

# ECCB2012

## Oral Presentations

### ALIEN AND INVASIVE SPECIES

#### O2.1.1

##### **In Search of the Giant Golden Bumblebee; Impacts of Non-native European Bumblebees on the Indigenous *Bombus Dahlbomi* in South America**

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Two species of bumblebee, *Bombus terrestris* and *Bombus ruderatus*, were deliberately introduced from Europe to Chile in the late twentieth century for crop pollination. These are now established in the wild and spreading. Both have crossed the Andes to Argentina, and continue to spread both north and south. Evidence is accumulating that the arrival of these non-native species is having a range of environmental impacts, including the rapid decline of the only native bumblebee in southern South America, *Bombus dahlbomi*. Causes for this decline remain uncertain, but it appears to be too rapid to be driven by competition; transmission of a non-native pathogen seems most probable. The disappearance of this native species is likely to have repercussions for the plant species with which is coevolved. Implications for the global trade in commercial bumblebees, which threatens to result in further escapes of non-native bumblebees elsewhere in the world, will be described.

#### O2.1.2

##### **Alien Malacostracan Crustaceans Influencing on Species Diversity and Stability of Native Aquatic Communities in North-Western Russia**

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The contemporaneous development of regional commercial fishery in newly built reservoirs of Russia based on alien crustaceans and invasive species research effort during the last century resulted in a body of knowledge useful for management. Aim of paper to show changes in ecosystem functioning accompany the range extension of invasive malacostracans and how this process relates to the regional species diversity. I analyzed current distribution, population dynamics and place in food webs of invasive amphipods *Gmelinoides fasciatus*, *Pontogammarus robustoides*, *Gammarus tigrinus*, the crayfish *Astacus leptodactylus*, and the crab *Eriocheir sinensis* in inland waters of north-western Russia. The selective predation on invertebrates by amphipods and decapods explains the replacement of co-existing species and shifts in native communities functioning. The predation impact index as the ratio between consumption rate of the predator population and sum production of their preys for a given period was ranked as high (>1), middle and low (< 0.5). According to ecological preferences (pH, ionic composition, calcium concentration, salinity of water) of the invasive malacostracans, around 60% lakes in study region may be classified as unsuitable for their successful establishment. It may be important for next management, prevention of the expansion of the invasives and native diversity conservation.

### O2.1.3

#### Control of an Invasive Species, the American Mink, on the Edge of a Terrestrial and Marine Environment

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The invasive American mink is now successfully controlled in East Scotland through a community based conservation project, the Scottish Mink Initiative (SMI). The approach used cannot be directly replicated in west Scotland, where difficult to access coastal mink populations potentially subsidise inland populations. It is thus necessary to mobilise all potential stakeholders and use mink ecology at the interface of habitats to enhance management strategies. A questionnaire was sent to tour boat operators in west Scotland to gauge opinion and attitudes towards mink control. The aim was to explore the possibility of harnessing local interest in low-cost, coastal, localised, mink control. The majority of respondents were concerned about the presence of mink in their area, agreed with control and were willing to volunteer. Respondents who would not volunteer but agreed with control may change their mind if their business became affected by mink presence. The minimum level of support people expected was information on where to get, and how to deploy, monitoring equipment. People with an intrinsic interest in wildlife are willing to protect their local area with limited resource input. This information will be combined with mink ecology to help target resources for mink management and control.

### O2.1.4

#### Effect of the Internet Commerce on the Dispersal Modes of Invasive Alien Species

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Dispersal pattern of the invasive alien species is a basic issue in conservation biology. The aim of our study was to characterize the role of the Internet commerce in the spread of invasive species at the local spatial scale in Poland. We aimed to assess how large distances are covered by invasive species from the seller to the receiver via the Internet in comparison to traditional sell in garden shops and flower marketplaces. We also estimated number of people who buy invasive species and their place of residence both in case of the Internet commerce and traditional selling. We selected 15 big shops in Poland that sell plants both via the Internet and in a traditional way. Also, sellers collected data about the purchasers. Our results showed, that selling by the Internet caused invasive species to "travel" much longer distances than through a traditional selling. Moreover, plants were transported more often to the countryside and seminatural habitats during the Internet selling than during selling in a traditional manner. Our results will help to better understand the mechanism of invasion of alien plants in a modern world and we believe that selling alien species via the Internet should be more restricted.

