area, in the vicinity of schools became an attractive tool for education of children and youth.

Methods
In order to present the most interesting parts of the quarry, with special emphasis on plant and animal species, their habitats and geological attractions, a trail with 16 educational boards was set up. Additional educational materials supporting the trail were published (audio guide available online, program of activities and list of various assignments connected to the particular trail stops).

Results
In 2013, Lipowka has been visited by many organized groups and individual guests. Several events of different type (educational/questing/sports/voluntary projects) have taken place in the quarry so far.

Conclusion
The industrially exploited and finally restored area became a local refuge of biodiversity and an attractive place for education.

O 138

Integrating traditional ecological knowledge and restoration ecology; how the spiritual component of TEK contributes to or hinders collaboration.

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Aim
This investigation considers the role of spirituality in helping or hindering integrating Traditional Ecological Knowledge into Ecological restoration projects.

Methods
This investigation utilises survey results and recent qualitative research on restoration ecologists, and tribal representatives in the US to shed light on incorporating TEK into restoration projects.

Results Conclusions
Throughout the world a growing number of restoration ecologists in public and private organisations are working with First Nations, Tribes and indigenous people to incorporate traditional ecological knowledge (TEK) into ecological restoration. Both ecologists and First Nations benefit from increased communication, increased knowledge about the habitat, and by developing allies in an era of biodiversity collapse. Accepting TEK has been a slow process for the western scientific community and US government agencies in particular. At the same time indigenous people are careful to allow access to long held culturally relevant information. One aspect to integrating TEK is rooted in the spiritual component. Western scientists trained in positivist research methods may have some reservations about knowledge connected to theology or cosmology. From a First Nations perspective, if restoration does not include a spiritual component it is incomplete and thus western methods are suspect. This research investigates how prevalent the biases are to integrating TEK and what may be at the root of the problem. One surprising insight is that restoration ecologists and the leaders in indigenous communities seek a very similar end point – completeness, balance or wholeness. The spiritual aspect to TEK often plays a key part in either obstructing or facilitating the interaction between groups who, in the end, are allies in restoring ecological systems.

O 139

Using biochar for soil restoration activities

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Joanne Tirocke

Soil restoration activities are often hampered by high bulk density and low precipitation. However in many forest areas there are millions of dry tons of excess biomass. Although biomass supply is plentiful, finding an economically viable and environmentally sound way to use it for bioenergy production has been difficult. Currently, most non-merchantable forest residues are burned at log landings. These practices waste energy, emit pollution, release carbon and negatively affect nutrient cycling. Mobile, in-woods, fast pyrolysis offers opportunity

to add value to non-merchantable biomass, provide energy, and reverse these negative environmental aspects. Field trials in North America have shown that biochar additions to many forest soils can decrease soil bulk density and increase soil water holding capacity, thereby increasing planting success. However, care must be taken to understand the site specific soil and biochar interactions.

O 140

Stream restoration outcomes: what is being measured? What should be measured?

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Kelly Hondula

Ecologists have long wrestled with the thorny problem of defining success in a restoration context. The Society for Ecological Restoration identified key attributes of successful restoration that fall into four main categories: 1) species composition, 2) ecosystem function, 3) ecosystem stability, and 4) landscape context. They further defined potential indicators for each category that could be used to assess the outcome of projects in the field. Stream ecologists have identified a number of indicators that can be linked to these categories and should provide guide to appropriate identification of metrics for measuring project effectiveness. In reviewing the outcome of >800 stream restoration projects, we found that the most common project goals were related to increasing biodiversity (27%) or habitat quality (17%), improving riparian habitat (11%), stabilizing channels (21%), and improving water quality (19%). Despite these somewhat common goals, these projects used over 500 different evaluation metrics to assess project outcome. In summarize these metrics for the presentation, we pooled them into logical groups that included structural and functional measures. Physical indicators such as channel morphology and in-stream habitat are the indicators of effectiveness most commonly reported despite ecological consensus that channel form is not an indicator of ecological outcome and is rarely linked to biodiversity in streams that have been restored. Our data synthesis showed that even when channel stability was the goal (e.g., to protect infrastructure) and stability was field-assessed post-restoration, the outcome was extremely poor unless the project implementation was primarily riparian planting. We also found that improvement in ecological status was not very common when projects used structural biological indicators such as species richness or abundance. Studies using indicators of hydrologic or biogeochemical functions to assess project outcome exhibited a higher success rate. How can we determine when such metrics really indicate success (or failure) of a restoration project vs. failure to select the most appropriate metric to assess restoration? Clearly, we need to put a great deal more thought into what we are measuring, how it is linked to project goals, and if the measure is sufficiently sensitive to provide useful information on the trajectory of the restored sites.

O 141

Distribution of threatened plant species in boreal peatland habitats: a modeling approach

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Knowledge on spatial distributions of species within a landscape, and environmental factors affecting species distributions has an important role in land management and regional conservation assessments. Habitat suitability modeling is a key method in environmental and ecological research with a growing amount of different techniques and statistical approaches. Habitat suitability modeling provides the basis for different research questions including: evaluation of habitat quality, prediction of biodiversity patterns and forecasting species distribution patterns for changing environmental conditions.

The specific aims of this work were to model and scrutinize how the occurrence of threatened mire plant species is affected by different environmental correlates in boreal mire landscape (Northern Finland). The study was performed using a dataset of threatened plant species and different existing and readily available environmental data sources.

Models can help in determining which aspects of the environment have a critical impact on the spatial distribution of a given species, and thus advance our understanding of the ecological requirements of the species. Predictive habitat suitability models provide also a useful basis for planning management practices, including conservation efforts, as well as help in focusing field surveys.

O 142

Effects of forest restoration on species recovery: Polypores as an example

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Polypore communities were studied in old-growth forest stands and in "restored" (fire and wind-fall areas) stands in three regions in southern Finland. These three regions represent different areas in respect to spatiotemporal continuity and connectivity of source areas (natural or semi-natural forest) and amount of coarse woody debris. We show that the quality of forest landscape largely determines the success of restoration in terms of recovery of red-listed species. The mean numbers of red-listed species of wood-rotting fungi and their occurrences were clearly the highest both in burned and windfall stands in northern Karelia where landscape quality was highest, and the lowest in those of south-western Finland where landscape quality was lowest. The large differences in the numbers of red-listed species between these regions remained when the effect of stand characteris-tics (e.g. amount and quality of dead wood) was accounted for. In addition, the mean numbers of red-listed species of wood-rotting fungi in old-growth stands were the highest in northern Karelia, and clearly much higher than in south-western Finland. Region and diversity of dead wood were the most important

variables affecting to the occurrence of both red-listed and common species in our data. In addition, local landscape connectivity was found to be a significant variable determining the occurrence of red-listed species but not the occurrence of common species.

O 143

Do sparse tree stands maintain disturbed hydrology in forestry-drained, low-productive peatlands?

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Forestry ditching has been a significant form of land-use even on low-productive peatlands in Finland. Due to poor wood productivity and environmental risks of ditch maintenance, there is a growing interest in restoring these sites. Restoration of hydrology is a key factor in these efforts. The impacts of restoration options - i)leaving sites without measures, ii)biomass harvesting+abandonment from forestry, and iii)active restoration measures - are addressed in a new LifePeatLandUse project. In all options, partial retention of tree stands may be feasible. Reduced canopy cover may, however, be needed for initiating the restoration process as evapotranspiration is known to maintain increased depths to water level (DWL). Here we aim at uncovering the interactions of DWL and various levels of stand stocking by applying simple correlation analyses in forestry-drained pine peatlands located in north (humid) and south (less humid) boreal conditions. In boreal regions, drainage and evapotranspiration are known to affect DWL mostly during July to August. Our results showed a very poor or no correlation between tree stand basal area (0–15 m²/ha) and August DWL in northern pine peatland stands. In the southern sites where the ditches were largely blocked by vegetation, even a moderate reduction in tree stand volume or canopy coverage significantly decreased late summer DWL, and resulted in clearly larger fluctuation of DWL owing to rainfall events. This impact, however, levelled off after a few years, probably due to the fairly rapid recovery of stand foliar biomass. Our results suggest that successful restoration of hydrology in south boreal conditions calls for fairly heavy cuttings of tree stands. In the north, the level of retained stand stocking is of minor importance.

O 144

Boreal Peatland LIFE – restoring valuable peatland habitats in Finland

Jouni Penttinen, Natural Heritage Services, Metsähallitus, FINLAND

In large parts of Finland over 75% of the original peatland area has been drained for forestry. Drainage has profound effects on function and diversity of mire ecosystems, mainly due to changes in hydrology. Active restoration actions are required to counteract these negative effects and to conserve biodiversity and peatland habitats, to improve the quality of protected areas and to re-establish long-term carbon sequestration into peat.

The Boreal Peatland LIFE project (running 2010–2014) is the biggest peatland restoration project in Finland up to date. During the first four years of the project more than 4000 hectares of various mire biotopes such as aapa mires, raised bogs, rich fens and spruce mires have been restored in different parts of Finland by filling in and damming ditches and re-directing water to its natural flow paths. In addition, trees that have appeared after drainage have been removed from over 3,000 hectares to decrease the effect of transpiration by trees on the hydrology and to recover the original open landscape.

The effects of restoration have been monitored extensively in the project. The monitoring results so far are promising and indicate that the restoration of hydrology – which is the prerequisite for the recovery of natural function and species assemblages of mire ecosystems – has been successful.

In addition, a thorough guidebook on restoration of peatlands has been prepared in the project, based on the experiences from more than 20 years of peatland restoration in Finland. A shortened version of the guidebook has been translated in English to disseminate the lessons learned in Finland to other countries. The English version can be downloaded from the website of the Boreal Peatland LIFE project.

O 145

Light and Fire open the Doors for Biodiversity LIFE

Jouni Penttinen, Natural Heritage Services, Metsähallitus, FINLAND
Kati Halme, Jussi Päivinen

The overall objective of the "Light & Fire LIFE" -project is to improve the conservation status of 19 Habitat Directive Annex I habitats. Their overall conservation status in the boreal biogeographic region of Finland was assessed as unfavourable-bad or unfavourable-inadequate. The project focuses on Natura 2000 habitats whose ecological characteristics are shaped by fire (fire-born habitats) or extreme solar radiation and luminosity (sunlit habitats). Concrete conservation actions will restore structural features important for the maintenance of the biological diversity of these habitats, and increase the extent of the target habitats by restoring severely degraded areas. The main restoration measure in sunlit habitats (e.g. esker forests, grasslands, dunes) is the removal of shading trees and bushes and burning or mechanical removal of the litter layer covering the mineral soil. In coastal habitats mechanical removal of roots and masses of algae washed up on the beach is also required to re-establish areas of open sand. In forested habitats controlled burning is used for restoring commercially managed forests by creating burned forest areas, which will develop into young successional stages of Western taiga habitat type. Project actions include also various habitat restoration monitoring schemes to secure successful restoration and long-term maintenance of the results. Moreover, actions will also be carried out to increase public awareness and to disseminate the results of the project. Project actions will be carried out in 69 Natura 2000 sites throughout Finland.

O 146

The knowledge of biodiversity as the tool of environmental education

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Éva Nagy

Secondary school students are receptive to innovation and scientific research, then, they consider their environment with a systematic and logical cognition for the first time. This learning process is enhanced, when before, in their early childhood, the effect of environmental education has been strong on their personality. This also means that the result of the elementary school environmental education might be a later fruitful secondary school talent management.

The aim of the scientific study to find the answer for the following question: What are the advantages and disadvantages of the application of the biodiversity monitoring programs, as environmental education tools?

The method of the work is a wide comparison of the monitoring methods and projects at different spatial and time scale, showing real examples. The integrated methodology, the standardized toolbar and processing of the international projects help students to explore the Earth-scale processes and correlations, so that the collection and processing of their own data, the inclusion of their measurement results into the database help their personal motivation, with which they become more susceptible to solve environmental problems as well. The disadvantage of this is that it is not certain that an international unified project may provide conclusions locally in relation to issues such as food production, biodiversity, waste management issues or the protection of our waters. Other possibilities of environmental education, which are smaller-scale but show much sensitivity regarding the local phenomena, are guided by national and regional organizations, educational institutions, zoos, botanical gardens and national parks.

O 147

Native plant materials: Using the Target Plant Concept to improve their quality and meet restoration goals

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Native plant materials for ecological restoration must meet diverse goals while facing many challenges once planted. The concept of ecological restoration is relatively young but the process of planting seedlings in disturbed ecosystems is not. Silvicultural practices have long since provided a framework for successfully planting seedlings on degraded sites. Borne from this framework is the Target Plant Concept, a way to define what plant materials to grow in the nursery to meet the needs on planting sites and achieve project objectives. Three interrelated ideas guide the defining process of the target plant material and provide the broad, fundamental basis needed to successfully complete desired projects: 1) start at the planting site;

2) forge a nursery-client partnership; and 3) emphasize plant quality, not appearance. During the process, the nursery manager and client systematically answer eight interrelated questions to ultimately define the target plant material. These questions focus on the restoration goals, site characteristics, factors limiting survival and growth, mitigation of those factors, appropriate species and genetic source, the best stocktype, proper planting tools, and the best planting season. Once a target plant is defined, grown, and planted, the success or failure is verified by trials that monitor survival and growth. This performance information provides valuable feedback to the nursery manager who works with the client to refine the target plant specifications for the next crop. This presentation will discuss the science behind the Target Plant Concept and use a case study example to illustrate its implementation.

O 148

Developing a common Key Performance Indicators framework for biodiversity management in gypsum quarries throughout Europe for Eurogypsum

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This study aimed to establish a common Key Performance Indicators framework to report biodiversity for the Gypsum Industry at the European level. An original approach of participatory process has been developed in order to integrate the different opinions and to reach a consensus framework between different stakeholders' groups: Eurogypsum stakeholders, European and local authorities, a scientific panel, European and local associations for the conservation of nature and stakeholders from the mining sector. The strategy is based on five main steps: (i) To build a stakeholders' network; (ii) To build a framework proposal to be submitted to stakeholders by selecting a maximum set of indicators based on the literature and reaching an agreement with Eurogypsum (Focus Group); (iii) Reaching a consensus framework with all the stakeholders and evaluating feasibility by a Delphi Policy survey, by the analysis of the Environmental Impact Assessments of the Gypsum Industry and by visiting three quarries; (iv) Final validation with Eurogypsum; (v) Creating indicators' Factsheets and a Eurogyspum report to the destination of the public. The resulting framework contains eleven indicators which are the most acceptable set of indicators for all the stakeholders. It answers to European legislation and strategies for biodiversity. It is a flexible framework adaptable given the local context of each gypsum quarry in order to prove if a No Net Loss has been reached at a quarry's scale.

O 149

The Reserves Standards Framework: A tool for managing and integrating recreation and restoration in protected areas

Mark Poll, Research Director, Natural Acumen, AUSTRALIA

This abstract has been prepared with the permission of the Tasmanian Parks and Wildlife Service.

Visitor management within natural areas is a balancing act between protecting natural and cultural values and providing for recreation activities that have the potential to impact on those values. The Reserves Standards Framework (RSF) was developed in Tasmania, Australia, as a strategic natural resource planning tool to facilitate targeted service provision in protected areas by matching service provision with the recreational needs and aspirations of visitors whilst ensuring that activities and development are consistent with the protection and conservation of the natural and cultural values.

The RSF is a tool for planning for an appropriate range of recreation opportunities and takes into account reservation status, land-use zoning, levels of planning and a range of codes and standards that relate to the provision and maintenance of services. Included in such planning is the notion of site closure that enables the managers of protected areas to decommission non-essential infrastructure, hence providing an integrated, costed approach to ecological restoration of protected areas and sites.

The RSF is implemented via a spatial database tool that comprises an asset management database, management plans, works schedules, and departmental budgeting tools. Thus, the Framework provides a mechanism for balancing use and conservation and ensures the often long-term, ongoing costs of site closure, restoration and monitoring are considered in protected area management.

O 150

Environmental education and Catchment Citizenship in mountain regions

Claude Poudrier, Environmental Education, PEEC, CANADA

The protection of mountain watersheds is made easier when the local community is fully engaged with the problems and processes and when they are capable of making informed decisions. The environmental education and the active citizenship plays a crucial role in successful ecosystem restoration.The concept of Catchment Citizenship is not new. However, this paper introduces a systematic school-based methodology for constructing an active citizenry by means of the thirteen step “Action Research for Community Problem Solving” (AR:CPS) educational model as explored within the Québecois Program in Environmental Education and Citizenship (PEEC). This program has been shown to build critical, reflective and empowering democratic skills and to inspire its participants to engage fully in problem-solving within their communities. Evaluation of the outcomes since 1993 suggest that

this is a method that is considered beneficial by participants, by their communities as by educational institutions at all levels, and that it may provide a more effective mode of education for environmental citizenship.

O 151

Restoration of plant communities in tree-planted riparian zones among agricultural watersheds: spatial components matter more than local factors

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Three main mechanisms might promote the restoration of plant communities: the presence of target species in the regional pool determined by landscape parameters, their ability to reach restored sites influenced by spatial components and their successful establishment at the reached sites depending on local factors. The importance of these three mechanisms was assessed in tree-planted riparian zones among two agricultural watersheds of southeastern Canada.

Botanical surveys were performed in 53 tree-planted riparian zones from 3 to 17 years ago, and in 14 riparian forests. Sixteen local factors including restoration and agricultural parameters were collected, as well as three landscape components. Spatial components were modelled using Asymmetric Eigenvectors Maps.

Plantations became similar to riparian forests 12 years after tree planting. Elevation above river, tree cover and crops type were key local factors, while the proportion of forests was the only landscape one. They, respectively, contribute to only 5% and less than 1% to plant composition, while spatial components account for 25% (of which 10% interact with local factors). As tree cover increases, forest plant communities are effectively restored by the replacement of heliophilic species by sciaphilic species. Spatial components suggest improving restoration success by planting trees from upstream to downstream. Propagules of forest species will thus reach by hydrochory the restored riparian zones favourable to their establishment.

O 152

Do not neglect surroundings in restoration of disturbed sites

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Most restoration projects concentrate on a restored site itself and the surroundings of a restored site is only rarely taken into consideration. We tested the influence of land cover or local species pools around a target site on the course of spontaneous vegetation succession (considered as a way of passive restoration) in various restored habitats in the Czech Republic, central Europe. We found that the occurrence of land cover categories in the surroundings exhibited nearly always significant effects on vegetation composition in restored sites

if tested, except for wetlands. We also find close relationships between local species pools and success of target species in colonization of restored sites, which among others indicate importance of traditional floristic research in ecological restoration. The following implications for practice emerged: (i) Make inventory of surrounding habitats at least up to 100m from a disturbed site prior to design of a restoration project, and also consider the character of the broader landscape. (ii) In the case of mining, building and similar activities, prescribe preservation of semi-natural habitats in the close vicinity of a disturbed site even before the activities start. (iii) Possibly control invasive aliens or other undesirable species not only in the restored site, but also in its surroundings, at least up to 100m distant. (iv) Because of the importance of the surroundings for the restoration process in a site itself, it may be desirable to conduct some restoration measures also in the surroundings of a restored site. However, legislation and private ownership may restrict these activities in reality.

Collaborators: Klára Rehounková, Petra Karešová, Alena Jírová, Helena Dvoráková, Petra Konvalinková, Ema Johanidesová, Karel Fajmon, and Ivana Jongepierová

O 153

Regionalising native seed production – An approach from Germany

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Increasingly native species are commercially propagated in nurseries and used in re-vegetation and restoration. Consequently, large quantities of cultivars of native species are annually released into the landscape. These "native" plants are produced for several generations under constant human care and mostly under environmental conditions differing from those of the place of release. Therefore, it was long assumed by conservations and practitioners from restoration that at least parts of the adaptations plant species acquire by natural selection are lost during cultivation and that the produced plant material may not be well adapted to the conditions it will face after being released. First studies comparing some life-history-traits of two species native to Central Europe and often used in re-vegetation proofed that the behaviour of cultivated plant varieties differs indeed from the behaviour of their wild progenitors. Already based on the assumption that the situation is as found by the mentioned studies we developed in cooperation with responsible governmental agencies and a set of plant nurseries a division of Germany into 22 seed-transfer-zones for native species. The delineation of these zones is based on a set of environmental factors known to be decisive for the geographic distribution of plant species. Using a rule based filter we selected for each transfer zone at set of native species suitable for blanket use. Since 2011 these set of seed-transfer-zones has been adopted into Germany's national seed directive as foundation for the development and use of preservation seed-mixtures (as introduced by the European seed directive). We assume that a division of Europe into seed-transfer-zones neglecting political borders would be favourable for nature conservation and restoration.

O 154

Pastoral practices for the restoration of shrub-encroached grasslands in the southwestern Italian Alps

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Throughout the last decades, agro-pastoral abandonment has produced profound landscape and ecological changes in southwestern Italian Alps. In particular, the reduction in grazing has led to an extensive tree and shrub-encroachment of sub-alpine grasslands, which represents a threat to biodiversity conservation and increases the probability of wild-fires, erosion, and avalanches. In summer 2011, two different pastoral practices were carried out to restore shrub-encroached grasslands: strategic placement of mineral mix supplements (MMS) and arrangement of temporary night camp areas (TNCA) for cattle. The effects produced on vegetation by practices were assessed in summer 2012 and 2013. Shrub cover was reduced in 2012 ($p < 0.05$) and it did not change in 2013, whereas bare ground cover increased ($p < 0.05$) in 2012 and decreased in 2013 both around MMS sites and within TNCA. Within TNCA the cover and height of the herbaceous layer constantly increased ($p < 0.05$) one and two years after the arrangement of TNCA. Forage pastoral value increased ($p < 0.05$) within TNCA but not around MMS sites. No differences in biodiversity indices were detected around MMS sites and within TNCA after two years. Our findings indicate that: i) both MMS and TNCA are sustainable practices to reverse shrub-encroachment, as they are low cost and they can be easily carried out on rugged terrain, ii) TNCA are more effective than MMS in terms of restoration of semi-natural grassland vegetation. Shrub encroachment in the Alps may therefore be reversed, and restoration of grassland enhanced, by using appropriate pastoral practices.

O 155

Methane cycling on rewetted cutaway peatlands – role of *Sphagnum* associated methanotrophs?

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Abandoned peat extraction areas are usually net carbon sources. Rewetting induced recolonization of the typical peatland vegetation may return the natural carbon sink function – although at the same time methane (CH_4) dynamics often start to recover.

First, we explored succession patterns of the two organism groups most relevant for the CH_4 cycle, methanotrophic bacteria (MOB) and methanogenic archaea, on three abandoned cutaway sites (2, 17 and 63 years past rewetting). In addition to peat, we sampled living Sphagnum mosses, as they are known to act as CH_4 biofilters. In peat, potential CH_4 oxidation and production and functional gene abundances increased with vegetation succession. In Sphagnum MOB abundance and activity was controlled more by the water table than the succession stage. Based on community analysis, different MOB types were more evenly present on the youngest site whereas older sites seemed to become dominated by type II MOB – a group

typically abundant on pristine acidic peatlands. Also methanogens were most diverse 2 y after rewetting.

Secondly, we tested if CH_4 oxidation in the recolonizing Sphagnum could be enhanced through watering with pore water showing high potential CH_4 oxidation. Interestingly, CH_4 emissions were significantly lower one year after the treatment when compared to control areas.

In conclusion, microbial CH_4 cycle seems to react relatively fast to rewetting and revegetation. Rewetting induced CH_4 emissions may be controlled by "transplanting" active methanotrophs from sites with higher oxidation activity.

O 156

Finnish Board on Ecological Restoration FBER

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Tapio Lindholm

The working group for ecological restoration and management in Finland, known as the The Finnish Board on Ecological Restoration (FBER), is a nationwide cooperation body established by Metsähallitus. Members include actors in the management of the Finnish natural environments and semi-natural grasslands, researchers and other experts. Its activities cover habitats on land and in freshwaters, in protected areas, in forests and on agricultural land, whether state-owned or in private ownership. In every case, activities in privately owned areas are performed in cooperation with landowners. The working group's task is to evaluate, develop and promote the quality of the ecological restoration and management of natural and semi-natural habitats, and their impact on society. The working group has solid scientific expertise and develops practical expertise by preparing guidebooks on the topic in question, and organising training events and seminars. The FBER consists of a steering group and four expert groups, whose activities promote the implementation of tasks defined for the working group.

O 157

Qualitative and monetized analysis of relations between a mining activity and its related ecosystem services in Belgium – Impacts and dependencies according to an Ecosystem Services Review

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The goal of the study is to conduct an ecosystem services analysis with respect to specific mining activities. Relations between ecosystems and mining are strong and can open opportunities. The research project uses the Ecosystem Service Review methodology that allow the analysis of impacts and dependencies the quarry have with global ecosystem. The external values are assessed by monetizing impacts and dependencies.

Out of a list of thirty one, thirteen relevant ecosystem services have been analysed. The relationship between the quarry activity and the ecosystems services can be characterized in terms of impacts (the effects that the quarry has on the environment due to its activity, positives or negatives ones) and dependencies (natural goods and services needed by the quarry activity to exist and to develop its knowhow and markets). Monetizing (where applicable) these relations leads to results in terms of risks and opportunities. While monetization does reveal values smaller than the turnover generated by the activity, several ecosystem services however reach significant values that emphasize the relevance of keeping track of their importance and evolution. Several opportunities for actions to be undertaken also appear. When conducting such studies on active mining sites companies do consolidate the understanding of their relations with ecosystem services and thereafter take them into account in their business plan.

O 158

Different approaches for ecosystems restoration in Italian Apennines environment – Speed up the vegetation dynamic or let it to the natural succession?

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Ecological restoration activities are part of the design of the gas pipeline network. Once the pipeline has been buried, all working areas are reinstated towards the original ecosystems. Along the Campochiaro-Sulmona pipeline, a proper vegetational design has been performed in order to compare the effectiveness of restoration activities against the natural evolution.

The design of restoration activities followed these main steps:

1. floristic and phytosociologic surveys order to characterize the existing coenoses;
2. selection of the more suitable species to be used;
3. selection of the more suitable procedures to be used.

Some adjacent areas, with similar characteristics, were left to the natural evolution.

Five years of monitoring were performed in 8 selected test areas comparing the revegetated plot with the non reinstated plot. Results showed significant differences in the behavior of herbaceous and wooden species mainly due to the uncontrolled spread out of seeding species also towards the non reinstated plots. For this reason, shrubs and trees were analysed for the comparison. Result was that non revegetated plots showed a slower but more natural evolution considering the ecological succession. Indeed, we observed in the years the gradual entry of species (perennial herbs and shrubs) in accordance with the typical dynamic processes of wood recovery in the Apennines.

O 159

Disturbance as a tool for biodiversity: An interdisciplinary approach to restoration and conservation benefits of post-mining sites

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The mining activities give arise to open periodically disturbed sites in early successional stages which became very rare in recent landscape. The restoration methods used afterwards lead either to their fast elimination or we can maintain them as open (temporary or long-term) and thus influence the potential of habitats for large spectrum of taxa.