### O2.1.5

#### Would Rat Eradication Benefit Cory's Shearwaters on the Island of Corvo?

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The eradication of invasive mice, rats, and cats from islands has benefited many seabird species. However, the eradication of all invasive mammal species is often not feasible, and the removal of one species may result in abundance changes of other species, which may adversely affect indigenous species. We assessed the influence of mice, rats, and cats on nest survival of Cory's shearwater (*Calonectris diomedea*) to evaluate the possible effects of rat eradication on the island of Corvo (Portugal). We monitored 6 breeding colonies over three years and measured the activity of mice, rats and cats to examine their influence on nest survival. Cory's shearwater nest survival was on average 0.38 (95% confidence interval 0.20 - 0.53) and mortality was highest shortly after chicks hatched. Cats were identified as main predators of shearwater chicks, but no measure of colony-specific cat activity was able to explain variation in shearwater nest survival. We found a positive influence of rats on nest survival, which may indicate that the presence of small rodents as alternative prey may reduce cat predation of shearwater chicks. Our findings suggest that the eradication of rodents alone may exacerbate the adverse effects of cats on shearwater nest survival.

## O2.1.6

### The Effect of Non-native Plant Invasions on Ecosystem Processes and Services

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Invasive non-native species are considered one of the major causes of biodiversity loss and their spread is expected to increase as a result of increased trade and travel. Invasions can also have consequences for ecosystem properties and functioning, especially when novel traits are introduced. Particularly dramatic cases have led to concerns that invasive species may alter ecosystem service provision. Here we examine the impact of invasive non-native plant species on ecosystem processes and services using meta-analysis. Generally, the effect of invasive plants on ecosystems appears to be relatively idiosyncratic. Invasions appeared to increase biomass and other carbon pools, while water resources were generally reduced with effects on other properties unclear. Traits of both invasive and native species were used for further analysis and allowed more nuanced explanation of the impacts of invasive plants.

## O2.1.7

### The Role of Brown Rat (*Rattus norvegicus*) Predation in Determining Breeding Success of Manx Shearwaters (*Puffinus puffinus*) on Rùm

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The Scottish island of Rùm is one of Britain's largest National Nature Reserves and supports populations of nationally and internationally important bird species, including Manx Shearwaters. Previous research has indicated that the Manx Shearwater breeding colony may be in slow decline, although the reasons for this are not fully understood. Predation of eggs, chicks or adult birds may be involved. We investigated the impact of predation, in particular by introduced Norway rats (*Rattus norvegicus*) on breeding success of Manx Shearwaters at 3 of the main breeding sites; a removal experiment was initiated in April 2010 to compare breeding success of Manx Shearwaters in areas where rats were removed with breeding success in untreated control areas. Overall productivity differed significantly between sites due to differences in occupancy rates, but success of occupied burrows did not significantly differ ( $X^2 = 0.653$ ,  $p = 0.419$ , 1 d.f.) between sites. This result may be due to low rat abundance at the study sites throughout the experiment, although switching treatments between sites over the next 1-2 years will reveal the importance of inter-site differences. This work will support future management decisions for this globally important Manx Shearwater breeding site.

## O2.1.8

### LIFE + Trachemys: Demonstration Strategy and Techniques for the Eradication of Invasive Freshwater Turtles

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Introduction of alien invasive species is one of the main causes of biodiversity loss. In Europe, the release in natural habitats of the Red-eared slider (*Trachemys scripta*), classified among 100 most harmful invasive species in the world, is of specially concern for freshwater native species. To reduce this impact the LIFE+ Trachemys project, co-funded by the European Commission, aims to address the negative environmental impacts of exotic invasive turtle species on Iberian wetlands. A set of innovative trapping techniques and a methodology strategy for control and eradication of wild populations of exotic freshwater turtles are being implemented in 13 pilot areas in Valencia (Spain) and 4 in Portugal, to demonstrate their suitability and viability for replication elsewhere. During the first year of the project we captured a total of 4800 exotic turtles in Spain and 114 in Portugal, with special relevance for the Red-eared slider. This strategy together with ex-situ reproduction of endangered *Emys orbicularis* and public awareness campaigns, aiming to avoid the continuous release of exotic turtles in nature, are being developed to control invasive turtle dissemination and preserve autochthonous freshwater biodiversity.

## O2.2.1

### Impact of Introduced Brook Trout (*Salvelinus fontinalis*) on High Altitude Alpine Lake Ecosystems: Towards an Eradication Plan for the Gran Paradiso National Park

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The organisms inhabiting alpine lakes are subject to strong environmental pressures, resulting in a simplified food web structure. The effects of naturally-occurring extreme conditions are often exacerbated by the anthropic introduction of alien fish, in naturally fish-less lakes. This study provides an extensive investigation (from 2006 to 2011) of the impact of introduced brook trout *Salvelinus fontinalis* on the native communities of alpine lakes in the Gran Paradiso National Park (Western Italian Alps). By comparing the community structure of 8 stocked and 12 unstocked lakes, we were able to accurately characterize macroinvertebrate, zooplankton and amphibian abundances, taking into account their seasonal variations. Our results indicate that the selective predation of more visible preys by alien fish dramatically affected the faunal assemblage of macroinvertebrates, the size structure and composition of the zooplankton community and the suitability of the lakes as breeding sites for amphibians. Moreover selective predation on more visible taxa confers an indirect advantage to less visible competitors, spreading the effect of predation throughout the communities. To recover alpine lakes ecosystems, the Gran Paradiso National Park is planning an extensive eradication project, which involves the use of intensive gill netting as a non-invasive conservation measure.

## O2.2.2

### Spatial Distribution of Non-native Red Swamp Crayfish *Procambarus Clarkii* in a Network of Ponds Suggests That Invasion Is Hindered by Native Invertebrates and Facilitated by Non-native Fish

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Freshwaters in Europe are threatened by the expansion of non-native species. The presence of the red swamp crayfish *Procambarus clarkii* is mostly inversely correlated with the native species richness. Our study site (Nature Park of Brière, France) presents the unique feature of a marsh (7 000 ha) with high crayfish densities (3.4-21.5 individuals/trap-day), surrounded by thousands of smaller ponds embedded in agricultural lands. To further our understanding of this species' ecology and interactions with other species, we quantified the relative abundance of *P. clarkii*, aquatic insects, amphibians and fish in virtually every pond in a 15 km<sup>2</sup> sampling frame using funnel traps. Only 35% of the 122 ponds were colonized by *P. clarkii* and abundance was generally low (mean 1.5 crayfish/trap-day). Models including landscape features (distance to marsh and other ponds) explained the presence of *P. clarkii* in almost third of ponds. Additionally, their presence was positively correlated with non-native fish and inversely correlated with native amphibian (newts) and invertebrates. Our results suggest that pond invasion by crayfish may be facilitated once the competing ecological guild (native invertebrates) is removed by non-native fishes. Understanding interaction mechanisms involved in an ecosystem resistance to invasive threats could be essential for management purposes.

### O2.2.3

#### **Incorporating Dispersal into Models of the Distribution of Spreading Non-native Species: A Case Study with the Common Waxbill *Estrilda astrild***

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Non-native species are major drivers of biodiversity loss. Species distribution models have often been used to understand what constrains their distribution and predict their potential distribution. These assume species are at equilibrium with the environment, so that absences are due to unsuitable environmental conditions. Non-native species are often absent due to dispersal limitation alone, violating this assumption. We propose a simple solution; we calculate the probability a species can disperse to a grid cell using a dispersal model, and use this to weight a regression model of the species' distribution, downweighting absences due to dispersal limitation. When tested with simulations it performed better than ordinary least squares models at describing the species-environment relationship and predicting the potential distribution of a non-native species. We applied the method to model the distribution of the non-native common waxbill in the Iberian Peninsula as a function of climate and land-use variables. Common waxbills were more likely to occupy areas with a moderate oceanic climate, and were associated with gardens and irrigated agriculture. However, the expansion of irrigated agriculture into central Spain allowed common waxbills to occupy climatically unsuitable areas. We conclude that our method is promising for modelling range changes in dispersal-limited species.

### O2.2.4

#### **Detecting Invasion and/or Survival Post Eradication Using Genetic Methods: The Stoat on New Zealand's Islands**

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When new individuals from a pest species are detected after/during an eradication programme, it is important to determine if these individuals are survivors from the eradication attempt or reinvaders from another population, as this enables managers to adjust the methodologies for future eradications. Within the New Zealand environment, the primary threat to native fauna on coastal islands is the stoat (*Mustela erminea*); a voracious introduced predator that has invaded at least 90 islands. Numerous stoat eradication programs are currently underway on New Zealand's islands, however on many of these islands stoats are still being caught. Using genetic assignment and kinship-based techniques we have assessed where these stoats came from - are they surviving residents or invading migrants? In each programme all stoats caught have been genotyped at 16 microsatellite markers along with stoats from nearby potential source populations. Results indicate that stoats can swim further, and do so more regularly than previously thought. Both invasion from the opposing mainland and in situ survival and breeding have been detected to various degrees. These results are vital to improve the management procedures and success of these eradication programmes, and they highlight the efficacy of genetic techniques in assessing these questions.