The post-mining sites comprised stages from 2 to 30 years since site abandonment within the large active sand pit (SW part of the Czech Republic). Effects of different restoration methods (forestry reclamation spontaneous succession, disturbed succession, i.e. naturally re-vegetated sites continuously disturbed by recreation activities) on the communities of vascular plants and assemblages of arthropods were compared to evaluate the biodiversity, restoration and conservation potential of a sand-pit.

In all studied groups, open spontaneously re-vegetated sites continuously disturbed by recreation activities hosted the largest proportion of target and endangered species which occurred less in more closed spontaneously re-vegetated sites and were nearly absent in forestry reclaimed sites. Open non-forested stands (young stages or older disturbed stages continuously maintained as open) can thus serve as a refuge for many endangered species declining from their natural habitats in the surrounding landscape.

The forestry reclamation should be used only rarely in a mosaic with ecologically restored areas. On the contrary, extensive recreational activities (e.g. swimming, fishing) seems to be efficient and promising restoration method how to maintain suitable habitats for rare and endangered species of open treeless habitats in post-mining sites.

O 160

New land-use options after peat harvesting

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The total peatland area in Finland amounts to 9.1 million hectares.The most common uses are forestry (4.7 million hectares, 51.7%,), mire conservation (1.2 million hectares, 13.2%), agriculture (0.25 million hectares, 2.8%) and peat production (0.06 million hectares, 0.7%). In addition to these, approximately one third (2,9 million hectares) of Finland's mires is still in a natural state. From the current peat production area, about 60,000 hectares, an average of 2,500 hectares of cut-away peatlands are released from the harvesting area annually. So far, these areas amount in total to about 40,000 hectares. The recent annual peat production volume was 15–20 million cubic meters. Peat is chiefly used as a fuel in domestic energy production in CHP plants together with wood fuels. About 10 per cent of the total peat volume

in Finland is used as litter in animal husbandry and as a growing medium constituent in horticulture.

It has been argued that the ecosystems of peat production sites have been destroyed finally and irreversibly. However, these areas open up numerous wise after-use options when peat harvesting has come to an end. The decision on the new land-use is in the hands of the land owner. In addition to many local socio-economic reasons, several geological-hydrological and biological factors determine the applicable after-use alternative. The hydrological condition of the area is a fundamental factor for further land-use. The drainage of the peat harvesting fields is often carried out by gravimetric methods resulting in normally dry cut-away areas. In some of the cut-away areas the mire bottom is lower than the water table in the receiving watershed. The drainage water is pumped away in order to allow peat drying and harvesting. When peat production ceases and the pumps are turned off, the area will be covered by water. By means of appropriate procedures, former, barren peat harvesting sites can be converted into diverse land-use forms, which have added value from the environmental as well as landscape and socio-economic points of view.

The most important means for further land-use in dry areas are forestry and arable farming. The submerged areas can be rehabilitated into different kinds of wetlands or mire regeneration ecosystems. Sometimes, cut-away peatlands are constructed in water treatment wetlands. The factors affecting the choice of desired and applicable land use of cut-away peatlands will be discussed further.

O 161

Rewetting organic soils for climate and biodiversity benefits

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Christoph Mueller, David Wilson

The biodiversity-climate change nexus is now well recognised and several studies have shown that it is possible to develop strategies that achieve mutually supportive outcomes. Re-wetting could provide synergies by reducing greenhouse gas (GHG) emissions together with enhancing the biodiversity value of organic soils. However, changes in the moisture regime may have implications for the biosphere–atmosphere exchange of GHGs, and in particular, may lead to an increase in methane (CH_4) emissions. The premise is that water level can be manipulated to various degrees thus causing different impacts on GHG emissions and removals from the organic soil. Maintaining the water table at a certain depth may also affect the vegetation composition and therefore its overall biodiversity value. In this study, we examined the effects of a water table gradient on carbon dioxide (CO_2) and CH_4 emissions from deep drained, shallow drained and rewetted organic soils under grassland. We hypothesised that an optimum water table can be achieved to reduce CO_2 emissions and minimise CH_4 emissions while improving biodiversity.

O 162

Introduced seed, native seed or natural succession for restoration on various soil types in an alpine environment

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A hydropower dam in Bitdalen (950 m.asl.), Southern Norway was rehabilitated and the surrounding areas were restored. An experiment comparing different native soil types (mineral soil vs. organic peat soil vs. 50/50 mineral/organic soil mixture) and plant material (no seeding vs. conventional (imported) seed mixture vs. Norwegian native seed mixture) was established in 2008. During the following years (2009, 2010, 2011 and 2013) plant composition and plant cover was recorded in 54 permanent plots (0.5 m x 0.5 m).

The mineral soil treatment had less plant cover, fewer species in total and fewer not-seeded species during the first years, but after five years there was no significant difference between the different soil treatments. However, after five years, the organic soil had significantly more not-seeded alpine species than the mineral soil. On mixed soil, the number of not-seeded alpine species was not significantly different from neither the organic soil nor the mineral soil.

There were more species in the native seed treatment during all years compared to the conventional or not-seeded treatments. The first year, there were less not-seeded species in the imported seed mixture treatment compared to the two other treatments. The not-seeded treatment had less plant cover but more not-seeded alpine species than the two seeded treatments the first year. After five years, there was no difference in plant cover, not-seeded species in total or not-seeded alpine species among the different sowing treatments.

These results indicate that sowing might not be essential for establishment of vegetation on an alpine restoration site. The soil at the site seems to be more important for the establishment of different species within a five years perspective.

O 163

Seasonal change of cattle foraging habits in year-round grazing systems

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Grassland restoration and management by year-round grazing with free-roaming cattle has become increasingly common in Western and Central Europe. It is assumed that within such grazing systems ruminants produce their own high quality fodder by selecting certain grazing patches constantly whereas other patches are avoided. The aim of this study was to analyze cattle grazing habits throughout the year and to detect relations between grazing patterns and changes or differences in biomass parameters. The study site was stratified into five vegetation structure types. To analyze the foraging habits one cattle was provided with a GPS-logger and the positions were recorded every two minutes. To determine nutrient contents, biomass sam-

ples were taken within each vegetation structure type every two month. The concentrations of P, K and Mg did not differ significantly between the structure types but Ca and Mg concentration as well as the digestibility were significant higher and the C/N ratio significantly closer in the grazing lawns than in all other vegetation types. All vegetation structure types revealed the same seasonal changes of P and K concentrations and digestibility. However, from spring to summer Ca and Mg concentrations increased in the grazing lawns whereas they decreased in high grasses and forbs. Furthermore, our results showed that in summer the cattle preferably fed at the grazing lawns whereas they consistently used all vegetation structure types for foraging in autumn and winter. This fact indicates a positive correlation between grazing intensity and fodder quality in summer when the cattle is able to select for best fodder. Our study gives evidence of pronounced seasonal changes in cattle foraging habits.

O 164

EU-LIFE project Alkaline Fens in Brandenburg

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From 2010 to 2015 the LIFE Nature Project "Alkaline Fens in Brandenburg" is currently being implemented. With this project, conservation activities intended to secure and develop the largest alkaline fens in 14 Natura-2000 areas, are managed. The project is supported by the regional authority for environment, public health and consumer protection as well as four private nature conservation societies. The first step of restoration is the removal of biomass and nutrients. During the project 156 ha of reed have been mowed. Additionally shrubbery was removed on 42 ha and 52 ha of pasture for water buffalo and sheep were fenced in. The next step is to restore the natural water balance within the fen areas. The goal is to stabilize the water level on or slightly above ground level, in order to prevent further peat mineralization. To achieve this, the drainage systems have to be deactivated. The filling material is obtained by top-soil-removal directly on bordering moorland. In this way, new raw-soil locations are established. Areas of intact and valuable vegetation remain undisturbed. So far 39 km of drainage systems have been deactivated and top soil removal has taken place on an area of 29 ha. The results of the rewetting efforts can be seen almost instantly after the drainage systems are deactivated. Ground water levels have been measured to rise as much as 20 cm within a few days. Pioneer vegetation and brown mosses have started to grow on raw soil locations within one vegetation period. The results of the conservation actions so far give hope that initial moor-revitalization has succeeded.

O 165

Understanding ecosystem services and the economic value of mineral sites restoration: An analytical framework for capturing ecosystem service benefits

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Jost Wilker

In the field of ecological economics there is a long tradition of researching on ways to quantify ecosystem services and to monetize benefits that accrue through them. Within this still expanding field of research one particular blindspot is getting more and more attention: The lack of understanding between ecologists, economists and practitioners (e.g. spatial planners) on how to conceptualize and integrate well-known approaches into a common analytical framework that is easy to access in applied studies.

Our research presents an analytical framework to assess ecosystem service benefits for the case of mineral sites restoration. Such sites are prototypic for ecosystem service valuation, because restoration offers a window of opportunity to decide on post-mining planning options. Those should be based on net benefits for ecology, economy and society.

To focus on relevant ecosystem services and on most appropriate economic valuation methods for a specific site, the analytical framework is structured along an impact pathway of ecosystem service functions. Following this structured, site-specific approach analyses are conducted to look only at relevant final ecosystem services in each restoration scenario. Those need to be quantified to be able to monetize benefits. So, our framework puts the ecosystem benefits in the centre of the analytical steps. Based on this, optimal approaches for valuation of benefits can be chosen (e.g. discrete choice experiments).

The framework is comprised of a stepwise procedure to identify relevant ecosystem services, planning alternatives, their impacts and their relevant benefits. To highlight this sequential procedure, case studies across Europe will be presented using a set of "factsheets". This documents help to structure the impact pathway.

O 166

The success of passive restoration in a semi-natural grassland experiment

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Aim: Semi-natural grasslands have decreased considerably in area, leading to high biodiversity loss. To counteract this trend we need to restore species-rich grasslands. Seeding with local seeds or transfer of freshly cut hay from local donor grasslands may be suitable methods. But when local grasslands disappear, distant donors need to be used, but how does this influence the restoration? The surrounding vegetation may also impact the outcome but how

strong is its influence? In field trial we tested four restoration methods: transferring fresh hay from a local and a distant donor, seeding, and natural regeneration.

Methods: We recorded the pre-trial species composition and -richness of the four treatments. At the trial site we established 14 blocks, each with four randomly positioned plots (0.25 m²) that were given one of the four treatments. In three successive years we recorded the species composition. We used GNMDS-ordination to extract the gradient structure in the data set, and we used general linear mixed-effects models in the statistical analyses.

Results and Discussion: Our study revealed decelerating succession rates. All trajectories synchronised from the second year, and by trial end, the treatments converged with respect to species richness and -composition. Distant hay transfer changed most and exemplified a climatic donor-receptor mismatch, while the failure of several seeded species to germinate indicated an ecological mismatch. Vigorous germination of non-trial seeds in the two bare soil treatments evened out the initial treatment-related differences. Dispersal from surroundings and between treatments may be utilised for restoration purposes.

O 167

Effects of restoration on stream bryophyte communities in sediment-stressed forest streams

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Forest drainage and the consequent sedimentation are the major factors changing the habitats of forest streams in Fennoscandia. Restoration measures (e.g. sediment traps) are commonly applied in Finland to prevent sediment transportation and to remove sediments from the streambed. However, effects of both increased sedimentation and restoration on stream bryophytes, an important component of stream ecosystems, are not well known. We studied the effects of near- and in-stream restoration measures on bryophyte communities in sediment-stressed boreal forest streams in Finland. We sampled riffles in 11 near natural reference streams with no or few ditches in their upstream catchment, 9 restored streams and 12 non-restored streams affected by sedimentation. The bryophyte communities of the restored streams were similar to those in impacted sites and clearly differed from those in the reference streams. Substrate type and streambed stability were the environmental variables that most strongly correlated with assemblage variation. Total relative abundance and number of bryophyte species did not differ between restored and impacted streams but were lower than in the reference streams. Our results indicate that land use induced sedimentation decreases the habitat quality and has strong negative impacts on stream bryophytes. The restoration did not have a clear effect on bryophyte communities, indicating that current restoration measures are insufficient in reducing streambed sedimentation to improve habitat quality for bryophytes.

O 168

Potential to restore hydrochemical ecosystem services of aapa-mires, a case study

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We studied the ability of an aapa-mire to filter impurities from through-flow waters. The mire retains 50% or more of Al, N, P, S, but is a source of DOC, 6,4 g m-2a^{-1}.The amounts retained are in line with previous results of aapa-mire peat chemistry and peat accumulation rates.

In the catchment of Iijoki, more than 60% of peatlands have been drained. By restoration lost ecosystem services might be recovered. Peatland restoration has, however, often resulted in short term deterioration of water quality.

Also many of the undrained aapa-mires have been degraded by ditches in the marginal parts. We classified the hydrology of undrained mires or mire fragments greater than 50 ha using aerial photographs and maps. A typical undrained mire fragment is a centre of an aapa-mire, degrading because no water feeds it due to ditches in the margins. These undrained degraded mire fragments are 25% of the peatlands greater than 50 ha in Iijoki catchment.

The larger mires are mainly in fair condition but 47% in size class 50–100 ha is degraded. Half of undrained area consists of patches smaller than 50 ha. More than a third of all undrained peatland area may be degraded and not capable of performing hydrological services typical to mires. Our conclusion is that hydrological restoration of these mire fragments is the most cost effective form of restoration, capable of bringing back both nature values and hydrochemical ecosystem services fast.

O 169

Linking biodiversity and Ecosystem Services: a test case in Flanders (north Belgium)

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Dirk Maes, Heidi Demolder, Toon Spanhove, Sander Jacobs, Helen Michels, Maarten Stevens, Peter Van Gossum, Wouter Van Reeth, Johan Peymen, Geert De Knijf, Wouter Van Landuyt, Glenn Vermeersch

As in many other European countries and regions, an Ecosystem Assessment for the region of Flanders (north Belgium) is under construction. Following the framework of the Milennium Ecosystem Assessment (MEA 2005), the interdependence between both concepts – biodiversity and ecosystem services (ES) – is widely accepted. This interdependence is adopted within the CBD and translated into EU-2020 target 2.

For the Flemish Ecosystem Assessment, the following research questions are taken into consideration:

1. What is the state of biodiversity within Flanders? What part of biodiversity is monitored and mapped? What kind of biodiversity indicators are available?
2. What is the link between 'status' indicators and 'ES-benefit' indicators?
3. What is the role of biodiversity in resilience capacity of ecosystems?
4. What is the role of biodiversity within each step of the ES framework: from function to benefit and valuation.

Trying to downscale the MEA framework on a regional scale, using real data and mapping tools, many difficulties are encountered. To disentangle all components of biodiversity and ES and clarify the links, an assessment framework was developed. Biodiversity is divided in four components (composition, structure, function, stock) nested in a range of organization levels (genes, species, ecosystems and landscapes). ES components used in the analysis are: ES functions, ES uptake of benefits and ES valuation.

Using this assessment framework, the role of biodiversity within the ES cycle will be analyzed for 16 services. The biodiversity valuation will be based on the organization level of species and ecosystems. The mapping of ES is based on a detailed land use map (grid cells 10 x 10m). Patterns of both sets of grid maps – species hot spots and ES bundles – will be compared and analysed.

O 170

Resilience-based restoration of mangrove social-ecological systems. A case study from the the Gulf of Guayaquil, Ecuador

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Efforts to restore degraded ecosystem services may fail if links between ecological and social systems are neglected. This has become particularly apparent for mangrove systems. Situated along increasingly populated tropical costs, the sustainable use of mangrove ecosystem services may not be separated from sustainable local development. The presented case study of a community-managed mangrove concession area illustrates how concepts of ecological restoration may be enhanced by applying a resilience perspective, while being tailored to local conditions.

The framework proposed here acts as an analytical tool that allows to identify possible leverage points for restoration actions along several sources of resilience, grouped into six themes: system identity; ecosystem structure and function; ecosystem services and use; management and governance institutions; social capital; and learning and participation. The themes are explored by combining quantitative assessment of six mature mangrove sites and abandoned shrimp ponds with semi-structured stakeholder interviews.

In all abandoned shrimp ponds assessed, recovery is characterized by high densities of natural regeneration, and shows signs of developing into functional mangrove stands as crab gathering has been resumed. However, conflicts between mangrove users and shrimp producers, violation of access rights, and ineffective institutions impose barriers to conservation and use of restored mangrove areas.

The study suggests that major challenges of mangrove restoration are not necessarily imposed by biophysical conditions. Instead, it highlights that key leverage points for management actions in the study area deal with missing consensus about restoration goals, institutional arrangement, conflicting property rights, and lack of trust between different actors.

O 171

Ecological restoration at the edges of the law: balancing between mitigation and compensation in Natura 2000

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Arguably, the assessment requirements laid down by Article 6(3) and (4) of the Habitats Directive are tagged by many business people and decision-makers as one of the major obstacles for planning projects. Yet, at the same time, these protection rules also spur ecological restoration in the context of spatial developments. As a matter of fact, in order to avert further delays and administrative burden, habitat restoration measures are ever more considered as interface between the strict assessment requirements of EU law and the spatial aspirations of planning authorities and project developers.

In recent national case-law it is submitted that the positive effects that might go along with the creation of new habitats in other parts of an affected Natura 2000-site, might ascertain that its integrity will not be adversely harmed. However, it remained unsure to what extent such practices comply with Article 6(3) of the Habitats Directive.

In this presentation, I will focus on the recent Opinion of Advocate General Sharpston in Case C-521/12. Here, the Court of Justice is asked to clarify the exact legal qualification of measures aimed at the restoration of degraded meadows, aimed at offsetting the impact that is predicted to go along with the widening of an existing motorway. I will argue that by excluding (future) enhancement measures from the framework of Article 6(3) of the Habitats Directive, the Advocate General might have effectively safeguarded the mitigation hierarchy in the context of the protection rules that apply for EU's most valuable ecological sites. At the same time, it will be demonstrated that not all is lost for habitat enhancement measures; that is, if one were to approach enhancement and restoration measures in a more proactive way.

O 172

Megaherbivore grazing in large scale sandy grassland and heathland ecosystems

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Since 2008, year-round grazing using free-ranging Heck cattle and Konik horses was established in an 800 ha sandy grassland-heathland ecosystem in the Oranienbaumer Heide area

(Eastern Germany). The management was implemented to preserve these European-wide threatened NATURA 2000 habitats, which were severe degraded by increasing cover of bushgrass (Calamagrostis epigejos L.), heather degeneration and shrub / tree encroachment since the former land-use ended in 1991. The latter was drastically reduced by cutting before grazing started. Grazing effects were evaluated by using before / after and with / without approaches. At the landscape-scale grazing resulted in a shift from 77% of bushgrass dominated stands to dry grassland communities. The grazing animals improved habitat quality rapidly and even the low soil nitrogen content of the sites could be maintained. Hence, plant species diversity increased remarkably: in former bushgrass stands from 18 to 48 species / 25 m² and in sandy grasslands from 28 to 48 due to the immigration of species typical for nutrient-poor site conditions. Grazing positively affected the number of breeding pairs of woodlark (Lullula arborea) and nightsjar (Camprimulgus europaeus) which increased from 37 to 45 and from 42 to 72, respectively. Due to the large size of the pasture overall costs of the grazing regime are manageable. Besides, economic sustainability has been ensured by integration into agri-environmental schemes. Furthermore, the project reached a high social acceptance due to comprehensive public relation work. Concluding, year-round grazing by megaherbivores offers an excellent tool to maintain and improve biodiversity in low productive large scale semi-open landscapes.

O 173

Topsoil and community translocation as a mean to restore metallophyte communities of katangan copper hills (D.R. Congo)

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Soizig Le Stradic, Julie Lebrun, Sylvain Boisson, Guylain Handjila, Grégory Mahy

The Katangan copper-cobalt deposits (Democratic Republic of Congo) represent one of the world's greatest metallogenic area. Copper outcrops host unique metallophyte plant communities supporting several endemic species highly threatened by the revival of mining activities. In this context, conservation of Cu-Co communities should be considered through their use in ecological restoration and site rehabilitation at mine closure. Methods to restore Cu-Co communities need to be tested to foresee future successes and failures. In this study we compared two methods broadly used in Europe and North America ecosystems (i.e. topsoil and community translocation) for the restoration of three kinds of Cu-Co communities: the steppe, the upper and the lower steppic savannas. Two years after the translocation, community translocation appears as the best method to conserve Cu-Co communities, on the other hand topsoil favors weed colonization. Restoration of the steppe, is currently more successful than for both steppic savannas. We also compare community translocation for two different copper clearings and analyze our results in the light of plant traits. In the second year after translocation, in both cases, structuring species of the original ecosystems show little cover, especially those with a large and well developed woody underground system. The results are expected to highly modify communities' trajectories on longer term and limit restoration success of these rare Cu-Co communities.

O 174

A landscape approach to planning restoration and conservation of anadromous fish habitat across a complex estuarine mosaic: moving from opportunistic to strategic

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Most ecosystem restoration opportunities ostensibly fulfill a broad ensemble of desirable ecosystem goods and services. However, the urgency and efficacy required to restore threatened and endangered species habitat is not well served by ad hoc, opportunistic approaches to restoration and conservation. Strategic planning is critical, especially in the case of juvenile anadromous fishes that must adapt to estuarine landscape mosaics of varying spatial and temporal habitat availability and quality as they migrate to the coastal ocean from their natal watersheds. We are developing a landscape ecology-based, geospatial approach to enable strategic planning for restoration and preservation of juvenile Pacific salmon (Oncorhynchus spp.) habitat in the 233-km Columbia River estuary. The Landscape Planning Framework adapts the structure and geodatabase of the hierarchical Columbia River Estuary Ecosystem Classification (Classification) to identify and compare spatially-explicit restoration and preservation sites that would most likely benefit at-risk unique genetic stocks of Columbia River salmon. We merge geomorphic and land cover data from the Classification to delineate fish habitat catena based on juvenile Chinook salmon (Oncorhynchus tshawytsacha) habitat requirements. Using landscape metrics to quantify the structure, composition, distribution and organization of existing and restorable fish habitat catena throughout the estuary, the Framework will allow managers and practitioners to strategically identify and rank the types and locations of juvenile salmon habitat for optimum restoration and conservation.

O 175

Multispectral remote sensing data as a tool for assessing the need and the effectiveness for peatland restoration

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Hundred thousands of hectares of drained peatlands were left abandoned in Russia and other CIS countries during the 1990s. Until recently many of these abandoned peatlands had no suitable economic use and became a source of greenhouse gas emissions and wild fires. Now, some of these peatlands undergo rewetting and restoration to create right conditions for fire prevention, reduction of carbon loss and GHG emissions, biodiversity rehabilitation and new opportunities of utilizing those peatlands in a sustainable and economically viable way.

To evaluate the mitigation potential of drained peatlands, to plan mitigation measures and to monitor their effects it is important to use economically reasonable methods that allow concurrently assessing fire hazard status, prioritization for restoration, testing the effectiveness of applied restoration measures and evaluation of emission factors and carbon fluxes.

Such economically reasonable methods based on Earth Observation (EO) data were developed, improved and verified within the project "Restoring Peatlands in Russia – for fire prevention and climate change mitigation" financed under the International Climate Initiative (ICI) by the German Federal Ministry for the Environment, Nature Conservation, Construction and Nuclear Safety (BMUB). A mapping methodology based on high resolution (Spot 5) space imagery was introduced and used for mapping of over 250 thousand hectares of peatlands of different type and under various conditions, belonging to different land categories in the Moscow region. The results of mapping were already used to identify the extent of peatland fires from archive data of forest-peat fires recorded in 2010. Such successfully developed and tested methods can be used to fulfill various scientific and practical tasks in similar projects and in other regions.

Another example of application of the developed method is the improved detection of the vegetative cover and of the humidity of bare peat surfaces at abandoned peat extraction lands. This type of a mapping exercise has been performed for the 'Meschera' National Park (Vladimir region) using Landsat-TM and ETM+ satellite images made in the period 1992–2007. The developed methodology was tested using modern EO data using Spot-5 HRG, Spot-6 HRG, UK-DMC2 MSI and Landsat-7 ETM+ (Landsat-8) satellite images. The verified approach from Meschera was then applied in the analysis of over 50 thousand ha of rewetted peatlands in the Moscow region.

O 176

Multiple Potential Natural Vegetation modelling an assistance for regional scale planning of restoration

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Restoration at large extents as planned in the EU 2020 biodiverstiy strategy needs substantial support regarding the range of habitats that could be restored at a location. The concept of Potential Natural Vegetation (PNV), although often criticized, provides an estimate what vegetation could cover a surface of interest. As an extension of the original concept we introduced "multiple Potential Natural Vegetation", which provides a distribution of habitat probabilities, rather than a single estimate, for each location.

As PNV expresses the landscape's capacity to foster a certain natural vegetation without human intervention, if PNV is set as the restoration target, the restored vegetation can be expected to be self-sustainable. Thus after the initial restoration efforts, no further human assistance will be required except for specific external threats (e.g. invasive species). While traditionally PNV is realized as a map providing a single estimate of PNV at any one point, restoration needs a more flexible and complete assessment of landscape potential, which also reflects stochastic components of community assembly. Multiple Potential Natural Vegetation allows the assessment of this range of potential vegetation types. The manager can then optimise between the suitability of the environment for a vegetation type and the feasibility of restoration, which may result in choosing another than the most probable PNV unit as the target vegetation type - a flexibility that single-layer PNV maps cannot offer.

O 177

Norwegian public perceptions regarding ecological restoration: how information of the social context can contribute to restoration planning

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Dagmar Hagen

All restoration projects exist within a social context and are the result of subjective decisions about which species should be promoted in the restored environment. Public support for ecological restoration will depend on how well the outcomes of the restoration projects match the public attitudes for how a landscape should look and how the corresponding ecosystem should function. An internet survey of Norwegian residents (N = 4077) provided insight into the general public's understanding of ecological restoration, as well as exploring general preferences for landscape types and how these related to attitudes about restoration and restoration-related issues. Survey participants rated their own knowledge of restoration as limited. Nonetheless, there was a strong general trend towards greater agreement with interpretations of restoration that focused on "enhancing naturalness" than agreement with the interpretation that restoration was focused on "human benefit", although agreement varied by demographic attributes. The survey uncovers a link between general environment concern, view on human influence, land use and resource consumptions, and the preferred restoration outcome. Participants who were more positive to increases in undisturbed landscapes (conifer forests, unregulated waterways and undeveloped alpine landscapes) also showed increasing agreement with interpretations of restoration that prioritize enhancing naturalness. We discuss how this insight can be incorporated into restoration planning strategies, such that the resources invested into future restoration projects in Norway can achieve greater social acceptance and the best prospects for cultural sustainability.

O 178

Regional habitat quality and meta-population structure are crucial for the success of river restorations

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The key variables determining whether river restorations reach their targets are still debated. In two studies, we examined the role of regional-scale variables versus local-scale variables for the success of restorations in promoting more diverse communities. Analyzing 1,458 benthic invertebrate community samples we demonstrate that riverine communities are predominantly determined by hydromorphological habitat quality at the regional scale. High habitat quality at the regional scale produced diverse communities, even if local habitat quality was poor. If regional habitat quality was impaired, local communities were poor, too, independent of local habitat quality. Only where regional habitat quality was at an intermediate level, local communities primarily depended on local habitat quality. Similar results were found when studying the role of the regional species pool for the colonization of restored river reaches by fish. Probabilities of individual species to colonize a restored reach predominantly

depended on the occurrence frequency and population density of this species in the nearby surroundings. These results corroborate the concept that spatial prioritization of river restorations based on regional-scale variables is crucial to promote restoration success.

O 179

Cooperative Planning

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Natural resource management groups, government bodies and agencies around the world invest significant public funds in environmental projects but it is often difficult for these organisations to identify the projects that will deliver the most effective and efficient outcomes. Factors such as community priorities, adequacy of scientific knowledge, technical feasibility, selection of appropriate policy tools and political constraints need to be considered for each project. Until recently there have been few suitable tools to effectively assist these organisations. INFFER (Investment Framework for Environmental Resources) was developed to facilitate the collection and integration of relevant scientific, technical, social and economic information to identify high value environmental projects that have the highest likelihood of success. Using INFFER, Rangelands NRM, managers of natural resources across more than 70% of Western Australia, developed a Regional Plan that integrates community, scientific and stakeholder input to identify a 'shortlist' of robust, internally consistent and cost-effective projects. The INFFER process led to the consolidation of strong networks and partnerships that promise to strengthen project delivery, organisational development and improve future funding opportunities. Beyond Australia, INFFER has been successfully implemented in projects in the different regulatory and socio-political contexts of Europe (Italy), North America (Canada) and the Asia Pacific (New Zealand).

O 180

Restoration of bryophyte communities by re-establishment of grazing in rural biotopes

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Re-establishment of grazing in abandoned semi-natural pastures is a potential way to restore their plant communities. The responses of bryophytes to the resumed grazing are, however, insufficiently known in semi-natural rural biotopes.

We compared the bryophyte communities of (1) continuously grazed, (2) abandoned and (3) previously abandoned but restored mesic semi-natural grasslands in Somero, southwestern Finland. In another study, we examined bryophyte communities of coniferous forest pastures on acidic soil in North Karelia.

In the mesic grasslands, bryophyte diversity was significantly higher in the continuously grazed compared to the abandoned pastures, and their community structures also differed. Re-established grasslands were ecologically heterogeneous and situated in between the continuously grazed and abandoned grasslands in all characteristics. Bryophyte communities of forest pastures were mainly composed of forest species, but scattered patches of dung and exposed mineral soil sustained some rare and red listed species. Microhabitat heterogeneity increased bryophyte species richness in this biotope.

Despite considerable variation, the results give evidence of positive effects of resumed grazing on diversity of bryophyte communities in abandoned mesic semi-natural grasslands. North-Karelian coniferous forest pastures on acidic soil seem less important for the Finnish bryophyte diversity. However, increasing microhabitat heterogeneity and amount of rare substrates (e.g. deadwood) could benefit also other species groups in this biotope.

O 181

Multiple socio-cultural benefits from restoration of a cultural service: A case of restoration and management of nature-related cultural heritage site

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There are few studies exploring effects of restoration of cultural ecosystem services (CES). The restoration of nature-related cultural heritages (CH) in local area has potential role to bring multiple socio-cultural benefits.

This study aims to reveal positive and negative effects of restoration of nature-related CH and management afterwards by local people based on awareness survey. Especially, we reveal changes before and after restoration of CH.

We focus on a restoration project of ruined mountain-top watchtower castle built in 15C. in Toyota City, JAPAN (0.12ha, a.s.l.130m). It made the most use of mountain topography. The castle building itself is not restored, but local people living in the same town have improved access to and view from the mountain. They also keep its condition by ecosystem management. We made a mail survey to 100 residents, the whole population of the town (23 responses), and in-depth interviews (17 residents).

Most respondents feel positive changes by the restoration (91% of the total): e.g., obtaining a vantage point (70%); feeling an attachment to the CH (65%). Some people feel negative changes at the same time (35%): e.g., loss of provisioning services (13%). At the time of the survey, 43% people have basic historical knowledge about the CH, but half of them obtained it before the restoration mainly via familial education. Generally, people more frequently participating in the management activities feel more positive changes.

In conclusion, restoration of a CH generates multiple CES and some trade-offs. The CH value derived from historical knowledge does not increase only by the restoration. Further educational effort is needed to improve the value itself.

O 182

Blocking the passage as a passive method for reforesting roads in protected areas in Finland

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Boreal coniferous forests and forested peatlands in Finland have been harvested intensively during the last decades. In the process, more than 120,000 km of gravel roads were built to facilitate the transfer of timber. Some of these roads are located in recently established nature protection areas and they are reforested to improve the connectivity between forest habitats. However, the costs of road reforestation raise a question about its long-term benefits. Thus, we may ask whether blocking the passage to road is a sufficient method to initiate forest regeneration. Our aim is to document the costs and outcomes of different reforestation methods.

In 2007, we reforested three roads, each in a different protected area. On each road, we established a full-factorial experiment replicated in three blocks. The combinations of road ripping and hummock transplanting treatments were compared with the reference without ripping and transplanting. We studied the impacts on soil properties, vegetation and tree regeneration during 2008–2013.

Ripping of road surface initially decreased soil organic matter and destroyed the established vegetation. Recovery of vegetation was slow in the ripping treatments, whereas vegetation and tree saplings in transplanted hummocks survived well. However, because the hummock transplanting nearly doubled the costs, longer-term monitoring is needed. In 2013, number of new tree seedlings increased with increasing ripping depth whereas hummock transplanting did not increase number of seedling. We can say that blocking the passage to road may be the cheapest method, but ripping the road surface facilitates the establishment of new tree generation and hummock transplanting promotes forest closure.

O 183

LIFE and Finnish Natura 2000 network – successes and challenges

Mikko Tiira, Natural Heritage Services, Metsähallitus, FINLAND

Since 1995 LIFE funding has been very important source for financing the maintenance and improvement of the natural and other values in the Finnish Natura 2000 network. By 2014 over 130 projects has been concluded or are under way, including over 50 LIFE Nature projects. Metsähallitus has participated in nearly all Finnish LIFE Nature projects. The total budget of LIFE projects exceeds 100 M€ of which EU has covered more than half.

The projects have been implemented in hundreds of Natura 2000 areas from the southern tip of Finland to the very northern peripheries. Almost half of Finland's nature projects have concerned peatlands to a greater or lesser degree. Nearly 20 projects have dealt with the restoration of forests, mostly boreal forest. Over 10 projects have targeted semi-natural grasslands and various kinds of wetlands. LIFE funding has had a crucial role in developing best prac-

tices for restoration and management of various habitat types. Only very few purely species protection projects or international projects have been realised. The projects include typically preparation of management plans. Land acquisition has been very important source in the required own contribution until last years.

During the first decade of Finnish LIFE era the projects were mainly regional projects covering a relatively small number of project areas. However, during the last years practically all nature projects have been designed thematically. These projects are relatively voluminous both with respect to project areas and budget.

But how should a successful LIFE project with sustainable results be planned and implemented? Is the future of LIFE project in integrating actions and funding to maximise the positive effects for regional Natura 2000 networks? Should we invest more in species and international projects?

O 184

Processes responding to restoration in forestry-drained peatlands

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Oili Tarvainen, Anna Laine

Almost one third of the total land area is covered by peatlands in Finland, which is a higher relative cover than in any other country in the world. Over a half of the peatland area has been drained for forestry, leading to the loss of valuable habitats and degradation of biodiversity. Restoration of peatlands is a relatively new measure, and long term results are still scarce. Reinstating the ecological function may be a slow and gradual process. To evaluate the development of peatland function and structure after restoration, indicators which respond at different speed to restoration are therefore useful.

We studied how restoration affects the hydrology, peat forming processes, and vegetation of forestry-drained peatlands. Fens drained for forestry 30–40 year earlier were restored in 2007 by harvesting trees and by filling ditches. After restoration, the raise of water level was immediate. Mineralization and decomposition rates, which were initially higher in drained peatlands, had slown down to the level of undrained peatlands two years after restoration. Little changes occurred in the vegetation in two years, whereas five years after restoration in 2012, moss species typical for hollows were found in the filled ditches of restored peatlands, which indicates restoration-driven plant succession. The results show a sequence of changes in ecological processes after restoration, whereby hydrology recovers first, mineralization and decomposition rates thereafter, and the plant succession is the last process to change.

O 185

Land manager looks for restoration ecologist: the Eurosite network

Jaume Tormo, Network Project Manager, Eurosite, NETHERLANDS

Eurosite was founded in 1989 by 23 nature conservation organisations in the UK, France and the Netherlands. We now have 60 members in 21 European countries. Our aim is to compare practices, exchange information and learn about effective site management. We focus on practical nature conservation, how to do it and what it involves.

Collaboration between Eurosite and SERE would open the door to interesting member-to-member collaborations. Eurosite members are eager for first hand information on restoration ecology and could offer a variety of case study areas and new research questions to the SERE ecologists.

During 2014–2016 Eurosite will support the European Commission's New (Natura 2000) Biogeographical Process and its Communication Platform. I encourage the SERE members to visit the Communication Platform, which is a very useful vehicle for reaching out, sharing information, conducting dialogues and finding new research partners.

O 186

Recovery dynamics of ground-dwelling assemblages in oak forest stands after clear-cutting

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We studied an oak forest secondary succession series after clear-cutting in forest patches in North-East Hungary by space-for-time substitution, in a multi-taxa approach studying carabids, isopods, millipedes, spiders, and staphilinids. We selected 5year, 15yr, and 45yr-old stages; and for control a more than 100yr-old lowland oak forest. There were 2 spatial replicates (stand) for each stage with 12 pitfall traps in each stand. Our results revealed contrasting reactions of respective taxa to the clear-cutting. In case of carabids we found that both the total number of species and the number of individuals were the highest in the young (5yr-old) plantation. From the 15yr-old stages onwards there were no significant differences in the number of species and the number of individuals. The young plantation was characterized by open-habitat species. These species disappeared from the 15yr-old stages onwards. Diplopods and isopods were characterized by an opposite tendency. For all studied taxa the forest species were missing from the 5yr-old stages. The number of forest species was stable from the 15yr-old stages onwards. The high air and soil surface temperature in the young plantation had a negative impact on the forest species. From the 15yr-old stages onwards the increasing vegetation cover and the closing of the shrub/tree canopy provided a forest-like microclimate, facilitating the recolonisation of the forest species.

O 187

Using LIFE funding to address ecological restoration – best practices and the new LIFE Programme for 2014–2020

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The LIFE programme is the European Union's funding instrument exclusively devoted to the environment. Since its establishment in 1992, LIFE "Nature and Biodiversity" strand has co-financed more than 1,400 projects, providing more than € 1.5 billion in funding, and mobilising a further €1.3 billion in other public and private contributions. This continuous source of targeted financing has radically changed the capacity of many countries and regions to care for and manage Natura 2000 network sites and to support the EU Biodiversity Strategy.

LIFE projects actions are varied and can encompass the development of management plans and other policy documents, support for the enlargement of the Natura 2000 network, improving knowledge of species and habitats, direct conservation actions, capacity building and awareness raising.

The LIFE programme for Environment and Climate Action plays a role of catalyst for promoting implementation and integration of environmental and climate objectives in other policies and Member State practice.

The new LIFE 2014–2020 Regulation (EC) No 1293/2013 establishes the Environment and Climate Action sub-programmes of the LIFE Programme for the next funding period, 2014–2020 with the budget set at €3.4 billion in current prices.

The 'Environment' strand of the new programme covers three priority areas: environment and resource efficiency; nature and biodiversity; and environmental governance and information. The 'Climate Action' strand covers climate change mitigation; climate change adaptation; and climate governance and information.

This communication will present some examples and best practices from successful projects addressing ecological restoration, with the aim of contributing to their active dissemination and the new LIFE programme approach for 2014–2020.

O 188

Can fly ash deposits harbour vanishing arthropods of continental sand dunes? Biodiversity of arthropods of fly ash deposits in the Czech Republic with evaluation of different restoration practice

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In Europe, inland sand dunes rank highly among the most threatened environments, suffering accelerating losses of associated biodiversity. Despite strong evidence that various vanishing species find refuges at post-industrial barrens, arthropods specialised for the highly specific conditions of drift sands have not been known to colonise any surrogates. Based on the physical conditions of fly ash, we hypothesised that it could be colonised by drift sand communities. During our recent intensive surveys of arthropods of fly ash deposits throughout Czech Republic, we have revealed that these common landscape structures indeed host arthropod communities of extraordinary conservation value, finding about 15 regionally extinct species, several tens of critically endangered and numerous endangered species. Simultaneously, we studied effects of different restoration practice on this so far unknown conservation potential. Here, we summarise the results of our studies.

O 189

Restoration of sediment-stressed streams has little effects on benthic biodiversity and ecosystem functions

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Excessive sedimentation due to intensive land use by agriculture and forestry is a predominant stressor to stream ecosystems. We studied the effects of small-scale catchment and in-stream restoration on benthic macroinvertebrate diversity and ecosystem functioning by comparing (i) restored streams (N=9), (ii) sediment-stressed streams (N=11), and (iii) near-natural streams (N=10) in northern Finland. The excessive sedimentation in our study area was mainly caused by sand originating from forest drainage activities. Macroinvertebrate community composition in the restored streams differed significantly from the near-natural streams, but not from the sediment-stressed streams. Similarly, macroinvertebrate diversity in the restored streams was significantly lower than in the near-natural streams, but did not differ from the sediment-stressed streams. However, ecosystem functioning measured by leaf litter breakdown rate was similar among the stream groups. The results thus indicate that sedimentation may degrade biodiversity but not necessarily key ecosystem functions. Overall, our results suggest that current management measures do not reduce streambed sedimentation sufficiently to enhance benthic biodiversity.

O 190

Long term soil nitrogen immobilization to restore endemic open sand grassland in Hungary

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Soil nitrogen immobilization by carbon amendment is a restoration technique used to increase the competitive ability of late-seral over early seral plant species based on their different tolerance of nitrogen shortage in the soil.We applied sucrose and sawdust as carbon sources for six growing seasons on three ex-arable fields in the Kiskunság inland sand dune region of Hungary to restore endemic open sand grassland community. We tested the efficacy of carbon amendment for lowering soil nitrogen availability and guiding vegetation succession in favour of late-seral plant species on poor sandy soil.

Carbon amendment significantly reduced soil nitrogen availability after two years. However, the desired impact on vegetation was not achieved despite long term application. Cover and species richness of early-seral and late-seral species changed irrespective of nitrogen immobilization. However, carbon amendment had a negative effect on moss cover from the fourth year on.

We conclude that carbon amendment is an effective tool to immobilize available soil nitrogen on poor sandy soils. Furthermore, nitrogen immobilization can be used to suppress bryophyte cover to enhance germination and establishment of grassland species without soil disturbance, and thus possibly avoiding the establishment of invasive species.

O 191

Suppression of noxious species is feasible even in the short-run: traditional Hungarian grey cattle grazing in alkali grasslands

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Orsolya Valkó, Balázs Deák, András Kelemen, Béla Tóthmérész

Extensively managed pastures are of high importance in sustaining biodiversity at multiple scales in conservation. Traditional grazing with robust cattle at low stocking rates is considered to be essential to mimic natural grazing regimes, but well designed case-studies are rare. Our aim was to evaluate the effectiveness of traditional Hungarian Grey cattle grazing in heterogeneous alkali landscape. We asked the following questions: (i) How does cattle grazing affect species composition and diversity in alkali and loess grasslands? (ii) What are the effects of grazing on short-lived and perennial noxious weeds? (iii) Are there distinct effects of grazing in dry-, mesophilous- and wet types of grasslands? Vegetation of fenced and grazed plots in a 200-ha sized habitat complex (secondary dry grasslands and pristine mesophilous- and wet alkali grasslands) was sampled from 2006–2009 in East-Hungary. We found higher diversity scores in grazed plots, while high cover of noxious species was typical in fenced

plots in the last year in every studied grassland type. We found that extensive cattle grazing is effective to suppress noxious species and to create a mosaic vegetation structure, which enables to maintain high species richness in the landscape.

O 192

Re-establishment and management of rare arable weeds in uncropped field margins: effects of cultivation and herbicide application regimes and the role of the soil seed bank

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Sarah Hulmes, John Redhead, Marek Nowakowski, Cath Shellswell, James Bullock, Richard Pywell

Aim

The historic shift towards intensive arable farming resulted in the decline of many species once common in arable fields. Uncropped cultivated margins are an important instrument for the preservation of such species which are now of considerable conservation interest. This study explored whether cultivation and herbicide application can be optimized for enhancement of rare arable species and for the control of undesirable pernicious species that can become an issue on such margins.

Methods

Experiments were set up in three regions across southern England. Tested management regimes varied in cultivation timing (spring vs. autumn), cultivation type, and herbicide application regime. Vegetation composition and occurrence of rare arable species were monitored annually, and occurrence of rare arable species in the soil seed bank was determined once at each site in autumn.

Results

Many rare arable species may persist as seed in the subsoil and their emergence can be stimulated by inversion tillage. We were also able to demonstrate management effects on vegetation composition.

Conclusions

The above results on their own do not allow extrapolation over longer periods of population trends of rare arable species on such field margins. However we aim to achieve such prediction by combining results of these and additional experiments with the use of modeling.

O 193

Success and sustainability of restoration: Seed banks and vegetation dynamics in recovered grasslands

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Grassland restoration on former croplands offers a vital opportunity to mitigate the loss of biodiversity. Weed suppression can be another benefit, which becomes increasingly important because of the high recent rate of abandonment of arable lands in Central- and Eastern-Europe. Our aim was to evaluate the usefulness of sowing two low-diversity seed mixtures followed by annual mowing, a frequently used restoration technique, in weed suppression. We studied post-restoration vegetation dynamics in 24 former croplands sown by low-diversity seed mixtures in Hortobágy National Park, East-Hungary. We found that rapidly forming cover of sown grasses effectively suppressed short-lived weeds and their germination after the first year. The detected dense seed bank of short-lived weeds points out the possibility and threat of later weed infestation. Perennial weeds, like Agropyron repens or Cirsium arvense cannot be suppressed easily by sowing and annual mowing in the short run. Our results suggest that without regular post-restoration mowing the favourable status of recovered grasslands can rapidly decline due to litter accumulation and by the expansion of undesirable species, even in the short-run. Our findings indicate that post-restoration management require carefully designed actions that are fine-tuned addressing specific threats at the site level.

O 194

The potential of GTK peat database in assessing sustainable re-use for low-productive forestry-drained peatlands

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About 9.2 million ha of the land area of Finland is covered by peat, making up about a third of the country's total land area. Since 1970's The Geological Survey of Finland (GTK) has investigated ca. 2 million ha peatlands throughout Finland. The GTK peat database is a unique and world record peat database: it comprises totally ~1.5 M peat study points, comprising totally 17,000 mires. GTK has also performed a wide range of airborne geophysical measurements. Following the open and accessible data policies GTK has started to share peat data in the web which offers multiple ways for exploring the data.

Not only the volume and high spatial coverage of the peat database, but the excellent tools for using and analysing the data makes GTK's peat database a great source for high grade scientific studies. However, the benefits of this data have not been fully utilized, and several methodological issues remain inadequately explored. Project LIFEPeatLandUse exploit GTK's peat database in order to scrutinize impacts of peatland use on ecosystem services and monetary value of low-productive drained peatlands, which cover ca. 0.8 million ha of the drained peatland area in Finland. Land use planning concerning these areas is highly dependent on the current state of the peatland ecosystem, its capability to produce different ecosystem ser-

vices and the amount and quality of the peat deposits of the area. Peat database produces valuable information of these issues, and it can be used in assessing, where and how to allocate peat harvesting and other peatland re-use options so that the environmental and social problems are minimized.

O 195

Topsoil removal in the conversion from agricultural meadows to matgrass swards: does it matter?

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Topsoil removal is a widely applied technique to remove nutrients in the conversion from agricultural fields to oligotrophic grasslands. Apart from vegetation topsoil removal affects the composition of the soil community and thereby decomposition and nutrient cycling. In the present study we compare vegetation and soil community development, soil chemistry, nutrient cycling and decomposition in two time sequences: with and without topsoil removal. Both sequences have an age range from 1 to 20 years and are compared to a reference site. Although nutrient availability was initially lower after topsoil removal, after 20 years there are no differences in both nutrient availability and nutrient cycling between sites. The vegetation similarity to mattgrass swards was higher along the whole age sequence for topsoil removal sites, still twice as high after 20 years. Older topsoil removal sites and the reference have higher microbial biomass but less activity. Although after 20 years there are no clear differences in nutrient status, both the vegetation and microbial community composition in areas with topsoil removal showed a higher resemblance to the reference site.

O 196

Can browsing moose restore an open fen by suppressing shrubs?

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In nutrient-limited systems, large herbivores can affect vegetation dynamics by redistribution of nutrients.They can preferentially forage on certain sites and deposit their pellets elsewhere, leading to local nutrient impoverishment. We studied whether moose (Alces alces) as the dominant large herbivore in a little disturbed wetland ecosystem, the Biebrza National Park (Poland), plays a role in affecting nitrogen dynamics. Microscopic analyses of epidermis fragments in faeces shows that 57% of the moose diet consists of the willow species Salix cinerea. Pellet density is also significantly higher in patches of Salix cinerea compared to the surrounding vegetation types. This implies that the skewed distribution of pellet deposition leads to a significant input of nutrients. We show that moose do not redistribute nitrogen between different vegetation types but instead speed up the local recycling of nitrogen in patches dominated by willows where they concentrate their feeding. As a consequence, nutrients become available here much faster than in other parts of the system. We hypothesise

that this enhanced N-availability may off-set the growth reduction caused by moose browsing on Salix, which fits to the observed bush encroachment in the study area. This suggests that despite high moose browsing intensity, moose likely stimulate the growth and expansion of Salix rather than the often supposed suppression of this woody species.

O 197

Recovery and Persistence of populations in river networks

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Connectivity in river networks is highly impacted by physical alterations posing risks to population persistence and restoration. The association of habitat quality and quantity with the landscape resilience, is still poorly understood in the context of species survival and recolonization processes, but essential to prioritize conservation and restoration actions.

We present a modelling approach that elucidates these aspects of network connectivity in spatial and temporal context to identify vital corridors and conservation priorities in the Loire river basin. A dynamic population modelling framework is used to bring population dynamics in relation to river landscape dynamics and network connectivity. Natural dynamics (resilience) of the river landscape can be confronted with physical alterations in such models and measured in population persistence. Disconnection and alteration of flooding and flow regimes is believed to be critical to population dynamics in river ecosystems. Still, little is known of critical levels of alteration both spatially as temporally, or the role of the river landscape resilience in this.

We applied modelling approaches to both recolonization dynamics of the otter and metapopulation dynamics for a dispersal- and a recruitment-limited tree species; black poplar and white elm. The European otter colonization of the Loire river basin over 25 years is modelled on the basis of large datasets on riparian corridor land use and hydromorphological characteristics of a 17,000 km river network. Channel straightening and riparian forest fragmentation are determined to be key elements that restrict the otter recolonization and allow identifying overall network connectivity and critical links/crucial zones in the network. The links with landscape dynamics are shown in metapopulation models as they allow to integrate the characteristic spatio-temporal dynamics of habitats and populations in river networks. Identifying metapopulation persistence for the two tree species over the river basin highlights crucial connections and network structure influence to extinction risks in relation to habitat quality and connectivity.

O 198

Enhancing urban ecosystem services through adaptation of plant selection for green infrastructures

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Ensuring urban life quality is important and improving ecosystem services, which are driven by ecosystem properties, is therefore essential. Urban green infrastructures, like green roofs, are important providers of ecosystem services and will be the focus here. We examined extensive green roof systems in terms of their functional (FD) and phylogenetic plant species diversity (PD) and proposed two methods that maximize FD starting from a dissimilarity matrix and hierarchical clustering techniques.

Results indicated that FD, PD and species richness differed significantly between the green roof systems. Also, species-rich systems had higher FD and PD values but in all systems there was room for improvement. Application of the two methods – one delivering an exact species list and the other a more practical one with alternative species – shows how plant selection can be adapted to offer improved ecosystem services.

The proposed methods are generic and can be applied on a broad range of novel ecosystems, although they are particularly interesting in an urban context. The approach can also be used to target one specific ecosystem service by selecting species that maximize this property. We believe that if green infrastructure elements are designed with respect to maximized FD, they can be a sustainable tool to ensure good urban life quality.

O 199

Linking the restoration of Natura 2000 habitats with renewable energy goals

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The Natura 2000 network of protected areas is set up to protect and restore endangered habitats and species within the European Union. Because of land-use intensification and the abandonment of marginal lands, many of the habitats suffer from severe degradation. In 2010, only 17% of the habitat types of Natura 2000 was in 'favourable condition'. In order to restore the habitats, management is often needed (e.g. mowing). Nature conservation is all too often still regarded as a cost, but can also be seen as an opportunity to produce a sustainable alternative for energy crops.

The objective of this study is to estimate the potentially available biomass that is originating from the restoration management of the Natura 2000 habitat types. We first made a selection of 46 habitat types that depend on or can be restored by a periodic mowing regime. Combin-

ing data about annual biomass yields and surface area, we provided estimates of the potentially harvestable biomass.

The selected habitats cover ca. 7.6 million hectares, corresponding to an annual biomass potential in the order of magnitude of 11.4–22.8 million ton dry matter. The conversion of Natura 2000 biomass to bioenergy is an opportunity to reconcile biodiversity goals with energy policies and is also an incentive to preserve the protection on the land. The focus of the study was on energetic valorization but it is evident that the biomass can also be used for other purposes like the production of renewable chemicals or fibers.

O 200

LIFE+ PROJECT: Bogs, flowing waters and nardus grasslands in the Bavarian Forest National Park

Jan Vancura, Nature Conservation and Science, Bavarian Forest National Park, GERMANY
Jochen Linner

In 2013 a Life project started in the National Park Bavarian Forest to improve the conservation status of the following habitats: peat bogs, rivers and nardus grasslands. Species targeted by the project are Black stork Ciconia nigra, European bullhead Cottus gobio, European otter Lutra lutra and ground beetle Carabus menetriesi pacholei. Following actions will be carried out as best practice projects:

1) Hydrological restoration of degraded peat bogs and bog woodlands. On altogether 5 ha of raised bog and approx. 50 ha of bog woodland draining ditches will be closed using some dams made of a local material (wood, peat). Partly a shrub removal is planned.

2) Removing obstacles for movement of aquatic organisms and stimulating dynamics in streams which were adapted to a transport of timber in the past. Reinforcements within some of selected stretches will be removed and some of selected pipe culverts will be replaced or removed.

3) So called “Schachten” are nardus grasslands which were built by traditional pastures in the past. Due to a presence of specialized species e.g. Arnica montana and Gentiana pannonica they present valuable habitats of European importance. A missing grazing and a tread disturbance endanger the nardus grasslands. Within a framework of the LIFE+ Project the National Park carries out an exemplary testing pasturing using Red mountain cattle with the aim to develop a new conservation approach.

Here we present the main actions of the project and related methods of the monitoring of success.

Project duration: 10/2013 - 09/2018, total budget: 1.3 million €. Within the project around 6.5 ha of land should be purchased.

O 201

The Strategy for Responsible Peatland Management (SRPM) with view to Peatland Restoration and Activities of IPS Commission V

Susann Warnecke, International Peat Society, FINLAND
Samu Valpola

The International Peat Society (IPS) has worked together with stakeholders from all areas of peatland interest to develop a Strategy for Responsible Peatland Management. This two-year process resulted in an extensive statement paper on how to approach different situations when deciding on options for peatlands, taking viewpoints of all interest groups and as many as possible priority issues into consideration. The Strategy was published in 2010 and has since been used in the development of national peatland and similar strategies in Europe, Northern America and Southeast Asia.

The aims of the SRPM are to:

- Undertake peatland management according to the principles and within the framework of Wise Use of Mires and Peatlands by safeguarding their environmental, social and economic functions and respecting their local, regional and global values
- Ensure that high conservation value peatlands are identified and conserved, utilised peatlands are managed responsibly; and drained, degraded or otherwise irreversibly changed peatlands are rehabilitated to restore as many ecological and landscape functions as possible
- Provide those involved in or responsible for peatland management with strategic objectives and actions for implementation.

The Strategy identifies the following priority issues:

- Biodiversity
- Hydrology and water regulation
- Peatlands and climate change
- Economic activities on peatlands
- After-use, rehabilitation and restoration
- Human and institutional capacity and information dissemination
- Engagement of local people
- Good governance

Special emphasis will be given to peatland restoration efforts. In addition, we will present the activities of IPS Commission V on after-use, rehabilitation and restoration of peatlands.

O 202

Wet grassland restoration on former quarry: working in partnership – a volunteer's perspective

Simon Warwick, Sharow Grange, Lower Ure Conservation Trust, UNITED KINGDOM

Nosterfield Nature Reserve is a 55 ha. former sand and gravel quarry lying over magnesian limestone. The quarrying process resulted in areas of open water, which proved highly attractive to an interesting assemblage of water birds. Given the opportunity to sympathetically develop the site, based on many years of accumulated knowledge, we aimed the subsequent restoration primarily at increasing the opportunities for breeding redshank and shoveler, wintering and passage birds. The extraction activity had resulted in the exposure of ground-water within the limestone (a typical fluctuation of 1.5–3 m per year) and with no method of controlling water levels, presented a restoration challenge. To tackle this problem, the land form had to be specifically designed to optimise the potential from these highly variable water levels. Here we present the methods used to overcome the restoration problems faced on the site, including the formation of a series of tiered scrapes and footdrains to optimise the potential from the varying water levels. The restored site is now being continuously monitored to calculate the success of the restoration techniques, with the reserve supporting approximately 150 species of bird annually and the naturally regenerated calcareous grassland providing habitat for over 300 plant and 1,500 insect species. The restoration at Nosterfield resulted from a valuable working partnership between the industry, mineral planners and enthusiastic/knowledgeable naturalists. Supporting strong, sustainable populations of key species of conservation concern, the site now stands as a valuable case-study for wet grassland and former mineral site restoration.

O 203

Restoration of rich fens: a case study and general aspects

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Tapani Sallantaus

All rich fen types are critically endangered in southern Finland. That is why their restoration is of ultimate importance. We describe a case study and discuss possibilities and difficulties based on a larger survey. The rich fen at Huppionvuori (1.3 ha), near Tampere, was drained in the 1960s. Restoration began in 1994 with the manual blocking of ditches and tree felling. After this, the struggling rich fen vegetation recovered rapidly. As thickets started to grow, the site was restored again in 1999, using machines this time.

The moss species now present are typical of swampy and herb-rich spruce mires. Most of the moss species closely associated with rich fens had not managed to spread over the dammed ditch. This could be due to the acidification of the peat in the middle of the ditch as a consequence of prolonged drying out, or because of an increase in the amounts of soluble nutrients induced by restoration measures. Concentrations of organic materials (TOC) in the runoff in the restored fen were still clearly higher than in natural rich fens or sites drained for forestry

purposes even 12 years after restoration. This reduces the pH of the water and also leaches away reserves of calcium.

The restoration can overall be said to have succeeded well. Over time true rich fen species will expand their occurrences when the effects of the chemical changes induced by the drainage and restoration processes become weaker. Rare and threatened rich fen mosses have spread successfully in many restored rich fens in northern sites which tend to be richer in calcium. Although there are several problems with the restoration of rich fens, there are also very promising experiences and we thus urge for their restoration.

O 204

Restoration of Acid Sulphate Soil (ASS) farmlands in Finland is needed to improve the ecological status of waters

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Tapio Sutela, Jukka Aroviita, Satu-Maaria Karjalainen, Kari-Matti Vuori, Anssi Teppo

The western coast of Finland has the largest area of Acid Sulphate Soils (ASS) in Europe. Agriculture is the main form of land use in the ASS region. Previously detailed information of ASS impacts on the water bodies in the region has been limited. In order to clarify ecological impacts of ASS, diatom, macroinvertebrate, and fish assemblages were sampled. In addition, water quality, including metal concentrations was monitored. About 100 study sites were selected to cover a wide range in the impact strength of ASS soils. All three biological elements showed a significant response to the level of disturbance from the ASS. The acid and metal loads have deteriorated ecological status of water bodies. Acidification is highly periodic, occurring mainly during flood peaks in the springs and in the autumns when sulfate load from ASS soils is at its highest. The effective drainage of farmland by modern subsurface techniques has supported the creation of conditions for acidic leaks. Farmland restoration, i.e. returning farmland to agricultural productivity with concern for environmental conditions, is needed to improve the ecological status of waters. Several techniques are described to reduce the amount and frequency of acidic leaks. This study is part of a multidisciplinary EU Life project, CATERMASS (Climate Change Adaptation Tools for Environmental Risk Mitigation of Acid Sulfate Soils).

O 205

Trends in vegetation development of ecologically friendly river banks. The case of the Moervaart (Belgium)

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Andy Van Kerckvoorde

In recent years, interest has grown in the construction of ecologically friendly river banks (EFRB) as a way to maintain and to develop the biodiversity along navigable waterways. Suc-

cessful vegetation colonisation and development depends on a variety of factors and results from mutual competition between species. On the other hand, it has been demonstrated that the species composition patterns along the bank reflect occurring stress and disturbance gradients. At higher levels of disturbance, gaps in the vegetation and a low interspecific competition can occur.

In this case study we focus on trends in vegetation development in relation to different types of ecologically friendly river banks in the Moervaart (Belgium). It is a minor navigable waterway where 35 km of EFRBs have been built. In our case study, shallow water zones of two different widths both with and without coconut fibre rolls were studied. In addition a comparison is made with fascines placed along the bank without the presence of a sheltered area.

The vegetation composition was monitored three times during a 8-year period using line transects perpendicular to the river. This study revealed common patterns in the vegetation development within each of ecologically friendly river constructions. Shallow water zones with coconut fibre rolls stabilised after 3 to 4 years, whereas it only took 2 to 3 years for constructions without fibre rolls. On the contrary, as fascines without sheltered area, it took 5 years to reach a stable situation after colonisation for wider shallow water zones.

This research aims to develop a tool to support waterway managers in designing the most appropriate type of EFRB construction given the specific characteristics of the river bank.

O 206

Biogeochemical processes in mires of the Tyumen region (Western Siberia) and their relevance for carbon cycling

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Miriam Lordieck, Nikolai Tretiakov, Till Kleinebecker, Norbert Hoelzel

The Western Siberian Lowland offers a mire region of outstanding uniqueness and importance and harbours some of the world's largest peatlands. Still there is a gap of knowledge concerning the biogeochemistry and evolution of these ecosystems in Siberia. For the Tyumen region amelioration activities and peat-cutting have destroyed large areas of natural transitional mires obviously leading to a great loss of biodiversity and negative responses to climate-change. The impact of these activities is still difficult to evaluate as studies on greenhouse-gas emissions and carbon fixation in natural and degraded mires are sparse for this region. In the course of the multi-disciplinary research project SASCHA different studies were performed in natural mires of the Tyumen region. In one transitional mire near the city of Tyumen pore-water peepers were installed at different trophic zones. The water samples were analysed for CO_2 and CH_4 concentrations and for those of different anions and cations. CO_2 and CH_4 production rates were calculated to get a first glimpse on the effects of amelioration regarding the carbon cycle. Additionally a peat core from the mire was analysed for stable isotopes of C, N and S to gain knowledge on the geochemical evolution of the mire. Our results underline the importance of these fast growing transitional mires for carbon fixation and may thus give a hint on appropriate reference conditions for restoration of similar habitats. Driving processes and the main influencing factors are discussed. Recommendations for an appropriate wise and sustainable future use of these ecosystems seem to be mandatory.

O 207

The application of spatial multi-criteria analysis to identify risks to endangered Australian alpine peatlands and assist ecological restoration decision making

Anita Wild, National Environmental Research Program, University of Tasmania, AUSTRALIA
Regina Magierowski, Ted Lefroy, Peter Davies

In Australia, alpine peatlands are restricted to the Australian Alps and Tasmania and are listed as an endangered vegetation community due to their limited extent, past loss and threatening processes. Research has shown that peatlands have suffered a reduction in ecological function and resilience across most of this range from impacts such as pest animal species (specifically horses, pigs and deer), weeds, wildfire, altered hydrological regimes and climate change. As a result, conservation and restoration of these communities is a national priority and detailed assessment of the relative risks and restoration responses is required.

Given the cross-boundary threats, three State management and planning jurisdictions and variability in the degree and severity of threats over both space and time, any approach to assess the risks and restoration priorities required a decision making tool capable of integrating bio-physical, social and economic data. These assessments also required outputs to be adaptable to reflect changing policy frameworks and stochastic events such as landscape-scale fires.

We used a spatial multi-criteria analysis approach to develop models that analyse key threats to alpine peatlands over multiple scales. These models incorporated spatial data for existing on-ground threats and projected climate change impacts to hydrology and vegetation. The models are presented using non-specialist freeware which allows managers to manipulate multiple map displays and threats to allow local-scale updates to visualise the consequence of actions. In doing so, restoration activities and funding can be allocated to areas and issues with increased efficacy and enable greater cross-border management of alpine peatland restoration.

O 208

Linking ecosystem service assessment with benefit valuation: A discrete choice experiment to identify quarry restoration preferences

Jost Wilker, Development of city regions, ILS, GERMANY
Karsten Rusche

Although, conditions for open-cast mining vary essentially, the proper handling of aftercare is a common, relevant challenge for whole Europe. Nature restoration of mineral sites provides the opportunity to allocate huge areas, which offer special conditions for new habitats, to the systems of green infrastructure and to recuperate important ecosystem services and biodiversity. These can be measured and their benefits (monetarily) quantified by means of different valuation methods in order to identify restoration strategies, which provide the highest biodiversity and ecosystem service benefits. Here, it is essential for the legitimisation of restoration

policy to involve all affected stakeholders (industry, local nature conservation NGOs, planners and citizens).

With the case study of the restoration of a limestone quarry in Maastricht, we present an approach of how to link the assessment of biodiversity and ecosystem services with benefit valuation to show what important ecosystem services arise through restorations and how much people value benefits. This is done by the application of a discrete choice experiment, in which people were asked for their preferences, expressed in willingness to pay, on certain restoration scenarios on the site. The scenarios differ in the level of restoration characteristics, so that people`s priorities against each level are revealed. The results are combined with ecosystem service values collected on-site to estimate the total benefit potential of the restoration scheme.

Our approach can support efficient and tailor-made restoration on the one hand and can identify foci for future quarry restoration projects. Moreover, it gathers actors related to the topic of nature restoration and may help to put it explicitly on the political agenda.

O 209

Eco art and bio art in Poland, mutual relations and determinants

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Maria Marko Worlowska

The erasure of the frontiers between nature and culture, that is particularly visible nowadays in the time of the biotechnological discoveries, is exemplified in contemporary world by art. Contemporary art is not only based on the principle of mimesis and beauty, but engaged in social, economical and political issues, can serve as a tool for a better understanding of culture and nature Ecological art that remains in harmony with nature, can have a large impact on the society and can be an attempt to draw attention to the environmental problems. Ecological inclination in art is a relatively new phenomenon in Poland, but because of the importance of its message and the richness of creative activities closely associated with non-anthropocentric aesthetics and the problem of the dichotomy of nature and culture, it requires a detailed analysis.

The first part of the presentation is therefore aimed at analysis of the problems associated with ecological art and it is an attempt to answer the following questions: Does in the post-humanist world dichotomy of nature and culture, in which a higher status is attributed to culture should still apply? What role should account for the art in environmental education and sustainability? Can it function as an inspiration for the ecologists as well? Does it enhance the ecological awareness and mobilize their recipients for a variety of environmental or cultural activities?

In this context, the paper should also reflect on what bio art is. Bio art cannot be clearly defined, but in general way it can be said that bio art encompasses these artistic activities that deal with the issues of life in the context of biotechnology. The second part of the paper is concerned with the questions: Does bio art affect environmental awareness and the develop-

ment of civilization capable of acceptance and respect for the needs and interests of non-human world as well, understood as the interest of the whole biosphere?

O 210

Soil and phosphorus accretion in treatment wetlands

Alan Wright, Everglades Research & Education Center, University of Florida, USA
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Constructed treatment wetlands are utilized to transform, modify or store excess nutrients and protect downstream ecosystems. This study was conducted to enhance our understanding of select biogeochemical processes that control treatment wetland performance, efficiency and long-term sustainability. Large constructed wetlands in South Florida, the Everglades Stormwater Treatment Areas (STAs), were built to treat surface runoff and remove excess phosphorus (P) from the water before entering the Everglades. The overarching goal was to understand key processes controlling transformation of P from reactive (potentially bio-available) pools into non-reactive (stable) pools and the long-term sustainable storage of the sequestered P. This task was carried out by analyzing long-term soil P data obtained from various STAs and characterizing soil P storage pools and forms within STAs in operation for up to16 years. Spatio-temporal variation in floc, recently accreted soil (RAS) and pre-STA (antecedent) soil P storage pools was calculated. Stratigraphic properties of the soil profile were utilized to determine the boundary between RAS and pre-STA soils, which were used to calculate accretion rates in treatment wetlands. Approximately 25–30% of soil total P was present in the non-reactive P pool. Typically, P-enriched STA soils (floc and RAS) contained less total P in the nonreactive pool than pre-STA soils. The Pi and Po fractions in the floc and RAS sections together accounted for 65–70% of all TP stored in soil sections. Inverse relationships were found between accretion rates and operational age of STAs, suggesting that the rate of new soil build-up processes decreased through time. Long-term effectiveness and sustainability of treatment wetlands is important to meet treatment targets and protect downstream targets. This research advanced our understanding on the extent and quality of P pools in treatment wetlands to allow for better planning and management in an event of environmental uncertainty.

O 211

Acceptance of and willingness to pay for restoration of sediment-stressed forest streams

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Elina Seppälä,Virpi Lehtoranta

Forest streams are important biodiversity hotspots and they influence the water quality of downstream water bodies. However, the condition of many Finnish forest streams has deteriorated due to forest drainage and consequent sedimentation. Restoration is a key component in freshwater management programs, in which the involvement and commitment of local inhabitants is viewed crucial.

We studied the attitudes of the inhabitants towards forest streams and their deteriorated status in north-eastern part of Northern Ostrobothnia in Finland. The aim was to identify measurable social benefits related to stream restorations and to reveal possible impacts of ecosystem services to recipients' willingness to pay (WTP).

We applied a contingent valuation method to estimate the recipients' WTP for restoration of forest streams. The questionnaire was mailed to 1,764 households at the end of 2013 and yielded a response rate of 39%.

The scenario of the questionnaire, describing the effects of the executed management program, was built in close co-operation with ecologists of the project. Recipients were asked if they were willing to support the scenario. The payment instrument was a yearly management cost during five years offering 10 alternative bids ranging from 0 € to over 423 €.

Our results indicate that willingness to contribute increases with younger age and acceptance of the management programme. Of the ecosystem services more suitable living conditions for brown trout and appreciation for clean and fresh air in forest had the most influence on willingness to contribute. 58% of the respondents supported the management programme described and 66% were concerned about the effects of sediments on forest streams.

O 212

Can functional group similarity prevent invasion during grassland restoration?

Florencia Yannelli, Chair of restoration Ecology, Technical University of Munich, GERMANY
Christiane Koch, Zoe Palmes, Johannes Kollmann

Grassland restoration is increasingly important for maintaining biodiversity and ecosystem services, as land use changes are leading to fast ecosystem degradation. The invasion by alien species (IAS) frequently hinders the efforts to restore these degraded systems. Thus, designing communities that can resist plant invasions could be a simple and efficient measure. The biotic resistance of a target community can be predicted by the "limiting similarity" theory, which states that IAS are unlikely to establish if there are native species sharing similar functional traits. However, most studies base biotic resistance on differences among functional groups based on life forms, and not on similarity in functional trait characteristics. This study investigates whether we can predict biotic resistance by using functional group identity, while IAS propagule pressure may be decisive in terms of overcoming this resistance. A greenhouse experiment with variation in functional group identity and IAS propagule pressure was conducted. Three functional groups were clustered according to eight functional traits, using native grassland species and two IAS (Solidago gigantea, Ambrosia artemisiifolia). One specific functional group community was particularly successful in suppressing the IAS, due to higher aboveground competition in this community, albeit with no significant differences related to propagule pressure. The IAS were not stronger suppressed by a community of the same functional group. The results show that functional group identity is not a factor explaining IAS suppression very well, while other variables such as vegetation biomass might be more important.

O 213

Indicators of landscape functionality in abandoned lands aimed for arid land conservation in the Monte Desert, Argentina

Florencia Yannelli, Chair of Restoration Ecology, Technical University of Munich, GERMANY
Solana Tabeni

Abandonment of agricultural land worldwide provides an opportunity to analyze the development of self-sustaining systems. It is highly relevant to assess the current status of an ecosystem after cessation of use, characterizing the composition, richness or diversity of communities, but also quantifying basic processes and functions. The Monte Desert is the most arid rangeland of Argentina, where human activities have been suggested as the main causes of degradation processes. This study explores the functional status of former agricultural fields, now abandoned for more than 40 years and currently used as a conservation area. We compare the effects in the organization of the landscape and the changes on the soil surface conditions related to the different periods of land abandonment. For this, we use the landscape function analysis (LFA) methodology as it reflects the status of critical ecosystem processes and leads to obtaining a classification of a given ecosystem based on their state of degradation, through three indices i.e. stability or resistance to erosion, infiltration or water storage capacity and nutrient cycling. The results showed that shrub cover, total patch area, the amount of patches and the landscape organization were enhanced by increased time of land abandonment, while the average interpatch length decreased. On the other hand, only the nutrient cycling index had significant differences and was higher for the old abandoned sites. Although conservation management based on land abandonment was proven to be positive in terms of patch area and shrub cover, it was not translated to landscape stability and infiltration. Thus, this measure is not efficient in preventing further degradation processes in the study area.

O 214

Strategies mitigating restoration conflicts in the context of water, climate and species protection in the course of peatland rewetting

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Rudy van Diggelen, Jurgen Augustin, Michael Trepel, Jörg Gelbrecht, Rob Mc Innes

Progressive drainage and agricultural use of fens has induced severe changes in their physical and geochemical soil properties. The long-term goals of fen restoration can include climate regulation, water quality improvement, and nature conservation. However the full rehabilitation of lost ecological functions, as habitats for endangered plant and animal species or as nutrient sinks, can be retarded for several decades (or centuries) in particular if degradation of upper soil layers is advanced. Depending on the characteristics of the fen (size, landscape position, land use history, degradation, and species inventory) and the restoration objective, potential conflicts can arise regarding the appropriate re-wetting strategy. In most cases conflicts can be mitigated if due consideration is given to potentially negative outcomes when setting the restoration objectives. For instance, where climate regulation, associated with mitigation of CO_2 and N_2O emissions, and the reduction of water quality impacts from non-point sources of nitrate are the objective then there will be an expected increase in export of phos-

phate and dissolved organic matter, especially for large, highly degraded fens. This paper provides empirical evidence based on field experiments in Germany on the implications and effectiveness of different restoration strategies.

O 215

Holes in the ground – marsupials as ecosystem engineers

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J Kirkpatrick, E Cameron, C N Johnson

In Australia medium-sized marsupials, especially bandicoots and rat-kangaroos, contribute significantly to bioturbation - the physical movement of soil – as they dig for food. Most such species are now rare or extinct, so their role as bioturbators has been much diminished or lost in the ecosystems of mainland Australia. We studied the ecological impacts of these marsupials in a woodland ecosystem in Tasmania, where they remain common. Marsupials (predominantly the Tasmanian bettong) were responsible for a standing density of 5000 diggings present/ha, covering 7% of the forest floor. Over 14 months, new diggings were created at an average rate of 275 (+-38)/month/ha, and decayed to non-detectability at a statistically similar rate of 386(+-61)/month/ha. Diggings were patchily distributed, more common in habitats with low basal density, sparse understory and dense litter layer, in some cases representing up to 25% of the forest floor (with up to 15000 diggings ha). Chemical and physical analysis demonstrated that compared to undisturbed topsoil, newly developed soil in excavated pits had significantly higher moisture and lower density, with significantly different levels of 16 out of 19 tested chemical components including higher Carbon, Nitrogen, Phosphorus, Potassium and many trace elements, demonstrating digging mammals increased local-scale heterogeneity in soil characteristics. Digging also increased the proportion of bare ground. These soil variations were associated with regeneration of different plant species. We conclude that bioturbation by marsupials is a process of ecosystem engineering, which increases the range of microhabitats and regeneration niches for plants. Restoration of these species where they have gone extinct could be powerful tool for the promotion of diversity and resilience in Australian woodland ecosystems

Poster presentations

P 1

Afforestation of cutaway peatlands with Scots pine and birch – effects of peat thickness, fertilization and soil preparation during 20 years

Lasse Aro, Parkano Unit, Finnish Forest Research Institute, FINLAND
Jyrki Hytönen, Markku Saarinen

Cutaway peatlands are areas which have been released from peat harvesting. Some of these areas were originally treed mires before peat production started. Thus, afforestation in certain conditions could also be considered as a restoration measure and not only a re-use option. Afforestation experiments of Scots pine, silver and downy birch were established in Finland in the late 1980s. The aim of the long-term study is to compare the main tree species in stem wood and energy wood production in relation to varying peat thickness. Also, the effects of soil preparation and PK fertilization were studied. Here we present preliminary results for the first 20 years. During the first ten years, survival, damage, height and height growth of the seedlings were measured several times, and during the second ten-year period also biomass production was measured twice. The mortality of unfertilized seedlings varied from 31 to 100% on the bare peat surface six to eight years after planting or sowing. Mortality continued to increase during the following ten years. However, the survival of PK-fertilized seedlings was good and independent of peat thickness. Besides fertilization, mounding also increased the height growth of trees. Mean annual increment of birch thickets varied between 1.2 and 2.4 Mg/ha/a during 20–22 years. The lowest values were measured from a site with a coarse-textured mineral sub-soil and thick peat layer. As a conclusion, sufficient nutrient supply either from underlying mineral soil or from fertilization ensures good stem wood production and development of pine and birch stands on shallow peat layers. However, refertilization is needed on thick peat layers. A rather shallow peat layer should be left on the site before afforestation.

P 2

Rehabilitating the river lamprey (*Lampetra fluviatilis*) population in the regulated River Kalajoki, Finland

Kimmo Aronsuu, Water Resources, ELY Centre for North Ostrobothnia, FINLAND
Timo Marjomäki, Kim Wennman

The River Kalajoki has been regulated to enhance flood control and hydro power production. ELY Centre for North Ostrobothnia (regional water authority) has, due to orders stipulated by Environmental court, compensated for the damage from the regulation measures by restoring all the fast flowing river sections (55 ha) below the lowermost hydro power plant. One of the main goals was to improve the spawning and wintering habitats of adult river lampreys with different restoration methods. There was no earlier knowledge on restoration methods of habitats for adult river lampreys. The number of upmigrating adult lampreys and larval densities were monitored for three decades to study the effects of the regulation and compensation measures on the lamprey population. Furthermore, radio telemetry was used to study the success of lampreys to pass the weir, where technical and nature-like fishways were constructed.

Larval densities above river-km 10 decreased during the three decades lasting regulation measures and after starting hydropeaking in 1980s. After cessation of regulation measures and restoration of fast flowing river sections in early 2000s, the densities of subyearling and older larvae increased despite the fact that since 2001 the upmigrating population stayed at a lower level than earlier and annual fishing mortality for migrants was close to 50%.

All radio-tagged lampreys selected the nature-like fish ramp (slope 1:40) instead of the super-active baffle fish way (slope 1:10) and passed the weir (head loss of 1.2 m) through it.

P 3

Aculeate Hymenoptera of reed galls in prefer postindustrial sites before near-natural and habitats

Alena Astapenkova, biology, University of Hradec Kralove, Faculty of Science, CZECH REPUBLIC

Petr Bogusch, Petr Heneberg

Numerous aculeate Hymenoptera show very interesting natural history, like the group of species nesting in empty galls induced by Lipara flies on common reed (Phragmites australis). In 2013 we collected 17,791 Lipara galls at 15 sampling sites in near-natural habitats and another 15 in post-industrial habitats in various parts of the Czech Republic. In total 14 species of aculeate hymenoptera at 2179 individuals were hatched. We installed also colour pan traps at the same sampling sites and obtained in total 1794 individuals of 175 aculeate hymenopteran species. Pemphredon fabricii and Hylaeus pectoralis were the dominant reed galls aculeate hymenopteran inquilines. Hylaeus moricei, Passaloecus clypealis, Rhopalum gracile and Trypoxylon deceptorium were identified as tightly bound to the presence of reed galls. The bigger abundance and diversity of aculeate Hymenoptera was in galls collected from postindustrial sites. In Moericke traps we found remarkably higher diversity of species in postindustrial sites, which can be caused by the presence of bare soil. We also found very rare species, like Nysson quadriguttatus (second historical record from the Czech Republic and only one of few from Europe) and Siberian bumblebee Bombus semenoviellus. The reed beds and reed galls are home to a diverse community of species, which are considered as endangered and in many cases limited to these sites. These species display specific habitat requirements, often requiring not only the presence of reed, but also the presence of loose sandy bedrock.

P 4

Coastal lagoon recovery by SEagrass RESTOration in Venice lagoon: concrete actions for seagrass transplantations and monitoring activities for the assessment of ecological status

Andrea Bonometto, Dep. for Mitigation and Prevention of Impacts, ISPRA, ITALY
Rossella Boscolo, Alessandro Buosi, Chiara Facca, Massimo Parravicini, Adriano Sfriso

The ecosystem functions of seagrass meadows are multiple: they provide food to consumers and are trap carbon and nutrient thanks to their physiological function; they have a structural role and are important habitats for other species contributing to maintain marine biodiversity. Seagrass loss by natural and human-induced disturbance has been recorded frequently throughout the word and their decline is now a worldwide problem.

The main objective of the recently co-funded SeResto project (LIFE12 NAT/IT/000331) is to restoring the Habitats 1,150* (Coastal lagoon) on large scale in Venice lagoon by supporting the self-rehabilitation capacity of aquatic seagrasses, where environmental conditions are going back to be suitable for Nanozostera noltii and/or Zostera marina colonization.

Our technical proposal is characterized by a low cost and low impact on donor sites, because is based on various small transplantation points used to trigger the natural development of seagrass meadows. Nine sods of 30-cm diameter were transplanted in each sites (17 sites for the first year and 18 for the second year) and fishers' direct intervention will enhance the seeds and rhizomes dispersion.

An intensive monitoring activity is planned. Biological Quality Elements (BQEs) required by Dir. 2000/60/CE as indicators (seagrasses, macroalgae, macrobenthos and fish fauna) and supporting abiotic elements in water and sediments will be monitored to investigate the effectiveness of this measure in improving the ecological status the area.

P 5

Methodology for coastal ecosystem valuation for facilitation of decision making processes

Liga Brunina, Association "Baltic Coasts", LATVIA
Elina Konstantinova

In Latvia biodiversity is one of the main values the coastal sustainable development is based on. However, the coastal area is constantly threatened both by natural processes and anthropogenic load. Coastal protection is implemented locally, without scientific justification, almost always enhancing the erosion processes in adjacent sectors, complex and inaccurate legal and administrative mechanisms for coastal management combined with economic aspects result in an inefficient decision making and growing threats to coastal area. Therefore efforts have been made lately for improving the situation and leading to an establishment of a common system for coastal management and ecological restoration.

As a part of this process a development of a set of recommendations has been started regarding not only coastal protection against erosion, but also other integral aspects of coastal management, such as economic, legal, cultural and social. Within the year 2013 an initial framework was developed for evaluation of the coastal ecosystems in Latvia and use of the obtained values for assessment of the planned actions.

The methodology, based on economic evaluation of ecosystems and their services, including cost-benefit analysis, was presented to the coastal municipalities and will serve as a basis for consequent development of recommendations for coastal protection, as well as understanding coastal processes, need for ecological restoration, and creation of a collaboration platform with active involvement of all the sectors of interest for facilitation of the decision making.

The further development and adaptation of the recommendations will be carried out within the following years as a part of EU LIFE+ programme project, to be launched in May/June 2014.

P 6

Functioning of natural ecosystems in the protected areas of Moscow megapolis

Anna Buyvolova, Soil Science, Lomonosov Moscow State University (MSU), RUSSIAN FEDERATION

Yuri Buyvolov, Elena Bykova

Functioning of the ecosystem in green zones of urban areas is influenced by interplay of natural and anthropogenic factors. This study is aimed to evaluate the contribution of factors of both kinds into functioning of macrofauna, forest litter, soil and vegetation cover in site located in protected area with the lowest recreational load in park “Kusminki-Lyublino”.

- to define condition of soil, vegetation, soil megafauna and integral indicators in park “Kusminki-Lyublino”.
- to identify primary anthropogenic factors that impact on components of ecosystems in the park “Kusminki-Lyublino”.

Soil cover was studied using physical-chemical analysis. We found that the soil on our study plots retained both morphological and phisicochemical characteristics of their natural counterparts. Forest litter showed a structure typical for the humified soils of the south taiga zone.

The degree of synanthropization was evaluated with standard method. In late successional stages in park “Kusminki-Lyublino”, an increase of cenophil (species that form successional system) species (Hypericum perforatum L., Calamagrostis arundinacea (L.) Roth, Vaccinium myrtillus L., Pinus silvestris L.) were observed. This indicates that successional process occurs, thus confirming a possibility of functioning of natural communities within a megapolis. The degree of synanthropization is natural.

Our data suggest that natural successional changes occur in cities, so that vegetation restoration in green zones is possible without solid investments.

P 7

A new device to foster oak forest restoration via seed sowing

Jorge Castro, **Department of Ecology, University of Granada,** ***SPAIN***
Alexandro B. Leverkus

Oak woodlands are one of the main vegetation types in the Northern Hemisphere. These forests have suffered disturbances for millennia, and they are currently one of the main targets in restoration policy. The most common oak reforestation technique is via plantations of nursery-grown seedlings, whereas acorn sowing is largely ruled out due to the high seed loss inflicted by vertebrate predators, mainly small rodents. However, the development of planted nursery-cultivated seedlings is poor in many cases, whereas the growth and survival of seedlings originated from sown acorns usually renders better results. Moreover, acorn sowing may be cheaper and is technically easier. We have developed a device that may potentially reduce (even eliminate) seed predation by rodents, while reducing seed predation by larger vertebrates such as ungulates. It is a structure with a truncated shape, either conical, pyramidal, or any other geometrical shape, that contains the seed in its interior and has an aperture for the shoot and the root. The whole device is a few centimetres in size and it is buried in the soil with the seed inside. We hypothesize that 1) this device will reduce acorn predation and 2) it will not affect the germination rate or seedling development. Consequently, we hypothesise that the device will enhance the success of reforestation via seed sowing. To test its viability we conducted seed-sowing experiments under field as well as nursery conditions. The access of different guilds of predators (rodents vs. ungulates) in the field experiments was controlled using either fenced vs. non-fenced areas, or habitats with different structural complexity.

Seed predation in fenced areas was nil for acorns protected inside the device, whereas non-protected seeds suffered high rates of seed predation. Ungulates such as the wild boar provoked seed losses even inside the devices, but its effect was reduced compared to non-protected acorns. Seedling emergence was not affected by the device. We conclude that the use of this seed protector may boost oak reforestation via acorn sowing provided that there is a way to reduce the access of ungulates. This may be achieved in situations of low population levels of ungulates, by fences or other artificial structures, or by taking advantage of habitat complexity provided by physical and biological structures such as snags, shrubs, etc… Overall, the results support the contention that oak reforestation via seed sowing is feasible.

P 8

Creation and restoration of aquatic ecosystems for water quality and biodiversity improvements CREAMAGUA (Life09ENV/ES/000431)

Francisco Comín, Biodiversity Conservation and Ecosystem Restoratio, Instituo Pirenaico de Ecología-CSIC, SPAIN

Adriá Masip, Victor Guirado, Javier Rodriguez, Alfonso Calvo, Nadia Darwiche, Francisca Galego, Gema Cacho, Ana Loriente, Ricardo Sorando, Mercedes Garcia, Alberto Barcos, Silvia Gutierrez

The EU Life project CREAMAGUA (Creation and restoration of aquatic ecosystems for the improvements of water quality and biodiversity) has been performed under the responsibility and coordination of Comarca de Los Monegros (Huesca, Spain) in collaboration with the regional water authority, a private and a semipublic company, a research center, and two local institutions for promoting culture and education. The project consisted on: writing the wetland restoration plans and the programs for monitoring water and sediment quality and the plants, macroinvertebrates and birds communities as representatives of biodiversity, which was finished by the end of 2011; restoring and constructing 11 in-stream and 5 off-stream wetlands adding 300 ha of new wetlands to the landscape of North Monegros which is semiarid zone intensively (irrigation) used for agriculture, which was finished in spring 2013.; monitoring the results of the project, which will finished by the end of 2014. All these actions were performed by different partners with a complex coordination, which shows the very much required establishment of a joint venture among the partners to perform the project successfully. Monitoring showed indicators of diverse high nitrate retention in some wetlands, particularly off-stream wetlands during the irrigation periods. Increase plants and the other studied groups indicate the adequacy of the restoring plans performed. Meetings of different types with local people (students, farmers, local authorities) were kept during all the time for dissemination of the objectives and results of the project.

P 9

Biodiversity restoration and conservation of remarkable military lands in southeast France – Life Défense nature 2 mil

Hervé Coquillart, Conservatoire des Espaces naturels Rhône-Alpes, FRANCE

Raphaël Cogne

Context: Military sites preserved from urbanization and agriculture since the beginning of last century are reservoirs of biodiversity. Of the 250,000 ha of Ministery of Defence property, 42,000 ha are included in the European network Natura 2000 site.

General objective: The aim is to better combine military activities (military drill, fire…) and biodiversity management.

Specific objective: Biodiversity restoration and conservation processes in military lands.

Coordinator: CEN Rhône –Alpes, NGO in biodiversity protection.

Partners: Ministery of Defence, NGO or Collectivity in biodiversity (CEN Corse, CEN PACA, SMGG).

Work developed: Processes to restore biodiversity in military lands : making an inventory with military activities, restoring with pyrotechnic hazards, creating the juridical foundations to engage the sale with environmental clauses of unoccupied properties and a convention about public goods one the domain. Awareness program for soldiers or nature managers: flyers, website, exhibitions, photography contest, posters, trainings, signs, information boards, seminar, media… and a study to evaluate our program.

Future work: The concrete realization of the restoration on the fourth experimental sites.

New tool in our awareness program: comic strip, guides, European communication…
Web site: http://www.lifeterrainsmilitaires.fr/

P 10

Solidago canadensis alters secondary succession in old-fields and impacts on native plant and pollinator communities

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Csongor Vágási, Anikó Kovács-Hostyánszki

Aim. Secondary succession of abandoned croplands might be altered by the colonization of invasive alien species with possible community-wide impacts. Therefore, we wanted to answer the following questions: (1) Does the invasion of Solidago canadensis cause shifts in the composition and diversity of plant and pollinator communities? (2) If so, in which stage of the succession does the greatest shift occur and what kind of compositional changes are manifested?

Methods. We studied the impact of S. canadensis on plant and pollinator communities along a gradient of invasion severity and along different successional stages of abandoned croplands in Southern Transylvania, Romania.

Results. The invasion reduced the native plant species richness throughout succession, although the most profound negative effect on diversity and naturalness was exerted mainly in late-stage communities. Moreover, the invasion of S. canadensis had a negative effect on the abundance of bees, but enhanced the abundance of hoverflies irrespective of the successional stage.

Conclusion. These results highlight the need for urgent eradication efforts to govern the trajectory of succession towards valuable, semi-natural communities.

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P 11

Management of natural valuable areas in the Czech Republic

Bohumil Fiser, Nature and Landscape Management, Nature Conservation Agency of the Czech Republic, CZECH REPUBLIC

In the Czech Republic, there are 4 National Parks, 26 Protected Landscape Areas, 110 National Nature Reserves, 808 Nature Reserves; 113 National Natural Monuments as well as 1,388 Natural Monuments. There are 41 Special Protection Areas pursuant to the Euroepean Union´s Bird Directive and 1075 Sites of European Interests pursuant to the EU Habitats Directive. In addition, there are many other areas, harbouring well preserved nature and the landscape outside the Specially Protecte Areas which should also be, in terms of nature conservation and landscape protection, mentioned. To these valuable areas with the adequate management, it has been decided to use specific nature conservation and landscape protection tools:

1) Pursuant to the current national legislation, reducing harmful disturbances by private persons can be financially compensated. In any case, proper law implementation can be enforced by checking and penalties. Each Specially Protected Areas has basic conditions set by law and detailed conditions can be included into a document on its declaration. Other regulations could be delivered by individual administrative acts.

2) Land purchase and management are used by the Government and also by non-govermental organisations only in the most valuable areas, because of the costs.

3) For each Specially Protected Area, a management plan has to developed, approved and implemented. Management measures from the plan are carried out by the contracts with land owners and tenants, the third subject respectively.

4) It is also important that subvention programmes are targeted to nature conservation and landscape protection.

5) Finally, communication, education and awareness among both the general public and the target groups are regularly used for better nature and landscape management in the Czech Republic.

P 12

Responsible management of South African peatlands – The impact of the hydrogeomorphic peatland type and the peat soil degradation on the restoration potential and sustainable management

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Franziska Faul, Niko Roßkopf, Jutta Zeitz, Lulu Pretorius, Cornie van Huyssteen

Most South African peatlands are located in the Maputaland Coastal Plain. They provide many ecosystem services; especially, they serve as an important source of livelihood for locals. But they are increasingly affected by human pressure. Drainage and inappropriate land

use lead to severe soil degradation. Thus, one important part of the interdisciplinary project AllWet RES (Alliance for Wetlands – Research and Restoration; 2012–2015) focusses on soil properties on near-natural and degraded peatlands in order to assess their restoration potential and to draft recommendations for the responsible use. The peat characteristics depend on the concrete hydrogeomorphic setting that influences the peatland hydrology and the vegetation cover. Selected peatlands of 3 main peat-forming hydrogeomorphic wetland types (HGMTs) have been investigated: (i) interdune depression, (ii) channelled valley-bottom and (iii) unchannelled valley-bottom. Whereas mostly mixtures of gyttja and radicell peat have been accumulated in type (i), the two other types are built by reed-sedge peat and wood peat originated from swamp forests. The knowledge of hydrochemical and hydrophysical characteristics of peat is crucial for a proper assessment of the feasibility and success of restoration measures. Hence, water retention capacity, water conductivity, hydrophobicity and capillary rise for the peat soils were also analysed. The values among the HGMT and between the degraded and near-natural sites vary considerably. Using selected examples the most prominent differences in the peat quality are shown and the first implications for the re-wetting potential and site restorability of the respective sites are derived.

P 13

EvRest – Evaluation of Ecological Restoration in the North

Guðmundur Halldorsson, Research & Development, Soil Conservation Service of Iceland, ICELAND

Ecosystem degradation in northern regions is a pronounced problem due to decimation of natural forest ecosystems, draining of wetlands, fragmentation of rivers and alpine areas and heavy grazing of heathland ecosystems. To remedy this ecological restoration is critical, as was recognized in the outcomes of a COP for the Convention of Biological Diversity in Nagoya in Japan in 2010. The Nordic network ReNo has recently compiled an overview of the status of ecological restoration in the Nordic region. One of the outcomes of the ReNo network was that the ecological and sociological outcomes of ecological restoration projects in the region are rarely subject to standardised evaluations. Worldwide, evaluation of restoration projects is also limited although the need to set clear objectives and use multiple indicators and specific standards to assess outcomes has been recognised.

The Nordic network EvRest was established in 2013 with the aims to give an overview of the status of evaluation of ecological restoration in northern regions and facilitate such evaluation. The study region includes: Canada, Denmark, Finland, Greenland, Iceland, Norway, Scotland, and Sweden. Preliminary results show that there are very significant differences in approaches towards ecological restoration in the study region. This is most clearly reflected in a study comparing evaluation of ecological restoration in Iceland and Finland. Although, Iceland has over 100 years history of ecological restoration and the largest extent of restored areas among the Nordic countries, evaluation of restoration in the country is very limited. In contrast, evaluation of ecological restoration in Finland is much better developed. In both countries evaluation is primarily aimed at ecological results, social and economic parameters rarely being addressed.

P 14

ER goes BEF: A formal comparison between biodiversity and restoration experiments in grasslands

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Johannes Kollmann

Grasslands are the subject of many ecological restoration (ER) studies and the basis of most biodiversity–ecosystem function (BEF) experiments. Species diversity and multiple ecosystem functions are often targets of restoration. Even so, the two research disciplines rarely interact. We systematically review 23 ER and BEF research projects performed in U.S. and European grasslands from the 1990s until present to pinpoint what they do and do not have in common. ER research aims at creating plant communities capable of persisting without further assistance, or under grassland management. Hence major efforts go into balancing functional groups, increasing species transfer efficiency, matching seed sources to environment; experimentation also involves management alternatives and manipulation of the abiotic environment, while aboveground biomass production is often the only ecosystem function recorded. In fully controlled BEF experiments, abiotic conditions, management and randomly chosen community composition are kept constant; more effort is made to measure multiple ecosystem functions, e.g. biomass production, carbon and nutrient cycling. Establishment of unseeded (non-)native species is a concern of both disciplines, and we propose this as common ground for research: Direct initial research at testing invasion resistance of experimental communities, then correlate the ecosystem functions and services most relevant in grassland restoration, e.g. pollination, forage production and carbon storage, to those levels of species diversity that result from both initial seeding and spontaneous assembly. This approach has real-world relevance and may permit crossover between both disciplines even when project resources are too limited for parallel ER-BEF research from the start.

P 15

Restoration and public access of urban coastal meadow complex in Pärnu town – URBANCOWS

Bert Holm, project coordinator, Environmental Board, ESTONIA

Project area
Boreal coastal meadows (1630) are spread all over western coasts of Estonia but only in a few areas these ecosystems reach more than hundred hectares, as they are split by villages, towns or other human settlements. Pärnu coastal meadow nature reserve habitat complex, which consists of boreal coastal meadows, coastal lagoons (1150) and dunes, even when located inside urban environment, is itself spread over more than 250 ha (size of the protected area, which includes also buffers is 371.4 ha). The coastal meadow complex of Pärnu town were heavily overgrown with reed after the grazing stopped there in 1970–1980's.

Project objectives
The overall goal of the project is to improve the favorable conservation status of the coastal meadow and lagoon habitats in Pärnu town as well as the species characteristic to this habitat complex. It is achieved by re-establishing traditional management, cattle grazing, on Pärnu coastal meadow and lagoon habitat complex and raising the awareness of the local community as well as the visitors of Pärnu about the nature values of the area. The experiences gained from restoration of boreal coastal meadows during last 10 years prove that the most cost–effective solution is grazing combined with reed cutting. The aim of the project is to establish necessary infrastructure (steady fences, cattle shelters etc) for grazing in the urban environment and to prepare the area for future management. Cattle grazing in the area was reestablished in 2013 and it reached ca 200 ha by the end of 2013. The restoration of ca 75 ha of coastal lagoons is prepared in 2014 and implemented in together with reducing the human impacts in natural hydrology of Pärnu coastal meadows in 2015. Also the tourism infrastructure will be established (information boards, observation towers, nature trail). Both local community and the tourists visiting the beach of Pärnu will be involved to management and dissemination activities to raise the awareness about the importance of this ecosystem.

P 16

LIFE murerleben, Inneralpine river basin management, Upper Mur

Rudolf Hornich, A14 Water management, Resources and Sustainability, Styrian Government, AUSTRIA

The 1,309 hectars wide Nature 2000 site set the project´s geographical background. The measures are allocated over a length of 90 km.

Background
During the systematic regulation of the River Mur at the end of the 19th century most of the backwaters were cut off and large areas were dried up. The River Mur was disconnected from its surrounding area and side streams and intensive agricultural use goes up to the water body. The alluvial forests on the river banks were reduced and a straightened, deepened river remained. This led to a loss of river dynamic and to a loss of habitats. The old abandoned branches with their alluvial forests and litter meadows are the last precious refuges for rare and/or endangered animal and plant species.

Project Aims
The main goal is the restoration of sidearms and river-widenings to regain the formerly typical braided river system. Additionally, river habitats and alluvial forests shall be restored by connecting existing ones with the dynamic river-system. Ponds on the floodplains shall also be re-established or improved. One of the most important aims is to enlarge the flooding areas where possible without putting adjacent settlements or infrastructure at risk.

After completion of murerleben I the project murerleben II started, considering the monitoring results and lessons learnt:

- to create large connected and diversified habitats in the river and its alluvial forest areas
- to support the consolidation of the revitalized sections
- to provide various, local separate habitat structures for species such as amphibians and fish, which benefit from these contiguous habitat complexes (wintering, spawning, summer quarters) among those they can move back and forth.

Measures
The general objective is the restoration, improvement and long-term protection of typical wetland forests and river landscape. Typical structures with branches, gravel bars, flat river banks, wetland forests and alluvial forest waters were and are going to be created or initiated on different sections of the River Mur.

Project budget: € 2.784.131.Project period: 02/2010 – 02/2015

P 17

Regeneration of raised bog vegetation after fire in the Aukstumala Telmological Reserve

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Jurate Sendzikaite, Romas Pakalnis

Over 270 ha of raised bog vegetation was strongly disturbed by a fire in the Aukštumala Telmological Reserve in 2011. The fire made a damage to the habitats of active raised bogs (7110*) and degraded raised bogs (7120). The aim of the research was to examine the effect of fire on the recovery of vegetation under different hydrological conditions. Since 2011, the measurements of ground water level fluctuations have been carried out and phytosociological relevés of vegetation at the burnt site have been made.

During the first year after the fire, the burnt habitats of the degraded raised bog were rapidly colonized by Marchantia polimorfa, Funaria hygrometrica, Chamerion angustifolium, Conyza canadensis, Caluna vulgaris, etc. This is evident on the north-eastern fringe of the Reserve, where 50–70 m wide zone is still influenced by drainage ditches (ground water table can reach up to -0.4–-0.5 m). None of Sphagnum species in this zone were found, whereas atypical plant species occupied up to 40% of the investigated plots. Marchantia polymoprpha covered up to 20% and Funaria hygrometrica – 12% of the research plots. In 2013, the coverage of these species decreased to 2% and 9%, correspondingly. The recovery of Caluna vulgaris was quite rapid: coverage increased from 20–34% in 2012 to 56–68% in 2013.

In the burnt habitats of the active raised bog (ground water level -0.2–-0.3 m), raised bog species Sphagnum magelanicum, S.fuscum, Rhynchosphora alba, Oxycocus palustris and Calluna vulgaris regenerated. Two-year studies indicated that the biggest changes were ascertained only in C.vulgaris (coverage increased from 7–17% in 2012 to 16–31% in 2013) and Rhynchosphora alba (from 1–7% to 3–12%, correspondingly).

P 18

Restoration of raised bog of Aukstumala in Nemunas Delta Regional Park (AUKSTUMALA LIFE12 NAT/LT/000965)

Leonas Jarasius, Lithuanian Fund for Nature, LITHUANIA
Nerijus Zableckis, Jurate Sendzikaite

The main objective of the project is to restore and maintain the favourable conservation status of the "7110 Active Raised bog" habitat within the Aukštumala Thelmological Reserve. This will be done by damming old drainage ditches within the raised bog, thus raising the water table within the project area and increasing sphagnum growth. A large scale removal of invading bushes and trees from overgrown raised bog areas will complement the damming action. Secondary project objective is to raise awareness about the importance of raised bog protection in Lithuania.

During the project approximately 70 km of small ditches and 10 km of main ditches draining the raised bog will be blocked and 100 ha of overgrown raised bog will be cleared. Public awareness will be raised by training nature guides, organizing excursions, launching project's website, translating and publishing the oldest wetland scientific monograph about Aukštumala in Lithuanian and renovating the educational trail in the bog.

Data obtained in the first year of the project has shown, that the average ground water table in active raised bogs was 27 (±8,3) cm, whereas in the damaged by drainage sites average ground water level was 54 (±19.4) cm and decreased to 93 cm beneath the surface of the peat in most dry places. The average water level for Sphagnum species in active raised bogs varied from -20 to-27 cm. After establishing of first dams ground water table increased by 15 to 20 cm. The continuous ecological restoration works will prevent raised bog from further degradation and ensure favourable conditions for typical bog habitats and species.

P 19

The dynamics of restored communities: how to characterize them?

Renaud Jaunatre, Mountain Ecosystems research unit, Irstea, FRANCE
Josu G. Alday

The aim of ecological restoration is to change degraded ecosystems into ecosystems that resemble a reference community. As a consequence, ecological restoration implies the manipulation of succession; e.g. pointing, accelerating or slowing the successional trajectories to reach a desirable state. One of the major steps of a restoration project must be the monitoring of restoration outcomes, which provides elements to assess the medium- or long-term success of restoration actions applied. The measure of restoration success is fundamental to assess the objective accomplishment and to adjust future management actions. Some reviews have already pointed out that many metrics are used to monitor restored communities (e.g. alpha-diversity, similarity to a reference, multivariate analyses, etc.). However, few frameworks are taking into account the dynamics of the restored communities, despite this dynamics raises many questions for both practitioners and scientists. Among these questions high-

light: How far did the restored communities move from the degraded state? Do they still differentiate from the degraded state? Are they creating alternative stable or transient states in between the degraded and the reference state? How close did they move to the reference state? The objective of our study is to present some methodological thoughts about the tools available to answer these questions. Here, we use the information from extensive research programs on mined sites in Spain to illustrate the methodologies suggested, trying to answer clearly the proposed questions. Finally, we discuss the implications of these methodologies on determining the restoration outcomes of degraded sites.

P 20

Temporal dynamics of restored communities in ecological engineering works

Renaud Jaunatre, Mountain Ecosystems research unit, Irstea, FRANCE
Freddy Rey

Among the numerous applications of ecological engineering are the creation of engineering structures made of living materials, of which objective is to perform a function (for instance, water purification or erosion mitigation). One distinctive characteristic of these living materials is that they have their own dynamics. Within a plant community constituting an engineering structure, diversity and species abundance may change. It is well-known that changes of the community structure can have a significant effect on the whole functioning, and the provided services. This is therefore of primary concern to determine if spontaneous dynamics of these engineering structures allows the preservation of expected services. Since 2002, about 2000 ecological engineering structures have been made up in the Durance catchment (South Eastern France) in order to control sedimentation in its eroded marly gullies. These structures are made up by brush layer with brush mat on wooden sill with Salix cuttings. The poster will present how vegetation develops on these structures, how community functional traits are changing with time and will try to answer if the sedimentation control expected service is still efficient after 12 years.

P 21

Straw and stones mulches modified soil water content in a semiarid Mediterranean area of SE Spain

Jeremiah Pinto, USDA Forest Service, Moscow, USA
María Noelia Jiménez Morales, Mª Ángeles Ripoll Morales, Ángela Sánchez-Miranda Moreno, Francisco Bruno Navarro Reyes

The ecological restoration of Mediterranean semi-arid and dry degraded lands involving seedling plantations of woody species should develop field techniques to maximize resource availability for introduced seedlings, especially during the first post-planting period. Using mulching for soil moisture conservation is a common practice mainly due to its positive effect on soil temperature and infiltration. This work analyzes the effectiveness of the application of

stone and straw mulches on the soil water content in depth. In an open Dehesa of SE Spain, 9 planting holes were dug by a backhoe excavator separated 3 m each other. In March 2010, ECH2O® soil-moisture probes of 20 x 8.2 cm were installed at 10, 20, 40, and 70 cm in depth in each planting hole. After probes were installed, two mulching treatments (plus control) were randomly applied to each planting bed. The stones mulch significantly showed the highest soil water content at 10 cm, whereas at 20, 40 and 70 cm the straw mulch showed the greatest values. The highest mean values of soil-water content were recorded at 40 and 70 cm in depth both under the straw mulch and the control treatment. The monthly rainfall showed a positive and significant correlation with soil-water content for all treatments and depths. During the dry season the straw mulch improved the soil-water content in all the studied depths, especially at the beginning of the summer, when it is crucial for plant growth. In some periods the soil water was between twice or three times higher than the control. However, it was also true for the stones mulch but only at 10 cm in depth.

P 22

Testing the efficiency of uneven-aged forestry as a conservation tool to promote biodiversity and ecological legacies.

Klara Joelsson, Wildlife, Fish, and Environmental Studies, Swedish University of Agricultural Sciences, SWEDEN

Forestry in Sweden is dominated by even-aged management. Even-aged forestry simplifies forest structure, breaks forest continuity and negatively effects biodiversity. This has led to a renewed interest in uneven-aged forestry, which maintains a layered forest structures and has less impact on micro-climate and biodiversity than clear-cutting. However, we still need to quantify differences and identify proximate reasons for this. By experimentally compare uneven-aged to even-aged forest management we will test the following hypotheses:

- Uneven-aged forest management will favour species associated with old growth forest characteristics but disfavour species associated with early successional forests
- Uneven-aged forestry will retain pertinent ecological structures necessary to maintain abundance, species richness and composition of insects, wood fungi and lichens: a) at higher levels than observed in stands with even-aged structure and b) similar to levels in reference stands

P 23

The social effects of demonstrative wetlands: Life+ Return of Rural Wetlands

Samuli Karppinen, Life+ Return of Rural Wetlands, Finnish Wildlife Agency, FINLAND
Jani Pellikka, Juha Siekkinen

Management actions made in environment may have various, situation-specific and unexpected effects for social-ecologic environment. Establishing a wetland affects to its surrounding environment. The first wetlands were established in the 1970's by hunters. Since then,

especially the state-owned enterprise, Metsähallitus has been active in establishing wetlands on areas that are unsuitable for forest management. The impacts of such projects on local people are unclearly known.

In 2010, the Finnish Wildlife Agency started the Life+ Return of rural wetlands project. One of the main goals was to set up demonstrative wetlands across Finland. In this research I will explore the direct and indirect impacts of establishing wetlands, throughout the process, on local peoples living conditions, quality and way of life.

The research data consist of two surveys, made among the actors participating in the establishing of the demonstrative wetlands. The first of the surveys was made out before the demonstrative wetlands was finished and the second one after the completion. In addition to surveys, interviews and observing as participant were made during the establishing of four wetlands in Southern Finland. The collection of data of the second survey is still ongoing (it will be completed by the end of October 2014) but preliminary results will be presented in this presentation. I will discuss the role of the demonstrative wetlands for encouraging local actors to establish more wetlands.

P 24

Near-natural restoration of urban areas: biodiversity and ecosystem functioning

Kathrin Kiehl, Vegetation Ecology, Osnabrueck University of Applied Sciences, GERMANY
Roland Schröder

Urban demolition sites and brownfields are often characterised by completely changed abiotic conditions due to anthropogenic activities. These areas often exhibit ruderal vegetation with a high proportion of non-native invasive plant species. On the other hand, extreme site conditions can also favour threatened species of dry grasslands and other species of low-productive habitats.

In times of increasing urbanisation it is a challenge for restoration science and urban planners to optimise these areas for several ecosystem services. Near-natural restoration of urban demolition sites by re-vegetation with native plant species seems to be a fruitful approach aiming to develop ecosystem services like aesthetic values for recreation as well as values for nature conservation such as promoting biodiversity. Moreover, restoration of urban areas provides a great potential for biodiversity and ecosystem functioning research. The aim of our project is to develop restoration strategies and techniques to enhance biodiversity and ecosystem services of urban-industrial areas by near-natural restoration approaches.

In spring 2014 we started an experiment on the effects of low- and high-diversity seed mixtures with different functional groups on the establishment of invasive species and successional pathways (priority effects). We sowed two different native plant seed mixtures with similar density in a block design at an urban demolition site of c. 10.000 m². In cooperation with local authorities interested in low cost management, we will also study effects of different management measures on species establishment and persistence as well as on aesthetical value during the next years.

P 25

The effects of wood ash on the biomass of trees at cutaway peatlands

Katri Ots, Silviculture, Estonian University of Life Sciences, ESTONIA
Karin Kikamägi

After peat extraction the land is bare of plants, the residual peat is practically free from seeds and colonisation may take years. Peat harvesting interrupts the C storage to turn peatlands a source of C emissions. Afforestation of abandoned cutaway peatlands can be restore CO_2 binding and accumulation of C in trees (Huotari et al. 2009) and restore biological diversity.

The objective of the study was to quantify the effect of wood ash on the biomass of Betula pendula, Pinus sylvestris and Picea abies on cutaway peatlands in Estonia. Therefor a experimental area with wood ash (10 t/ha and 15 t/ha) were established in 2011. One-year-old B. pendula, two-year-old P. sylvestris and three-year-old P. abies seedlings were planted with density 1.2 m × 2 m. The model trees (n=3–5) for the determination of biomass and biomass production of the two-year-old stands were felled at the beginning of September 2012.

Already after the first growing season ash fertilisation significantly increased growth of B. pendula seedlings, on the other hand the average height of P. sylvestris and P. abies was almost equal ($p>0.05$) on all plots. After the second growing year differences in the average height growth of B. pendula, P. sylvestris and P. abies were statistically significantly higher on ash-treated plots than on the control plots ($p<0.05$).

In the second year after fertilisation the mean tree biomass of B. pendula was 217 g on the plot treated with 15 t/ha, whilst in the control plot the mean tree biomass was only 10 g. The mean annual biomass increment of B. pendula on the treated with 15 t/ha was 135 g/yr. The biomass production of the two conifer species (22 g/yr P. sylvestris; 66 g/yr P. abies)was the greatest on the wood ash 15 t/ha treatments also.

P 26

Conversion of arable land to a lowland hay meadow using native plant material

Anita Kirmer, Nature Conservation and Landscape Planning, Anhalt University of Applied Sciences, GERMANY
Sabine Tischew

In Central Europe, the area of species-rich grasslands is decreasing rapidly, due to intensification of agriculture, abandonment, and conversion to arable fields. In 2007, we implemented a large-scale trial on former arable land in the agricultural region of Saxony-Anhalt (Germany). The site was cultivated twice without fertilization, followed by shallow grubbing after harvest to deplete the soil seed bank. In August 2009, seed material for restoration was harvested directly on a species-rich donor site and propagated seed were purchased from regional seed propagation. Four variants were installed in complete block design (green hay, threshed mate-

rial, both with/without additional sowing of 37 grassland species). Since 2010, the site was mown in June and grazed in September.

Until 2013, vegetation surveys revealed high transfer rates of common target species (c. 65–75%) but lower values for rare target species (c. 45%). The highest number of rare grasslands species occurred on variants with additionally sown species. The overall establishment rate of sown species reached c. 70–75%. On all variants, the share of target species on total coverage is almost 100%. Due to the harvest of a late second cut, grasses are underrepresented especially on variants without additional sowing, indicating an imbalance of functional groups that led to the dominance of Trifolium pratense in 2012 and Galium mollugo in 2013. With ongoing time, we expect that grasses as well as rare target species will increase their abundance on all variants, shifting the course of succession continuously in direction to the intended target community.

P 27

EU LIFE Project National Conservation and Management Programme for Natura 2000 Sites in Latvia – NAT-PROGRAMME

Erika Klavina, Nature education and supervision department, Nature Conservation Agency, LATVIA

EU LIFE+ Project "NAT-PROGRAMME", implemented by the Nature Conservation Agency of Latvia (2012–2017), actively contributed to raising awareness about the importance of responsible and effective management of EU protected habitats.

Project NAT-PROGRAMME aims to contribute to improving the quality of habitats in Latvia by drafting comprehensive Habitat Management Guidelines and the National Conservation and Management Programme for Natura 2000. There are more than 300 Natura sites in Latvia but only 18% of them have Nature Management Plans. Elaboration of National conservation programme allows comparing the most valuable sites, and prioritising the actual needs for habitats conservation and restoration.

The elaboration of the Programme shows that scientific communication, and the involvement of a very wide range of professionals in processes concerning different habitat management and protection issues has given synergy effects not only to the better ways to protect and manage habitats but also an understanding of the ecological functions of the ecosystems. The methods for the elaboration of Programme includes improved public awareness of the appropriate nature conservation and management measures and increased public understanding of the link between the costs of nature conservation and the benefits from healthy ecosystem services.

The first findings of the project show, that we need to learn and develop an integrated approach to the way we think of ecosystem management and biological diversity. Close collaboration is needed between various organisations and institutions that represent the use of nature resources and habitats conservations. We need continuous evaluation of the efficiency of existing habitat restoration and management activities. Specifically concerning water habitats - the current state and functionality of riparian buffer belts must be clarified at all levels to

maintain water quality. Motivation and education of land owners is a crucial starting point for successful and long-term sustainable management of habitats in Latvia.

P 28

Lake Ecosystem Services in Regional Policies

Saija Koljonen, Freshwater Centre, Finnish Environment Institute, FINLAND

Ilkka Sammalkorpi, Teresa O´Reilly, Molloy Mary, Marco Simone, Zdenek Adamek, Gabor Molnar, Zita Egerszegi, Lea Tuvikene, Antoine Griscti, Ole Dahlqvist-Sorensen, Ville Matikka

This collaborative project will enhance the knowledge of local and regional stakeholders in lake management issues. It will also provide them with better tools to maintain and enhance Ecosystem Services which can be achieved through lake restoration measures and improving other water bodies. The Interreg IVC project LakeAdmin has ten partners from regions across Europe which have a wide variety of water resources management issues – and all of whom have identified lake management as an important element of their regional policies. In this project, Good Practices related to water management are identified and transferred into regional Implementation Plans. A preliminary survey of Ecosystem Services in partner regions presented 16 mainly provisioning lacustrine ecosystem services which are of significant economic use. This highlighted the regions’ dependence on such natural resources. These recognised ecosystem services are either directly (e.g. raw water, irrigation, aquaculture, commercial fisheries, hydropower) or indirectly (e.g. recreation, tourism, other forms of fisheries) highly important locally. Most of the ecosystem services are also heavily dependent on water which is of sufficiently high quality. Their local economic value is so high that extensive water protection or management measures have been or will be carried out to maintain them. The role of, for example irrigation and biodiversity is of special importance in the southern, Mediterranean- partner regions while boating and fisheries are more prevalent northern services. Recreation, biodiversity and landscape value were high priorities in all regions. We can conclude that the regions share a common interest in maintaining biodiversity and economically significant Ecosystem Services. The cost of managing economically valuable Ecosystem Services may benefit biodiversity and can be based on cost effective use of management activities.

P 29

Nature and nurture: how site productivity and seed source of a dominant species affect a subordinate grassland species

Johannes Kollmann, Restoration Ecology, TUM, GERMANY

Emer Walker, Timo Conradi, Harald Meimberg

Although recommendations exist for the use of locally sourced seed material for grassland restoration, cultivars are still included in seed mixtures. Cultivars are selected for certain traits which may hinder establishment and growth of other grassland species. In addition, nutrient-rich sites could favour the development of dominant grasses at the cost of subordinates.

The aim of this study is to determine whether the seed source (cultivar/regional) influences the competitive effect of a dominant grass, interacting with site productivity. A competition experiment was established with three nutrient levels: Dianthus carthusianorum was chosen as a subordinate while the dominant grass was Festuca rubra. The grass was sourced from 13 cultivar and 12 regional sources. No significant difference in the total number of emerged F. rubra from either source was observed; yet, the cultivars showed faster seedling emergence. A significant effect of the source, nutrient level and their interaction on the competitive effect of F. rubra was found. Regional F. rubra had a greater effect on the subordinate species in medium and high nutrient levels. The highest effect on D. carthusianorum occurred in the medium and not the high nutrient treatment. Overall, regional grasses showed greater variability in emergence and competitive effect in comparison to cultivars. The strong competitive abilities of regional F. rubra may hinder the establishment of subordinates, particularly at higher soil nutrient levels.

P 30

Responsible management of South African wetlands – AllWet RES project for sustainable land use and restoration of peatlands in KwaZulu Natal, South Africa

Johannes Kollmann, Restoration Ecology, TUM, GERMANY

Martin von Roeder, Naret Guerrero, Jonas Arndt, Niko Roßkopf, Marvin Gabriel, Mathilde L. Pretorius, Piet-Louis Grundling, Jutta Zeitz, Cornie van Huyssteen, Jean Simonis, Jan Sliva

During the past decades most efforts in peatland restoration have focused on the northern hemisphere, while environmental problems related to degradation and non-sustainable use of peatlands in sub-Saharan Africa and Latin America are underrepresented, although these ecosystems provide essential services, especially in countries affected by drought. In a pilot study area within the Maputaland Coastal Plains, comprising about 60% of the South African peatlands, the interdisciplinary project AllWet RES (Alliance for Wetlands – Research and Restoration) aims at the development of recommendations for conservation, restoration and wise use of peatlands. Although partially protected by national and international laws and conventions, the manifold impacts of cultivation, urbanization and afforestation have resulted in severe degradation of many wetlands in the region. Within the scope of the project individual studies supervised by several German and South African universities contribute to the improvement of basic and applied knowledge on sustainable use of peatlands as well as on the possibilities and limits of their restoration. Each study represents a "puzzle piece" in the research encompassing landscape-ecological and socio-economic investigations, as well as studies in soil science, vegetation and restoration ecology. The contribution explains the overall scheme of the inter-linked research within the project. First results are presented, regarding the historical analysis of the land use, socio-economic surveys and the peat soil investigations as the essential basis for the development of restoration concepts. Project outcomes are already acknowledged by key stakeholders and incorporated in their decision making work.

P 31

Restoration of wetland ecosystems under the new highway trestle bridge (Central Poland)

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Edyta Charazka, Jacek Forysiak

Almost 2400 kms of expressways and highways have been built in Poland over the last decade. Rapid development of road infrastructure poses a threat to the natural environment. One of the most serious threats is the direct and indirect human impact on valuable ecosystems of the river valleys. A number of mitigation measures are undertaken to minimize the negative impact, which include construction of trestle bridges to preserve the valleys' function as wildlife corridors and to maintain proper water conditions in the valley.

A new section of A1 highway and a trestle bridge of about 2 kms in length was completed in 2012. The trestle bridge crosses the Bzura River valley (Central Poland) protected under the Natura 2000 program. In 2013 botanical studies were conducted under the trestle bridge and in its immediate neighborhood mainly to assess the rate and potential for spontaneous restoration of peatland vegetation destroyed by the construction works. Line transect method was used with transects perpendicular to the road axis. 12 transects were established in the area of 10.57 ha, composed of adjacent square-shaped study areas (2m x 2m). 254 areas were established, within which in 2013 a total of 170 species of vascular plants were identified. Most of them are anthropogenic habitat species, including invasive species such as Echinocystis lobata, Bidens frondosa, Galinsoga parviflora, Galinsoga ciliata and Conyza canadensis. The results show that restoration of the area is necessary as its spontaneous regeneration into reed beds is impossible. Restoration will comprise leveling of the road lane under the trestle road to the level of the surrounding unmodified peatland and sowing the exposed ground with green hay.

P 32

Certification and restoration actions in forests – boon or bane

Klaus Kretschmer, Life-Projects, Biologische Station im Kreis Wesel e.V., GERMANY

In the context of the Life+Project "Acidophilous oak woods with bogs and heaths" (Lower Rhine Area, Northwest Germany) several actions for the restoration of Natura-2000 habitats and species were fulfilled by the project partners. The operating forestry office is certified by FSC as well as by PEFC. Both labels take up for itself to grant a responsible management of forests by maintaining natural communities and high conservation values. By the practical implementation is these positive intention not easy to handle. The obligations received with the certification lead to conflicts concerning to the nature conservation measures.

The conversion from not indigenous to natural forest communities by clear-cutting off all unwanted trees contradicts to the principle of removing only single or groups of trees. The restoration of nutrient poor habitats does not fit to the aspiration to leave the treetops on the

surface. The removal of invasive alien species is complicated by the ban of removing complete trees and high restriction of using biozides.

In most case FSC and PEFC permit exceptions, nevertheless, their practical conversion is neither easy nor enough widespread relating to the real facts of necessary conservation actions. Bureaucracy as well as long and complicated decisive ways make it difficult to get the corresponding permission. Changes are necessary, which in practice due to quick decisions, particular if nature conservation and forestry well work together.

P 33

Monitoring and evaluation of novel ecosystem development on post-mining restoration site

Diana Laarmann, Forest Management, Estonian University of Life Sciences, ESTONIA
Henn Korjus

Ecological restoration of exhausted surface mining sites aims to direct their development towards a long-term sustainable ecosystem and to return the degraded system to pre-mining conditions where ecosystem structure, function and processes are regained. Afforestation can play a key role in harmonizing long-term reclamation of the ecosystem by restoring productivity, biological diversity, and ecological integrity on such degraded areas. Often on post-mining restoration sites develop novel ecosystems as soil conditions are completely new and ecosystem assemblage is random and spontaneous in the beginning. This study is based on long-term monitoring and evaluation of afforested oil shale quarry in Estonia. The study is based on chronosequence data of soil and vegetation. After site reclamation soil formation has started and our study shows that N, K and organic C content in soil is similar to common Hepatica forest site type and P, C and pH are more similar to Calamagrostis forest site type. Vegetation of the restoration area differs from common forest sites, there are represented dry and wet site specific species as well as poor and fertile type specific species. Forest stand development is similar to Hepatica type forest. Studied novel ecosystems are quite dynamic, changing quickly by disturbances and have not easily predictable development pathways. Monitoring and evaluation gives an access to plan further management activities in these areas.

P 34

Seedling growth success on degraded tropical peat, reforestation with local tree species

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Jyrki Jauhiainen, Harri Vasander

Tropical peatlands of the Southeast Asia cover about 25 million hectares. The main peat forming ecosystem in the tropics is peat swamp forest, an ecosystem which is extensively converted by clear-cutting, drainage and fires to other land uses. In this planting experiment, we

aimed to find native tree species suitable for restoring degraded tropical peatland vegetation. The study site is drained and burnt area on deep peat in the province of Central Kalimantan in Indonesia. We chose 12 tree species with known potential for restoration purposes based on the local knowledge. Seeds were collected from local sources and seedlings were grown in a field nursery for 6–11 months. In order to study the effect of the ground-water table on the seedling success the seedlings were planted in three blocks representing differing wetness conditions. Mortality of the seedlings was monitored once in four weeks and height and diameter growth once in 12 weeks for one year. Survival of the seedlings after one year varied greatly by species and was between 93 and 26%, with the highest survival rates in the driest block. Drought periods increased mortality in several species but on the other hand the height growth was often negatively correlated with the high water tables. The most promising species based on both growth and survival were Shorea balangeran, Dacryodes rostrata, Adenanthera pavonina and Horsfieldia crassifolia. These results show that both drought and flooding can inhibit the seedling growth success and only a limited number of species had notable growth during the first year, which sets challenges for heavily degraded peatland restoration.

P 35

From Brachypodium-stand to fully developed chalk grassland

Martine Lejeune, Communicatie en Ecologie, BELGIUM
Willy Verbeke

Thirty years in the life of a permanent plot on the Belgian Montagne Saint-Pierre

Before 1985, one species dominated all the vegetation and even determined the aspect of a grass slope in the region of Montagne Saint-Pierre. Named as the Tor Grass Slope, it was not a natural slope, having been created as a result of spoil from quarrying in the 1960's. The vegetation of the slope was very poor in species, resulting in an unattractive environment and one which was further marred by an annual spring burning regime.

In 1985, with a significant change in the management regime, a grazing experiment commenced which has been maintained. Since then, the slope has been subject to intensive grazing by a high density of sheep during one or two very short periods, usually once in spring and once in early autumn. This nature of this change led us to establish a permanent plot on the slope, so that the development of the vegetation could be monitored over a sustained period of time. Our observations were designed to monitor the challenging situation, in order that we could answer questions such as: would the vegetation become more species-rich, would the Tor-grass decline, would other typical chalk grassland species succeed in colonizing the plot?

Now, after almost 30 years we can report on the longterm effects and begin to formulate answers to those questions.

P 36

An innovative approach to mitigate the conflicts between local communities and park management to favour long-term conservation of grasslands in Gran Sasso Laga National Park

Pina Leone, Scientific Service, Gran Sasso Laga National Park, ITALY
Osvaldo Locasciulli

The experiences made by the gran sasso national park in the past Life project has shown that traditional technical, legal and economic measures alone are not sufficient to mitigate the conflicts between conservation polices and local communities. The social research carried out in the national park has shed a light on the roles and attitudes of the different involved stakeholders categories, as well as on many different points of view, dissimilar positions and interests between all involved parties, including the park administration. The understanding of these divergences has been the starting point of a process that aimed at the common search of solutions for conservation in cooperation with all involved parties. The LIFE Praterie project is currently involving many stakeholders categories in order to commonly develop community regulations for pasture management, as a tool of long-term conservation of grasslands. We are carrying out a long series of local meetings in which we use different participatory techniques that help to build a dialogue between parties. These meetings shall also guarantee the prosecution of the durable participatory process in order to improve confidence, communication levels, conflict management and accountability of the involved stakeholders. This process has developed a discussion channel regarding values and weak points of grassland management, types and intensity of existing conflicts, and shared solutions to mitigate tensions and conflicts levels. The encouraging result of this process is that newly identified conservation measures are more effective thanks to the management of the existing conflicts and the improved dialogue between parties.

P 37

Urgent actions for the conservation of grasslans and pastures in the Gran Sasso -Laga National Park, Italy

Pina Leone, Scientific Service, Gran Sasso-Laga National Park, ITALY
Osvaldo Locasciulli

The Southern slope of the Gran Sasso mountain is characterized by the landscapes of the high plain of Campo Imperatore and the higher alpine regions. This is a unique environment in Central Italy, due to the alpine features and due to the vast extensions of grasslands and pastures. This area is home to a several habitats listed in the HD, also present also in the area of the Monti della Laga.

The wellbeing of the grasslands and of important animal species found there, is endangered by two main types of threats:

1. The extensive and improper livestock raising practices.

2. The unregulated presence of tourists. Many habitats are affected by this problem, all included in the HD. In addition, the Orsini viper (Vipera ursinii) and the chamois (*Rupicapra pyrenaica ornata - priority species) suffer from this problem.

Due to this situation the objectives of the project are:

- The long-term conservation of pastures through the application of correct pasturing practices
- The management of tourism in order to limit indiscriminated access to high conservation value sites.

Actions and means involved:

- Collection and analysis of the community regulations for pasture management.
- Geo and photo database of the land use and the spoiled areas.
- Evaluation of the main livestock management problems for livestock breeders.
- Fencing mountain lakes to prevent access of livestock and construction of alternative water troughs.
- Structural interventions to improve extensive livestock raising.
- Negotiation between local Administrations, livestock raisers and Park management.
- Structural interventions to control the movements of tourism
- Itinerant dissemination of good practice to livestock raisers
- General information activities, a website and networking with other LIFE projects will aim to disseminate the project and to exchange experience with other similar initiatives.
- General project monitoring the success of the project through a post-hoc analysis

P 38

Moss propagation for ecological restoration

Magnea Magnusdottir, Power plants, ON, ICELAND
Asa L. Aradottir

Icelandic moss heaths are damaged by various construction; thus it is important find methods to restore moss cover where it has been disturbed. The goal of this study was to develop methods to speed up moss colonization. The study focused on R. lanuginosum but Racomitrium ericoides, Hylocomium splendens and Rhytidiadelphus squarrosus were also included in a part of the study.

Moss colonization experiments in disturbed areas at Hellisheidi tested the effects of propagule size and substrate by distributing whole branches, 1 cm fragments from top of branches and moss slurry of R. lanuginosum, R. ericoides and H. splendens on mineral soil and R. lanuginosum on coarse tephra. R. lanuginosum propagules colonized successful on coarse tephra and all species colonized successfully on mineral soil with moss slurry, but most of the whole branches and 1 cm fragments disappeared from plots.

P 39

Ecological restoration after constructions of a geothermal power plant

Magnea Magnusdottir, Power plants, ON, ICELAND

In Hellisheidi Iceland, alpine vegetation has been damaged during the construction of a geothermal power plant. The damages are related to the establishment of drilling platforms, gravel mines, pipe ditches, roads, buildings, etc. With the goal of restoring similar vegetation as was in the damaged sites prior to disturbance, methods such as seed containing hey transfer, turf transplantations, distribution of moss fragments and collection and planting of willow cuttings have been used. Most of these methods have given promising results and show potential for restoration of damaged alpine vegetation. The poster will address the results of these restoration interventions.

P 40

Hands-on educational programme in ecological restoration for youth in Iceland

Rannveig Magnusdottir, L, Landvernd, ICELAND

Kristin Svavarsdóttir, S Jonsdottir,T Petursdottir, B Koch, I Heidarsdottir, J Stefansson, G Magnusdottir, G Gudbrandsson

Education, training and youth involvement in addressing the challenges of environmental issues at a local level are key factors in contributing to changing attitudes and conduct towards nature. A novel ecological restoration project was initiated in 2013 with the aim of increasing youth's understanding and teachers' capacities to deal with complex environmental issues. Landvernd, a non-governmental organization, leads the project in collaboration with the Soil Conservation Service of Iceland (SCSI) and three Eco-Schools in South Iceland. The project involves educating young people about ecological restoration and its importance for desertification, biodiversity and climate change. In spring 2014, primary school pupils, under the guidance of teachers, Landvernd and SCSI staff, set up restoration experiments on eroded land. Pupils will monitor changes, beginning in autumn 2014, e.g. vegetation cover and biodiversity, and estimate how much carbon from the atmosphere is sequestered by their actions. Thus, pupils become active participants in ecological restoration activities and as these actions are put forth as experiments; they will also encounter scientific methodology. They will process the data they collect and present their findings to their school and local community. Surveys and questionnaires are being used to test teachers and pupils' knowledge prior to, during and after the first phases of the project. We aim at using the results of this project to develop a model for education on complex environmental issues in Icelandic schools.

P 41

Soil bacteria at the roadside: Implications for management and restoration of antrhosols from road embankments

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Dolores Trigo, Eiko Eurya Kuramae, Luis Balaguer

Changes in land use are nowadays one of the main forces of terrestrial ecosystem degradation. Historical and current human-mediated changes have significantly altered soil structure and function given rise to the so called anthropogenic soils or anthrosols. A particular case of these anthrosols are those present in road embankments, derived from road construction. Although it is well known the effect of anthropogenic practices as agriculture upon soil bacteria community composition, little is known about soil microbes communities inhabiting these newly created environments. The aim of this study was characterize soil bacteria community composition and diversity on road embankments as well as factors affecting changes in community composition. We selected four road embankments in Madrid central Spain, in which we have collected 48 bulk soil samples. Soil bacteria community structure was analyzed by means of 16S rRNA partial gene sequences. Our results showed microbial communities from unmanaged road embankments are relatively low diverse and dominated by some groups that are indicative of soil stable conditions and secondary succession pathways. These findings highlight the importance of reviewing common management practices on road embankments in order to preserve functionality and ecosystem services that these environments can deliver.

P 42

Effect of sediment stress and restoration on in-stream conditions at forest stream: hydraulic aspects

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Increased supply of fine sediments from different land uses is a major human impact on stream biota worldwide. In Finland, especially problematic is the transport of organic particulate matter and siltation of stream reaches with inorganic bed load. In this study, focus is on effect of extensive bed load on ecological and hydraulic processes in forest streams. Processes at the interface of surface water hydraulics and hydrological conditions and hyporheic water will be studied using field surveys and artificial flumes, side by side with ecological studies. Main research questions are i) how extensive siltation and restoration practices affect stream hydraulics and sedimentation conditions; ii) how changes in flow conditions and level of siltation affect hyporheic zone processes; and iii) how changes in sedimentation and hydraulic patterns can be seen in ecological processes. The research questions are solved by carrying out extensive field campaigns and artificial flume studies. Heavily siltated forest streams in the Northeastern part of Finland, Koillismaa, are used as a natural laboratory and 33 sites including siltated, restored and natural conditions are compared. Controlled experiments in artificial flumes are used to study hyporheic processes in different flow and siltation conditions. Both studies are made parallel with ecological studies.

P 43

Innovative Systems for the Biochemical Restoration and Monitoring of Degraded Soils (BIOREM LIFE11/ENV/IT/000113)

Grazia Masciandaro, National Research Council (CNR), Institute for Ecosystem Study, ITALY
Serena Doni, Eleonora Peruzzi, Cristina Macci

Inappropriate agricultural practices, combined with adverse environmental and climatic factors, make the soil particularly prone to intense degradation processes, especially in Mediterranean area.

The BIOREM project (LIFE11/ENV/IT/000113) will demonstrate the viability of the addition of stabilized organic matter and the plantation of autochthonous species as an environmental approach to recover and to protect the soil in areas with high risk of degradation processes.

Ten sites (about 360 m² each) have been set up for the experimentation in Italy and in Spain. Each one was divided in four plots and assigned to a different treatment with the aim to evaluate the single and combined effect of plants (Pino halepensis and Pistacia lentiscus) and organic amendment (compost 9 kg C /m²) on soil quality improvement.

Conventional chemical-physical parameters usually related to soil fertility along with more sensitive biochemical and biological indicators of soil quality and functionality have been used as innovative integrated characterization and monitoring methodology.

The results of soil characterization showed that microbial metabolism and carbon cycle were strictly interrelated each other and positively affected by the organic matter added. These parameters clearly discriminated the different sites and a higher soil quality and functionality were generally observed in Spanish with respect to Italian sites. After six months, the proposed remediation strategies have already showed their effectiveness in soil quality amelioration in terms of total C and N content and biochemical activities. The experimentation is still under monitoring and other specific parameters (e.g. humic-enzyme complexes and microbial structure and activity) reflecting organic matter transformation and storage in soil are ongoing.

P 44

Monitoring of habitat development on industrial cutaway bog in Ireland

Mark McCorry, Ecology Team, Bord na Móna, IRELAND
David Fallon, Catherine Farrell

Bord na Móna (Irish Peat Company) owns approx 80,000ha of peatland largely in the midlands of Ireland. Since the 1940s these former raised bogs have been developed industrially for fuel, energy and horticultural peat. Bord na Móna is committed to the rehabilitation of these cutaway areas where peat production has ceased. Rehabilitation generally involves the

stabilisation of cutaway areas using targeted rehabilitation measures such as drain blocking coupled with natural processes.

Since 2009 an ecological monitoring programme has documented the outcome of ongoing Bord na Móna cutaway rehabilitation work. Monitoring involves habitat mapping to track the progress of natural colonization as well as surveying indicator species colonising these 'new' and developing habitats. Monitoring also identifies areas of cutaway that are slow to stabilise and require further rehabilitation measures, while providing an understanding of the successional development of cutaway habitats.

Derries Bog is located in Co. Offaly, Ireland. Industrial peat production ceased in the majority of the site between 1990 and 1995 and targeted rehabilitation was carried out in 1999. This involved blocking of outfalls which resulted in flooding of 10% of the site. A baseline survey was completed in 2009 using standard habitat survey methods combined with aerial photography and GIS. The site was resurveyed in 2013.

Between 2009 and 2013, vegetation cover in Derries Bog increased from approx 80% to 90%. This is due to increasing cover of reedbed, birch-dominated scrub and birch woodland. Natural colonisation is progressing, reducing the overall area of exposed bare peat and thereby stabilising the former production area. The biodiversity value of the site has increased significantly since peat production ceased.

P 45

Restoration and management of habitats for *Acrocephalus paludicola* in Lithuania

Zymantas Morkvenas, N/A, Baltic environmental forum Lithuania, LITHUANIA
Jurate Sendzikaite, Zidrunas Preiksa

Acrocephalus paludicola is one of the rarest migratory birds throughout all of Europe. This bird is a habitat specialist, which breeds only on open sedge fens or wet flooded meadows. In past 100 year global population declined over 90%. The project "Baltic Aquatic Warbler" (LIFE 09 NAT/LT/000233) restores bird's habitat as well as establishes preconditions for long-term conservation. One of the biggest challenges is to organize agri-environmental measures, which will encourage local farmers to comply environment-friendly farming practices (late mowing, grazing regulation, etc.). The project demonstrates late-cut biomass utilization for producing fuel pellets. Different types of management measures (cutting away bushes or reeds, removing old vegetation by cutting or controlled fires, etc.) implemented in the project sites. Among major achievements of the project is the progress of habitat restoration in the most important area for breeding in Lithuania. Besides the overview of A. paludicola special conservation requirements and habitat restoration work, the presentation will cover two aspects, actual in the current EU nature conservation practice and which followed throughout A. paludicola conservation work in particular: a) ambiguous human role in the ecosystem management – is farmer is "nature management tool" or equal member of ecosystem with equally important interests; b) challenges of the current EU nature conservation policy tools – does it really setup adequate preconditions for the achieving favorable conservation status.

P 46

How landscape can provide information on riparian vegetation restoration and enhance ecosystem services?

Isabelle Muller, Ecology and Ecosystem Health, INRA, FRANCE
Marion Delisle, Ivan Bernez

Headwaters ecological restoration is a key issue to increase the provision of ecosystem services. Passive ecological restoration of headwater riparian vegetation degraded by cattle in a rural landscape of Normandy (France) was successfully tested at the scale of the bank. But, because ecosystem is associated with the ecological functions of landscapes, landscape appears as a value-delivering system and can provide functions, translated into services when they are valued by people. We tested in the study the landscape service approach, to determine how landscape structure contributes to provide ecosystem services, through riparian vegetation restoration. Current landscape structure generates knowledge on riparian vegetation resilience and can thus be related to ecological values and benefits. For example, tree recruitment in passive riparian vegetation restoration can prevent erosion's damage. This function and the service associated need a specific structure of landscape to be generated after passive restoration. We used landscape structure to determine their effect on headwater riparian vegetation response after passive ecological restoration (PER) and on ecosystem services provision. We analyzed the impact of land-use and habitat structure on the composition and species richness of different headwater riparian vegetation in diverse landscape contexts after PER. Results showed that landscape appeared as a major factor in the restoration of riparian vegetation. Landscape approach could be implemented as a guideline to help managers and decisions makers to select riparian vegetation restoration project based on their landscape, with the aim to maximize ecosystem services.

P 47

Dehesa ecosystems: development of policies and tools for biodiversity conservation and management (Life+ bioDEHESA)

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Dehesas are considered types of open oak forests traditionally transformed by humans to obtain pastures for livestock, resulting in a high nature value agro-silvicultural system providing a number of ecosystem services to the society. However, they have recently declined because of abandonment, agricultural intensification or unsuitable practices. Hence the importance of developing specific regulations, policies and tools.

The European cofinanced project Life+ bioDEHESA (Life11BIO/ES/000726) aims to enhance the sustainable and integrated management of dehesas in order to improve the situation of biodiversity through the dissemination of demonstrational actions that address the main challenges related to their conservation.

Amongst the vast Andalusian dehesa area, 42 properties were selected according to concerted criteria. An Integrated Management Plan has been drawn up including every approach involved in a dehesa farm, and was applied on those exploitations in order to be tested before legal approval. Cooperation agreements will then be signed with landowners, since concrete conservation measures will be implemented in this Pilot Dehesas Network dealing with woodland renovation, rational pruning, livestock and hunting species management, improved grazing, pastureland management, soil and water conservation, control of forest pests and diseases and habitat diversification. The effects of those actions will be monitored through appropriate indicators.

P 48

Art, ecology and environmental education: protection strategies for the natural environment and recovery of degraded territories

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This paper presents the R&D project "Art and ecology: strategies to protect the natural environment and recover degraded territories". This project aims at causing an interdisciplinary theoretical discussion on the relations art/science and at enhancing the capacity of art to promote the recovery and restoration of degraded spaces. A basic component of the project is the environmental education linked to sustainability, since it is necessary to wake up the ecologic consciousness, engaged with the respect and conservation of the environment, in the affected populations. This detaches the concept of nature from the strict concept of landscape and allows for a broader perception: nature not only as extractive or contemplative resource, but as interlocutor of our actions. From this perspective, art and environmental education promote a vision of nature as subject, the existence of moral links humanity/nature and the necessity of a constructive dialogue that is not just utilitarian with natural spaces.

Following this idea, the project supports viable educational proposals that, by linking art and ecology, enable the generation of model experiences.

P 49

Should we hydrologically reconnect floodplain lakes with rivers? Assessment of the ecological state of restored water bodies based on macroinvertebrate communities

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The removal of dams and flood embankments in order to restore and intensify the hydrological connectivity in river valleys has become more common practice. It is particularly important in the case of floodplain lakes which functioning depends on flood pulses in the riverbed. Three left bank oxbow lakes, located in the Slupia River valley (northern Poland), were recon-

nected with the mother river in 2008. Simultaneously with the restoration works, the monitoring of the ecological state of the water bodies was conducted based on benthic invertebrates (according to the recommendations of Directive 2000) which qualitative and quantitative structure indicated changes occurring in the renaturized aquatic ecosystems. Several biomonitoring indices as well as the indices of biological diversity were used in this study.

In the first year after reconnection a considerable improvement in ecological conditions of the studied oxbow lakes was recorded which manifested in the high values if biomonitoring indices as well as in high biological diversity. A considerable but short-term deterioration of ecological state was observed in summer 2011 but in the next years (2012–2013) it was moderately good which indicated that the ecosystems stabilized after the perturbations caused by the inflow of river water.

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P 50

Nowadays valuable forest habitats in Estonia are heritage of 20th centuries land use practices

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Estonia has established quality standards for Habitat Directive forest habitats. New monitoring program of their actual structural and functional representativity was started in 2010. We used four topographical maps (1:42 000 – beginning of 20th century, 1:50 000 – mostly 1946–1948, 1:25 000 – around 1970, 1:20 000 – end of 20-th century) to study the land use history in near landscapes of today's valuable forests. Grasslands, wooded grasslands, forests, clearcuts and melioration were detected from the maps (425 sample areas). We found that about 55% of landscapes in r=100m and 21% in r=300m had stable land use (wooded grassland, forest or bog forest) during the whole century. There was more agricultural use at the beginning of 20th century. In r=100m, 37% of areas had some kind of agricultural use in that time, during the 1970-s 32% was still in use, but at the end of 20th century, only 14% of the areas had signs of agricultural use. In r=300, the proportions are respectively 70%, 67% and 59%. In r=100 cutting rate was decreasing, in r=300 increasing to the 1970-s and then stabilized. Land use changes are related to the intensity of melioration, which promotes cutting and the development of wooded and swampy grasslands into forests, or into a mosaic of forests and cultivated grasslands. As the past ownership of lands was related to forest habitat types, we conclude that many nowadays valuable forests are heritage of past mixed land use, and their succession has played role in developing this habitats. Change of traditional land use technics and increasing use of clearcut will form different forest landscapes than we are familiar with today.

P 51

Boosting pollination services in northern boreal forest

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The boreal forest berry plants depend on insect pollination. However, pollinator habitats have diminished. Especially dead wood offering nesting sites for pollinators have almost disappeared from managed forests. Restoring nesting sites would improve wild berry harvests, which would benefit forest berry-utilizing forest biota and berry business.

Artificial nests (110x110x130 mm) were placed to Kivalo forest research area (66 19´N 26 39´E) on spring 2012. Lower and upper compartments of nests were composed of aspen planks and polyurethane insulator. Equal number of holes (4, 6 and 8 mm diameter, 110 mm depth, 84 holes/nest) were drilled into compartments. The nests were placed in four habitats, 18 per habitat: forest roadside, clear-cut area, pond- and bog proximity. Nesting frequencies (number of leaf- or sand-covered holes) were determined on autumn 2012 and 2013. Bilberry fruit sets near the nests were determined on 2013 and 2 nests from each area were removed for species identification.

The nesting frequencies on 2012 were 58, 23, 17 and 0 on roadside, clear-cut area, pond- and bog proximity, respectively. On 2013, the frequencies were 43, 31, 47 and 12. The 4 mm holes in aspen were preferred.

By March 2014, several nested species have been identified: Wild bees (H. tuberculata), potter wasps (S. angustatus, A. antilop), digger wasps (P. lugens, P. lugubris, R. clavipes, P. monilicornis), nest parasites (C. longula, O. aeneus), spider parasites (D. bifasciatus, D. wechti, A. cinctellus) and carpenter ant (C. herculeanus). The most important pollinators are the wild bees and potter wasps.

Preliminary results indicated higher fruit set up to 200m from the nests.

P 52

Where to restore wetland ecosystem services?

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Wetlands are great providers of important ecosystem services (ES), i.e. the benefits that humans obtain from ecosystems, while also being rich in biodiversity. Land-use changes can significantly alter the capacity of wetlands to supply ES. Thus, the restoration of ES in degraded wetlands can represent a step toward the maintenance and durability of human well-being. However, the restoration of multiple wetland ES may cause conflicting land-use or management practices in restored wetlands. A framework is therefore needed to determine where and which ES to focus on for restoration. We present a case-study on wetland conservation to illustrate how ES and their demand should be considered for land-use and restora-

tion planning. We first show that ES do not provide benefits to human populations nor are they in demand everywhere they are potentially supplied. Accordingly, we found that simultaneously targeting ES accessible supply and ES demand in conservation assessment resulted in selecting sites that are up to three times more efficient in fulfilling beneficiary demands. This suggests that ignoring the demand for ES in conservation assessment fails to position reserves where an ES supply is likely to be most useful. We believe that this methodology could be adapted to wetland restoration projects, providing information on where to focus on the restoration of particular ES in the territory in order to fulfill the demand (and well-being) of the greatest possible number of beneficiaries.

P 53

Topsoil inversion in UK ecological restoration and habitat creation schemes

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Aim

Habitat restoration is advocated as an approach to establishing a more resilient network of wildlife sites in the UK. Restoration or creation schemes on formerly intensively managed agricultural soils are constrained by high residual soil fertility and a weedy seed bank. Topsoil inversion (deep ploughing) may address these constraints. The aim of this study was to evaluate the ecological impacts of topsoil inversion at trial sites across the UK.

Methods

We investigated 15 topsoil inversion sites ranging in age from 6 months to 4 years 10 months. We assessed their surface soil fertility compared to non-inverted soil, and their vegetation composition with respect to the species introduced at each site.

Results

Soil organic matter, total and extractable N and P were lower in inversion surface soils. This reduction was maintained over the timescale of the study (58 months). Introduced nurse crops gave way to grassland species over time. Introduced species varied widely in their establishment success. Introduced forbs established with reduced competition from the seed bank. Plant communities did not give a good match with semi-natural communities, although all were in the early stages of community development.

Conclusions

Topsoil inversion can successfully reduce surface soil fertility and the weed seed bank across a range of soil conditions, removing important constraints on the creation and restoration of habitats to establish a resilient network.

P 54

Experiences of mire restoration in Latvia

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In this study, we summarized experiences and development of concepts in mire conservation over the post-soviet period in Latvia.

The experiences of mire restoration in Latvia date back to the end of 1990s. Over the last two decades, different organizations have carried out mire restoration projects: from small-scale activities with shrub removal in calcareous fens to application of tricky restoration methods in severely deteriorated bogs. The experiences learnt elsewhere in Europe facilitated gradual development of passive mire protection approach since the 1990s to active management and restoration approach, being more and more emphasized over the last few years.

Overall, within the post-soviet period, the habitat-approach dominated over the functional approach, putting more emphasis on conservation of species and habitats rather than restoring the functions of ecosystem. Most of restoration activities in mires have been related to restoration of hydrological regime in raised bogs, while a little attention had been paid to calcareous, spring fens and bog woodlands. Another issue is the passive restoration of cut-over peatlands, where spontaneous revegetation takes place – both good and bad examples can be found. Mire restoration in Latvia is largely limited within the project schedules. In few areas, the post-restoration monitoring is being continued.

Currently a restoration guideline for habitats listed in the Habitats Directive I is being developed (LIFE+ NAT-PROGRAME project). Lessons learnt from field experiments, scientific studies, expert opinions and restoration experiences elsewhere abroad are being incorporated in a nationally applicable document.

P 55

Effects of restoration on tree stand structure on primary succession mires

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Anne Tolvanen

Approximately 95% of primary succession mires have drained. Because the growth of forest has been minor, the restoration actions on the area were conducted to examine effects of restoration. In 2005 we chose 4 similar forestry drained mires for the research. They were drained in late 1960. Later, two pristine mires were added for comparison. Restored sites were whole tree harvested in summer 2008. The ditches were filled in 2008. Unrestored sites were not harvested and the ditches are unfilled. Tree variables of dominated and understory trees and seedlings measured in 2005 and 2013.

Pristine sites are treeless. In restored sites volume of trees is 15 m³/ha. However, in unrestored site the volume is 73 m³/ha, and trees are still growing. The amounts of understory pines, birch and alder decreased in restored sites. However, the amount of understory Salix sp. increased. Furthermore, the amount of all species is clearly higher than in pristine sites. In unrestored sites amount of understory pine slightly decreased, but amounts of birch and Salix sp. increased and amounts of them are clearly higher than in restored and pristine sites. In restored site amounts of pine seedlings slightly decreased, but amount of birch seedlings increased notably. Amounts of grey alder and Salix sp. are unchanged. In unrestored site pine seedlings slightly decreased, but some spruce seedlings appeared at site. Amounts of birch and Salix sp. are unchanged. All in all, amounts of other seedlings than birch are clearly the highest in unrestored sites. Amounts of all seedlings than alder are smallest in pristine site.

As a conclusion we can say that process towards natural state has not begun in unrestored site, and the coppicing of pubescent birch may cause problems in restoration process in restored sites.

P 56

The management and significance of traditional rural biotopes from the perspective of sustainable development

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This project aims to determine the most critical factors affecting the quality of management of traditional rural biotopes (TRBs) in Finland. These diverse, species-rich habitats are created and maintained by practices typical of old-fashioned agriculture, e.g. mowing and grazing. During the last century, over 99 percent of the TRB cover has disappeared in Finland. The national assessments of Finnish red-listed species and threatened habitats show that TRBs hold the greatest proportion of endangered habitat types, and they provide the primary habitat for one fourth of threatened species.

The research consists of ecological, social, and economic studies, and an integrative synthesis. A strong focus is on the biological attributes of TRB management, i.e. the spatial-temporal connectivity of TRB network and the population viability of rare TRB vascular plant species. In addition, motivational factors of TRB keepers are studied, and effectiveness of Finnish EU-based subsidy system is evaluated in relation to management quality. We study also in what ways the management and resource effort targeted to these valuable sites could be optimized in relation to the sustainable conservation status of the site network. Since the work started in 2013, no results are ready yet, but here a general outline of the project is presented together with short descriptions of the individual subprojects.

P 57

Getting connected – the Finnish Expert Group of Semi-natural Grasslands

Katja Raatikainen, Natural Heritage Services, Metsähallitus, FINLAND

The Finnish Expert Group of Semi-natural Grasslands was established in 2008 as a part of the Finnish Board on Ecological Restoration (FBER). The FBER Grassland Group (PerinneELO) concentrates on habitats of semi-natural grasslands and issues related to their management. Group members represent all the important operators and organizations related semi-natural grasslands in Finland. Main goal is to increase the knowledge and exchange of information between different stakeholders and to promote the connection between research and practical management. The group has made guidelines for monitoring and inventorying semi-natural grasslands and promoted the compilation of data into a shared-use GIS system. The group has been active in discussion on management methods and on financing the management of semi-natural grasslands. For the preparation of CAP 2014 the group has compiled several proposals for making better Rural Development Programme and for improving the state of Finnish semi-natural grasslands. Since 2010 the grassland issues relating to the national assessment of threatened habitat types have also been a part of FBER Grassland Group's work. In addition, the group assists at the reporting of the EU Article 17.

P 58

Mapping high biodiversity spots of semi-natural grasslands in the southwest Finland archipelago

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Semi-natural grasslands and their species have faced a drastic decline as agricultural practices and animal husbandry have changed. Urgent restoration actions are needed for rescuing valuable sites to maintain their habitat types and species richness. Locating the most valuable sites for restoration is one of the first actions needed. As it is time consuming and difficult with old field based inventories, it is useful to map the most potential sites for restoration first with GIS methods. For detailed studies 4 islands in the Archipelago National Park (ANP) were selected. We used historical and current maps and aerial photographs to detect the old and current land use and land cover. GIS analyses were cross-checked in the field with habitat and vegetation survey. Information about the current biodiversity can be found by combining GIS material from different time periods with appropriate interpretation of the data. Our case revealed that the most important areas for species of semi-natural habitats are located often at the edges of former hay meadows, outside the actual meadow. On the aerial photographs they usually appear as wooded or covered with juniper in all, or some time layers and currently they often are overgrown. At the same time, they still have high potential to be restored into semi-natural grasslands. Historical maps and aerial photographs can guide us to the most valuable sites when also low-productive and edge areas are included into the survey. Addition of topographic data can provide additional information of local high biodiversity spots. Experiences of detailed survey were utilized in the large scale mapping of habitat network in the ANP.

P 59

Restoration of Great Bittern *Botaurus stellaris* habitats in two coastal lakes in Latvia: a new step towards wetland ecosystem and species integrated conservation

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Girts Strazdins, Roberts Silins, Ints Mednis

In 2013 we have started wetland restoration LIFE+ project (Restoration of Bittern habitats in two coastal lakes in Latvia, LIFE12 NAT/LV/000118), directed at two most important Bittern breeding sites in Latvia. The current project has the ambitious aim to provide the information about the species requirements, to generate the widely applicable and regionally tested habitat restoration methods and thus set the scene for further Bittern conservation actions in Latvia and Boreal region. We will apply new reedbed management techniques and expect to provide valuable knowledge on species management and ecosystem services.

Concrete conservation actions are aimed to improve the conservation status of Bittern and improve ecosystem functions in two most important coastal lakes for the species – Lake Engure Natura 2000 site and Lake Pape Natura 2000 site. They are also aimed to reduce the impact of direct and indirect threats on Bittern population by securing sustainable lake habitat management including improvements to existing and restoring of currently degraded breeding and feeding sites for Bittern.

Here we present our approaches on how to improve the conservation status of Bittern and improve ecosystem functions in two most important coastal lakes for the species. Concrete conservation actions planned to establish demonstration area of the Bittern conservation in Lake Engure and restoring Bittern habitats in Engure and Pape lakes will be presented. Monitoring and evaluation of the impact of the project actions also will be discussed.

P 60

Regional forest nature management programs as a holistic approach for the execution of restoration targets in small and fragmented forestland ownership

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Finland has established the Forest Biodiversity Programme METSO 2008–2020, which aims to halt the on-going decline in the biodiversity of forest habitats and species in Finland's forest ecosystems. One of the main tools in METSO is the use of biodiversity-oriented forest nature management practices in managed forest areas, comprising all operations which aim to actively maintain or increase forests' nature values.

We represent the main objects of development work that will be done between 2014–2016 to increase the volume and ecological soundness of restoration and nature management meas-

ures in private owned forests. We suggest that all the crucial bottlenecks should be viewed in a new process called Regional forest nature management programs, which dismount the Finnish National Forest Programme to the field. The main elements of the work are 1) the priorization of state-funded nature management measures in private owned forests, 2) boosting the implementation of forest nature management and 3) making visible the benefits of nature management to the ecosystem services and for the whole local society.

Two pilot cases will be analyzed and after that the Regional forest nature management programmes will be created to whole Finland. The work includes e.g. GIS-data collecting and selection for the priorization, developing the use of areal Zonation analysis results, mapping of the practical learning needs of operational forestry organizations and creating nature management example sites for landowners visits.

P 61

Near-natural restoration vs. forestry reclamation in post-mining sand pits

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Post-mining sites must be reclaimed to their previous use according to the Czech legislation. Forestry reclamation is a widely used option, however, near-natural restoration has been increasingly asserted among scientists as an alternative for its conservation potential and usually lower costs. The question on spontaneous vegetation development in various mining sites have been addressed in many studies, however, studies comparing different restoration approaches have been very scarce.

The aim of this study was to compare the vegetation development in sites restored with two different methods, to determine how species richness change in time and to identify benefits and limitations of both approaches in practical restoration of abandoned sand pits.

The space-for-time substitution method was applied in sites with different restoration status in four sand pit mining systems located in the Trebonsko PLA, Czech Republic. Sufficiently large sites with known history were sampled using phytosociological relevés. The restoration status, time since site abandonment/reclamation, groundwater table level and slope of particular plot were also recorded.

The results indicate that sites left to spontaneous succession exhibited higher numbers of target and Red List species than that forestry reclaimed. Vegetation development on forestry reclaimed sites led from open initial stages to dense monoculture forests with low species diversity whereas diverse, species-rich forests established on spontaneously re-vegetated sites. The results support the scientific view on the use of the minimum intervention approach and may contribute to its implementation into the practice.

P 62

Restoration of moss carpet on a calcareous spring fen in Estonia

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Calcareous tufa-forming spring fens are one of the most valuable and endangered mire types worldwide. Mosses are considered ecologically important constituents in plant cover but re-establishment of the moss layer is a challenging task. Scorpidium scorpioides and Campylium stellatum are two most common moss species but they have slightly different ecological demands and tolerance in Ca-rich spring fens in Estonia. In 2010 we started with the experiment to study the effect of N and P fertilization on the establishment and growth of these two key moss species on weakly drained Paraspõllu fen (N - Estonia). Three years later, the production of S. scorpioides and C. stellatum was highest in P treated pots (1.0 and 3.5 g P m-2a^{-1}). However, the moss growth had depressing tendency on the third year of the experiment in 3.5 g P m-2a^{-1} treatment. The production was smaller in the control and N treatments (only fen water, 0.7 and 1.5 g N m-2a^{-1}, respectively), the effect of N addition even decreased the growth of C. stellatum. P conduced to the establishment of other fen moss species ($R>0.7$, $p<0.05$) which constituted about half of the total mass of mosses on P treated pots after 3 years. We concluded that the growth of the moss species is facilitated by the low concentration of P addition.

P 63

Restoration and creation of wetlands can benefit waterfowl populations. Results from censuses done in Life+ Return of Rural Wetlands

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Mikko Alhainen

In Finland Life+ Return of Rural Wetlands –project has restored and created 43 demonstrative wetlands varying from half a hectare to more than 20 hectares in size between 2011 and January 2014.

To investigate the impact of restoration and creation, waterfowl censuses were accomplished in 43 demonstrative wetlands before and after actions. The censuses were conducted by volunteer hunters and birdwatchers. The method used was the point count system of the Finnish Game and Fisheries Research Institute and the Finnish Museum of Natural History. The main targets of the counts were Mallard, Teal, Eurasian Wigeon and Common Goldeneye, but counts also include other quarry species such as Shoveler and Pintail.

Breeding populations were assessed twice in May with counts of nesting pairs, and broods with one brood count in July. Furthermore only in Life+-project, the staging birds were counted in the beginning of August. In demonstrative wetlands supplemental feeding was not allowed before censuses.

Waterfowl censuses indicate that the restored and created wetlands can benefit waterfowl populations. In restored wetland sites both the increased surface area and the proportion of open-water had a positive influence to the number of individuals and species. In created wetlands plenty of birds were present already in the first summer after actions, e.g. in some sites dozens of mallards, teals and wigeons were counted.

Wetland creation by flooding seems to be advisable method compared to mere excavation. Also flooding is mitigating the effects of beaver and therefore recommended as more natural-like method of wetland creation.

P 64

EU Life supporting wetland restoration and creation on private land, examples from Life Return of Rural Wetlands

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Mikko Alhainen, Timo Niemelä

EU Life has been successful in 7 topics

1) Supports the implementation of wetlands. Life funding offered resources to provide advice, create wetland plans and concrete actions.

2) Collaborative planning. Life funding enables planning with landowners resulting open discussions of the implementation alternatives. As a result, landowners are committed to manage their wetlands after Life and have positive attitude towards Life Programme in general.

3) Media work from local to national level. Life funding enables to prepare material e.g. essential for awareness of the biodiversity, restoration and management of wetlands. Wetland projects have been successfully completed in teamwork with landowners which encourages others.

4) Little bureaucracy for landowners. Life workers make the wetland plans, are responsible for licensing issues and regulatory authorities cooperation.

5) Life funding enables rapid start-up of concrete measures. Landowners are very satisfied and excited to hear that concrete wetland actions can start as early as a few weeks after completion of the wetland plan.

6) Positive environmental impact. Life funding will enable the direct benefits to wetland fauna and flora and ecosystem services.

7) Working model of the wetland restoration on private land. Even a small financial support, which is intended for construction, can initiate local wetland projects. Key success factors are the commitment of landowners, hands on working model and customer services attitude.

P 65

Can we accelerate amphibians habitat restoration in the post-mining areas?

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The study was aimed to evaluate the acceleration possibilities of nature restoration in exploited gravel pit. The study site was located on the meadow terrace of the Narew River (Sitno, Central Poland). It consisted of four water reservoirs of different shape and size. The surroundings were planted with native plant species. Ecological succession monitoring conducted for three seasons since the completion of gravel mining focused on amphibians. This environmentally fragile group of animals (influenced by both aquatic and terrestrial habitats, as well as being a predator on high level of ecological food chain) seems to be the good bioindicator of habitat changes. A twofold approach upheld amphibian species population dynamics and structure, as well as some habitat elements assessed by use of Habitat Suitability Index (HSI) models. Considering the lack of reference exploited pit, the results were compared to the conditions of the surrounding habitat and already published data on former mining areas in different locations. The explosive amphibians colonization and breeding success was observed, showing the high value contribution of restoration measures.

Key words: gravel pit, nature restoration, amphibians, Narew River Valley, Habitat Suitability Index

P 66

Restoration of the Old Rhine (FRANCE) through controlled bank erosion

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During the two past centuries, the Rhine floodplain was submitted to important engineering civil works (rectification, channelization…) that severely damaged floodplain functionality. The Old Rhine (a 60-km long by passed single bed paved on the Upper Rhine) especially exhibit poor functionality together with geomorphological dysfunctioning (deficits in sediment drift). For several years, restoration works were carried on in order to create pioneers islands with a network of flow channels (e.g. sediment artificial recharge in 2010).

In summer 2013, 'Electricité de France' (EDF, the hydroelectric power plant manager) has implemented several restoration works in order to promote lateral bank erosion and artificial feed of the river with gravel. These measures aim to restore the river's ecological dynamics, by recreated a network of braided channels.

In order to evaluate the ecological efficiency of these restoration works, ecological surveys (benthic macro-invertebrates and macrophytes) were conducted in summer 2013 spring and

summer 2014. The mains outcomes of these results will be the assessment of the sensibility of such river restored ecosystems to invasive species (both plants and invertebrates) and the link between geomorphological restoration and biodiversity. We here present the first results of these surveys.

P 67

Vertebrates killed on the main road in Khao Yai National Park, Thailand

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Aroon, Sarawee

Roads in protected areas have many negative impacts on wildlife. There are many roads in protected areas in Thailand but lack of data on negative impacts of roads on wildlife in these protected areas. The aims of this study were to study the species and number of vertebrates killed by vehicles, relationship of vertebrates killed with times and seasons, and distribution patterns of vertebrates killed on the main road in Khao Yai Nation Park. The road was surveyed by driving from the Km. 30 view point to Heaw Suwat waterfall and the National Park Check Point at Prachinburi, total road length is 52.4 kilometers. The surveys were conducted 4 days per month from October 2011 to September 2012. The results showed that a total of 58 vertebrate killed were found. Of these 3 species were birds (n=4), 4 species were mammals (n=9), 15 species were reptiles (n=22), 2 species were amphibians (n=15), 7 individuals were unidentified reptile, and 1 individual was unidentified bird. Number of vertebrate road killed was highest in summer, while number of vertebrate killed did not significantly different between day time and night time, between weekdays and weekends, and among months. The distribution pattern of mammal killed and bird killed was random distribution, while amphibian killed and reptile killed was clump distribution. The data from this study will be used for road management in Khao Yai National Park and other protected areas in Thailand.

P 68

Fighting desertification through RECARE: Preventing and remediating degradation of soils in Europe

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Kristin Svavarsdóttir, Andres Arnalds, Anne Bau

Soils are currently under increasing threat from a wide range of processes, such as soil erosion, compaction, desertification, sealing, contamination and others. The RECARE project has brought together a multidisciplinary team of 27 different organisations to find ways of assessing the current threats to soils and finding innovative solutions to prevent further soil degradation across Europe. As soil degradation problems are caused by the interplay of biophysical, socio-economic and political factors, 17 case studies of soil threats are included in RECARE to study the various conditions that occur across Europe and to find appropriate responses using an innovative approach combining scientific and local knowledge (RECARE, 2014).

One of two case studies focusing on desertification is located in Iceland where severe desertification is present on 25% of the land (Arnalds et al. 2001). The study focus on assessing on how various land use and land reclamation efforts affect ecosystem resilience through series of space-for-time experiments in which wind and water erosion thresholds will be quantified as well as changes in vegetation cover and soil organic carbon. Stakeholder assessments will be conducted concurrently to evaluate their perception on both the land reclamation methods and their results. The poster will present both the case study site and experimental manipulations.

References

RECARE, 2014: RECARE: Preventing and Remediating Degradation of Soils in Europe. URL: http://www.recare-hub.eu/. Accessed: April 24 2014.

Arnalds, O., Thorarinsdottir, E. F., Metusalemsson, S., Jonsson, A., Gretarsson, E., and Arnason, A., 2001: Soil Erosion in Iceland. Reykjavik: Soil Conservation Service and the Agricultural Research Institute, 121 pp.

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Soil carbon sequestration: A component of ecological restoration

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Organized revegetation activities began early last century by the Soil Conservation Service of Iceland (SCSI) and have since the 1980s focused increasingly on ecological restoration (Magnusson, 1997). To date approx. 2,000 km² or more than 2% of the island have been restored (Aradóttir et al. 2013). Revegetation activities that can be classified as ecological restoration aim at recovering degraded, damaged or destroyed ecosystems by accelerating local ecosystem processes. Ecological restoration increases biodiversity and resilience of restored ecosystem, and carbon is sequestrated. Evaluation of ecological restoration projects is critical for continuous improvements of restoration measures, and in that monitoring has an important role.

In 2007, a monitoring project started aiming at determining carbon sequestration in SCSI revegetation areas initiated after 1990. Results suggest that there is a difference between degradation stages in terms of C sequestration in the soil. Highly degraded areas, where ecosystem functions are severely dysfunctional, sequester at lower rates than other sites. This suggests that there are ecological thresholds present in the system which have to be overcome. These thresholds must be identified for optimizing outcome of ecological restoration and to maximize use of resources.

References

Aradóttir, Á.L., Pétursdóttir, T., Halldórsson, G., Svavarsdóttir, K. & Arnalds, Ó., 2013: Drivers of Ecological Restoration: Lessons from a Century of Restoration in Iceland. Ecology and Society, 18 10.5751/es-05946-180433.

Magnusson, S. H., 1997: Restoration of eroded areas in Iceland. In Urbanska, K. M., Webb, N. R., and Edwards, P. J. (eds.), Restauration Ecology and Sustainable Development. Cambridge: Cambridge Universtiy Press, 188–211.

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Quantification and valuation of ecosystem services to optimize sustainable re-use for low-productive drained peatlands

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Almost one-third of European peatland resource is situated in Finland, where more than half of the original peatlands have been drained to increase tree growth. However, 20% of the drained peatland area does not produce enough timber to fulfill commercial purposes. At the same time, their biodiversity is degraded, they may continue environmental loading to watercourses, and act as greenhouse gas (GHG) sources. A key question concerning the use of peatlands is what to do with these low-productive drained peatlands that have been left aside from active forestry.

Low-productive peatlands can be re-used in many different ways. The problem is that the impacts of different re-use options on biodiversity, environment and economy are not yet fully understood and thus it is hard to give proposals for re-use actions. The challenge is to develop mechanisms that can balance the conflicting demands on the use of peatlands and to ensure their sustainable use. Our 5-year EU funded LIFE+ project LIFEPeatLandUse (2013–2018) consolidates and increases the knowledge on the impacts of peatland re-use on ecosystem services. Under investigation, there are seven different peatland re-use options, representing the economic activity as well as measures related to the protection. The purpose is to evaluate and predict their potential impacts on the peatland landscapes, if they were applied in practice. The aim is to find cost-efficient re-use options to low-productive drained peatlands, which help to prevent or stop decline of biodiversity and environmental loading to watercourses, and improve capacity of peatlands to store greenhouse gases.

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Cutting down Molinia tussocks as an effective tool for vegetation re-establishment on a drained calcareous spring fen

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Drainage of Carex davalliana and Schoenus ferrugineus dominated calcium-rich spring fens may turn into pure Molinia field with high (up to 60 cm) and dense tussocks (with coverage up to 80–90%).

We studied effect of cutting-down of Molinia tussocks and rising water level aimed to recover native plant cover on the spring fen Paraspõllu (N-Estonia) in 2010–2013. Five experimental blocks by 10 x 10 m, nested with 21 plots by 1 x 1 m on each block were established. Molinia tussocks were cut down at three levels – very bottom, half height, top only; water level was kept in different depth.

Successional vectors applied, demonstrated that re-establishment of common (Carex davalliana and Schoenus ferrugineus) and rare species (e.q. Selaginella selaginoides, Pinquicula alpina, Primula farinosa, orchids, ect.) was facilitated as Molinia tussocks were cut down to bottom or to half. The recovery of moss cover (Campylium stellatum, Fissidens adianthoides, Drepanocladus cossonii, Scorpidium scorpidioides) was successful in deeply cut down plots the water level stayed long on above-surface level. Also, tufa precipitation recovered while moss stems acted as precipitation centres.

In conclusion, deep cutting-down of Molinia tussocks and temporary inundation with Ca-rich spring water likely supports the re-establishment of native plant species on Ca-rich spring fen.

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Neoecosystems evolution resulting from ecological restoration activities. The case of Campochiaro Sulmona Gas Pipeline in Italian Apennines environment.

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The study area is crossed by the gas pipeline through the Italian Central Apennines, characterized by a variety of complex ecological systems. Following pipeline construction, ecological restoration activities were carried out to stimulate the natural evolution of ecosystems, restore habitats and landscape over the long term. The activities effectiveness was assessed by monitoring vegetation, soil and fauna, from the ante-operam characterization, over 5 years after the completion of pipeline construction and restoration works. Surveys were carried out in 8 monitoring areas representative of highly different ecological situations existing along the survey corridor. Data concerning floristic, phytosociologic and structural pattern, for wood species only (for vegetation), amphibians, reptiles, mammals and birds (for fauna) and pedological profile description and physical-chemical data from laboratories analysis (for soil), have been collected for each area during the five years post-operam monitoring period. The collected data were processed statistically in order to define the vegetative evolution pattern and the effectiveness of the revegetation activities. Other comparison, using scatterplot and clustering, showed a correlation between various soil parameters and vegetation evolution.

Results describe a greater dynamic evolution, also in relation to the ecological restorations performed. In particular, we observed during the years, a gradual substitution of the species sawn and planted with spontaneous species. Indeed, the natural processes of evolution that lead to the restore of the potential natural have been quicken.

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Research on low intensity grazing for restoration and education in het Zwin (Belgian coast)

Jan Van Uytvanck, Ecosystem Management, Research Institute for Nature and Forest, BELGIUM

As part of large scale restoration in “het Zwin”, one of Belgium’s oldest and most visited nature reserves, large herbivores are introduced in grassland, dune and salt march habitats. The goals of grazing management are the restoration of intensively used grasslands, dune grasslands that are invaded by shrubs (mostly Hippophae rhamnoides) and restoration of salt marshes that are dominated by Elymus athericus. Deforestation, shrub removal, sod cutting, relief restoration and digging of ponds and shallow waters were the implemented restoration techniques before large herbivores were introduced. Ponies, horses, cattle and sheep are used in different combinations in four grazing blocks.

We used gps-collars to asses habitat use and preference of different large herbivores to help the setting and evaluation of management goals. Because of the importance of the degree of vegetation and landscape openness, we confronted the results with recent insights in the process of woodland development under different grazing regimes. Different large herbivores have a different impact on vegetation and landscape openness in (dune) grasslands, but none of them is able to prevent shrub regeneration at low grazing densities, i.e. < 0.5 animal units $ha^{-1}y^{-1}$. On the contrary, low intensity grazing enhances shrub establishment through mechanisms that are related to shifts in competition and associational resistance of surrounding vegetation patches.

Collar gps-data also offer great opportunities for visual information transfer to the visitors of the nature reserve’s visitor centre. Often, large herbivores such as Highland cattle and Konik horses are very attractive for visitors, but their role in the conservation of nature areas is not always clear. Combined with air photos or vegetation maps, the non-random actions and the behavior of large herbivores can be visualized on screens or maps. This might help visitors to understand why the animals are there and why they are useful for management. The Natura People project of the Province of West Flanders, that aims to inform people about the Natura 2000 network and actions, supports the grazing research in “het Zwin”. The return for visitors is accessible and visual information about the conservation management of the area and a straight connection with applied conservation biology.

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LIFE+ PROJECT: Bogs, flowing waters and nardus grasslands in the Bavarian Forest National Park

Jan Vancura, Nature Conservation and Science, Bavarian Forest National Park, GERMANY
Jochen Linner

In 2013 a Life project started in the National Park Bavarian Forest to improve the conservation status of the following habitats: peat bogs, rivers and nardus grasslands. Species targeted by the project are Black stork Ciconia nigra, European bullhead Cottus gobio, European otter Lutra lutra and ground beetle Carabus menetriesi pacholei. Following actions will be carried out as best practice projects:

1) Hydrological restoration of degraded peat bogs and bog woodlands. On altogether 5 ha of raised bog and approx. 50 ha of bog woodland draining ditches will be closed using some dams made of a local material (wood, peat). Partly a shrub removal is planned.

2) Removing obstacles for movement of aquatic organisms and stimulating dynamics in streams which were adapted to a transport of timber in the past. Reinforcements within some of selected stretches will be removed and some of selected pipe culverts will be replaced or removed.

3) So called "Schachten" are nardus grasslands which were built by traditional pastures in the past. Due to a presence of specialized species e.g. Arnica montana and Gentiana pannonica they present valuable habitats of European importance. A missing grazing and a tread disturbance endanger the nardus grasslands. Within a framework of the LIFE+ Project the National Park carries out an exemplary testing pasturing using Red mountain cattle with the aim to develop a new conservation approach.

Here we present the main actions of the project and related methods of the monitoring of success.

Project duration: 10/2013–09/2018, total budget: 1.3 million €. Within the project around 6.5 ha of land should be purchased.

P 75

Low intensive management of West Siberian croplands benefits diversity of Orthopera communities

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New developments in agriculture and an increasing global demand for arable land for food production and growing of energy crops leads to replacement of natural and semi-natural ecosystems by arable land, resulting in a loss of biodiversity, but as well in the creation of new arable habitats. However, to what extend croplands may contribute to the biodiversity at land-

scape level is strongly affected by their agricultural management. We sampled grasshoppers in an agricultural landscape in Western Siberia on summer grain fields, in grasslands on former arable land and in (semi-)natural grasslands with different types of land use. Additionally we sampled vegetation and further environmental variables, e.g. vegetation structure. In total we found comparable high diversity of grasshoppers. But the different types of grasslands do not differ significantly concerning Orthoptera-diversity, even the type of land use (abandoned, grazed, mown) has only low impact. Croplands contain surprisingly species-rich grasshopper communities with in total 17 species. For most of them we found as well nymphs, proving that croplands serve as reproduction habitats. Compared to surveyed grasslands some species occur significantly predominantly in croplands. The number of adult individuals and nymphs correlated significantly with cover of old grain stubbles/litter (meaning no ploughing before seeding) and the cover of weed. Hence, key factors for grasshopper occurrence are firstly reduced tillage practices leading to low disturbance and no destruction of eggs and nymphs and secondly high structural diversity reached e.g. by low input of fertilisers and agro-chemicals or unmanaged patches. While in Central Europe arable grasshopper habitats are scarce, low intensive management of croplands in Western Siberia shows that suitable management practices benefit biodiversity in agricultural dominated landscapes.

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Constructed marginal shallow water zones as ecological restoration tool for navigable waterways: a case study along a canal in Flanders (Belgium)

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Andy Van Kerckvoorde

Banks of navigable canals are often stabilized with “hard” materials leading to unsuitable conditions for riparian vegetation. Nowadays, there is a growing practice to use ecologically friendly bank stabilisations attempting to restore, rehabilitate, enhance or protect the riparian zone and its biological functions.

This case study focuses on a constructed marginal shallow water zone along the navigable canal Ghent-Bruges. The shallow water zone has been constructed by building a defence dam parallel and in front of the actual canal bank. It is expected that the dam inhibits the waves and currents. As a result a sheltered zone between the actual bank and the dam with suitable condition for vegetation development is supposed. In order to evaluate plant vegetation development in the shallow water zone, its spatial variation and its succession, sixty 10m x 1m vegetation plots, were recorded in 2006, 2009 and 2013. In the studied shallow water zones riparian vegetation developed on both sides but hardly in the middle. Differences in number of taxa, Shannon-Wiener diversity and Grime’s competitiveness and ruderality were observed on the sides. The application of different construction materials is discussed as a possible cause. An increase of competitiveness and a decrease of ruderality indicated vegetation succession during the period 2006–2013. Rooted aquatic plant vegetation was poorly developed probably due to the deposition and accumulation of fine sediments.

Studies like this increase our knowledge on the effectiveness of measures to mitigate negative ecological effects associated with navigation. Such bank rehabilitation measures may be necessary to achieve the ecological goals of the European Water Framework Directive.

P 77

Balancing between military exercise, recreation and nature conservation – mission impossible?

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Cape Vattajanniemi is the most extensive and representative area of boreal zone dune habitats in Europe. All six dune habitats defined by the EU Habitats Directive are found in Vattaja. Natural processes affecting the vegetation succession are land uplift (8,8 mm/yr) and erosion by wind, ice and waves. Vattaja is a military exercise area for The Finnish Defence Forces as well as a popular recreation area. The erosion of the dunes through the military training and to a lesser extent recreational use forms the most significant threat to area´s natural values. On the other hand, some dune habitats are threatened by the overgrowth caused by eutrophication of the Baltic Sea and ending of traditional grazing.

To reconcile the various uses and natural values, an EU Life project was implemented during 2005–2009. A wide range of management and restoration actions was completed, e.g. re-introduction of sheep grazing, tree removal and restoration of structurally damaged dunes. Eroding effects were also minimized by moving the firing stations away from the most important dune areas, by standardizing the routes and locations of exercise facilities and by building new recreational facilities.

The status and development of habitats was monitored in 2012.The average plant cover has increased in all monitored dune habitats: Grey dunes, Empetrum nigrum -dunes, wooded dunes and humid dune slacks. The average increase in plant cover varies between 16% and 47%.

Restoration and controlling excessive disturbance has been effective, in some cases too effective. The conservation status of gray dunes has improved. In Empetrum nigrum –dunes the decrease in disturbance has lead to another problem: colonization by pine seedlings. Empetrum nigrum -dunes will need continuous management by grazing or manual clearing of seedlings.

P 78

Are transplants of target species capable to establish in a restored peatbog?

Ludmila Vlkova, Botany, Faculty of Science, University of South Bohemia, CZECH REPUBLIC

Restoration of the extracted peatbog Soumarský most in the Sumava NP, Czech Republic, started in 2000 with blocking drainage ditches and increasing water table. There were 26 boreholes installed to measure water table fluctuations in monthly intervals. Around each borehole, vegetation record was made, three specimens of Oxycoccus palustris and Andromeda polifolia, as typical peatbog species which disappeared during extraction, were planted. Moreover, seeds of the species were sown. Survivorship of the transplants and seedling emergence were related to the average water table and composition of vegetation around the boreholes. Preliminary results of the experiment showed some capability of the species to be re-introduced by these ways. However, both dispersal limitations and habitat limitations should be considered in the establishment and spread of the peatbog species. This ought to be taken in mind in the next restoration attempts in this and comparable disturbed peatbogs.

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Seedling responses to biomass extraction in the northern Rocky Mountains, USA: Indicators of forest productivity impacts

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Growing interest in the potential of forest biomass as an energy feedstock has been matched by an increasing public concern over possible degradation of forest productivity. To address this concern, we commenced an investigation of the impacts of experimental biomass harvesting performed at Coram Experimental Forest in the northern Rocky Mountains in 1974. Within each of three clearcuts, biomass was extracted at three standards, including a standard timber harvest and two intensified extraction levels. Douglas-fir seedlings were planted thereafter during four consecutive years starting in 1976. Because artificial regeneration allows for empirical analysis of biomass harvest effects on site productivity by equalizing factors that can otherwise introduce variance in natural regeneration growth rates, we measured those planted trees in 2013, and removed tree core and foliage samples to evaluate radial growth and physiological conditions. For each tree, height and dbh were measured; recent-5-year basal area increment, leaf area, and growth efficiency (basal area growth per unit leaf area) were calculated; and foliar carbon and nitrogen contents were assayed. Mean height, dbh, 5-year basal area increment, leaf area, and growth efficiency of planted trees were 8.8 m, 13.7 cm, 42.6 cm^2, 31.67 m^2, and 1.315 cm^2/m^2, respectively; mean foliar C and N contents were 49.98% and 0.79%. All analyses reveal no statistically significant differences between the normal timber harvest and intensified biomass extraction levels, suggesting intensified biomass extraction is not associated with a commensurate reduction in forest productivity in this forest type.

P 80

Natural regeneration of subarctic mountain vegetation after disturbance in the time frame of 60 years

Anna-Liisa Ylisirniö, Arctic Centre, University of Lapland, FINLAND
A. Allen

Increasing tourism in northern Fennoscandia causes increasing damages in subarctic mountain heaths, which are vulnerable to trampling and other disturbances. Our knowledge on the natural regeneration of vegetation in subarctic conditions is limited regarding the time perspective. The vegetation damages caused by German soldiers at the end of the World War II in Malla Strict Nature Reserve in Finnish Lapland give us an opportunity to study natural succession in the time frame of 60 years. About 1,000 men spent seven months in the reserve area mainly in snow covered winter months in 1944–45, and their camping and observation posts were documented in the map. We compared the coverage of mosses, lichens and vascular plants of camping places of the mountain birch zone and observation posts of the barren mountain with the vegetation of undisturbed areas of both zones. The signs of disturbance were more profound in the camping places, possibly because they were inhabited by more solders than observation posts. The camping places had about 50% thinner humus layer and 20% smaller coverage of vegetation than their controls. The coverages of Vaccinium myrtillus and Empetrum hermafroditum were affected most, the latter being especially vulnerable to trampling. Similar effects, but less profound, were observed in the barren mountain. Moreover, species in the genera Carex and Luzula and other graminoides had increased, and lichens in genera of Stereocaulon and Cladonia had decreased in coverage. The results show that re-vegetation of the subarctic heath is very slow, and some changes in the species composition like replacement of evergreens and blueberry by graminoids may be permanent. Passive restoration is, however, best option in the strict nature reserve where human interference is not allowed.

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Temperature and moisture regime of the revegetated oil spill in Northern Russia as a resilience indicator

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High latitude ecosystems are generally characterized by low resilience, especially if disturbance modify severely the soil properties. It is nearly impossible to directly establish the pre-disturbance communities and restoration practice in Russia is based on introduction of pioneering species. Factors, determining whether the shift to native communities occurs spontaneously by succession or the "weedy tundra" prevails for infinitely long are still poorly quantified. In this study we propose that the modification of temperature and moisture regime by disturbance is one of the keys determining the system resilience and following revegetation attempts should aim at reversal of this shift in the soil. We have monitored the soil temperature at 5 depths for 2 years in the soil in Komi Republic, Northern Russia that was a subject of oil spill and subsequent mechanical cleaning and seeding with native pioneering cere-

als. Numerical procedure was applied to derive the thermal diffusivity and heat fluxes in the soil, and soil moisture, surface net radiation and snow properties were derived indirectly. The results show that the thermal diffusivity known to increase with soil moisture was two times lower at the former oil spill than at the control site during the first year presumably due to the hydrophobic properties of the polluted soil. During the second year, when the vegetation on the former oil spill site has increased significantly in fractional cover, the difference in thermal diffusivity between the sites was much smaller, as we hypothesize not only due to remnants of oil leaching from the soil, but also due to the action of roots, that increased the soil permeability.

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Establishment of ecological network for European pond turtles (*Emys orbicularis*) and threatened amphibians in abandoned farmland in Lithuania

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The EU LIFE+ project ECONAT LIFE09NAT/LT/000581 "Development of a Pilot Ecological Network through Nature Frame areas in South Lithuania" aimed to establish ecological network and secure the long-term viability of small and isolated populations of European pond turtles (Emys orbicularis) and European tree frog (Hyla arborea); also other amphibians and pond insects species, listed under Habitats Directive Annex II and Annex IV.

The following methods were used to establish an ecological connection:

- restoration of aquatic and terrestrial habitats within core areas where target species are most abundant
- creation of "stepping stones" in between the core areas
- establishment of buffer zones along the migration corridors
- establishment of hardy grazers farm to maintain the habitats

Results
In 2010–2014 6 migration corridors were established in the Southern part of Lithuania forming an entire ecological network of Natura 2000 sites, mainly situated in mosaic farmland. Over 100 ponds were dug, 30 egg laying sites restored, 15 dams installed by restoring hydrological regime within 10 ha of wetlands. 1 extensive grazing farm with initial herd of 20 Aberdeen Angus cattle was established, and the method of grazing spread in the region. Additionally, rearing of eggs of European pond turtle and European tree frog was performed in situ. Juveniles were released into restored habitats to support local populations.

Conclusions
Natura 2000 sites established for European pond turtles and threatened amphibians. e.g. European tree frog, European fire-bellied toad, are small and scattered in the region, therefor the populations remain isolated for years. The situation was improved significantly by restoring number of habitats in the region. Beef farming helps to maintain habitats if extensive breeds are applied and careful monitoring of farming is performed.

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