## O2.2.5

### Linking Plant Traits to Population Performance for an Invasive Herb

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Species traits can potentially be used to predict species invasiveness outside their native range as invaders generally show a greater trait performance than non-invaders. However, studies have usually correlated traits with the status of species invasiveness, and few studies have investigated traits explicitly in relation to population performance. I examined five fitness-related plant traits (germination, survival, growth, flowering probability, seed production) and their variability in relation to population growth rate ( $\lambda$ ) using data on 37 populations of an invasive herb (*Lupinus polyphyllus*) in its invaded range. All five fitness-related traits varied more within than among populations, no difference was detected among habitat types. The performance of the populations varied from declines to rapid increases but did not differ among habitats. Population growth rate increased linearly with seed germination, plant survival and growth, while flowering probability and seed production were unassociated with  $\lambda$ . These results demonstrate that populations of the same invasive species in its invaded range are not homogeneous, and that measures of individual plant traits do not necessarily reflect population performance and invasiveness correctly as only some fitness-related plant traits map directly into population growth rate.

## O2.2.6

### Invasional Meltdown in Iberia: American Crayfish Subsidise American Mink Populations

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Invasions take place within ecological assemblages within local communities of predators, preys and natural enemies. Whereas most research and conservation efforts focus on interactions between invasive and native species, interactions between invasive species are rarely documented. However, the later can determine species persistence. For example, an invasive species can facilitate another by enhancing its probability of survival or increasing its carrying capacity. This facilitation might lead to an invasional meltdown: an increasing rate of establishment of introduced species and/or an accelerating impact. We studied this phenomenon in a riparian predator community including American mink and American crayfish in Spain. Despite trophic niche overlap with its competitors, the American crayfish constituted the main prey for mink (85%). The reduction of competition mediated to the invasive crayfish, enhanced American mink density in the area (1.16mink/km), higher than in similar communities uninvaded by American crayfish. American mink establishment has been facilitated through the positive indirect effects of predation by the previously established American crayfish. This finding arises two management questions: would removing mink worsen the impact of crayfish?, and is mink eradication feasible when they are so strongly subsidised by another invader?

## O2.2.7

### Changes in Abundance of Shorebirds after Implementation of Culling of Invasive American Minks (*Neovison vison*) in the Baltic Sea: A 12-year Experiment

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Non-native populations of a generalist predator, the American Mink (*Neovison vison*), have had detrimental impacts on mammal, fish, and bird populations in Europe. Since the establishment of American Minks in the archipelago of the Swedish Baltic Sea in the 1980's, many shorebirds (ducks, waders, gulls, terns and auks) have shown significant population declines, probably caused by predation from Minks. In a unique experiment to examine the effects of Minks on shorebird abundance and species composition, culling of Minks was instigated in two large archipelagos in 1998, whereas two nearby archipelagos served as control areas without mink removal. Annual monitoring of shorebirds in the four areas documented the changes in bird communities. The results showed that annual intensive Mink culling is necessary to keep the number of Minks low, as constant immigration to the area occurs. However, a majority of the shorebird species, as well as total species numbers, increased significantly in the archipelagos where Mink culling occurred, whereas the abundance of shorebirds continued to decline in the control areas. This study clearly demonstrates the negative effects of Mink on shorebirds. However, it also highlights the need of persistent removal of Minks in order to create predator refugia.

## O2.2.8

### The Effect of American Mink (*Neovison vison*) Eradication in Four National Parks in Poland

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The negative impacts of invasive mammals on native species can be devastating. Understanding the mechanisms that underlie compensatory responses in populations of invasive species has the potential to enhance the effectiveness of control programmes. The aim of this study was to examine the feral mink population response to increased mortality caused by eradication. To address this purpose we studied the colonization rate after eradication in relation to population density. The American mink eradication programme was conducted in 4 National Parks in Poland at two areas in each of them: eradication area [EA] (where mink were removed) and control area [CA] (where mink were marked and released). After eradication, 10 rafts were deployed at each area (both EA and CA) for population monitoring. The percentage of rafts visited by mink at CA and EA in consecutive years was positively correlated with the number of mink trapped in spring ( $r=0.71$ ,  $n=9$ ,  $p=0.033$  and  $r=0.85$ ,  $n=8$ ,  $p=0.007$ , respectively). At EA, the percentage of rafts visited was 10% lower than at CA, and this was associated with lower mink densities during spring-summer. The local and short-term reduction of invasive species numbers seems possible, however, recolonization removes the effect of eradication within few months.

## BIODIVERSITY AND CONSERVATION IN NON EUROPEAN COUNTRIES

### O4.1.1

#### Habitats Directive Index, Sibling of Elders and Fruit of New Assessments

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The key instruments in biodiversity policy are the indicators, in EU compiled to the SEBI set. Only some indicators are devoted to species diversity. The key role plays Red List Index, comprising the knowledge of all accessible Red Lists within the assessed territory. The large amount of data is also collated into the results of obligatory surveillance and reporting in the EU, devoted to the species and habitats of Annexes of Habitat Directive. These data are also included in SEBI just as sum of assessments. The results have not been combined into an index. Habitats Directive Index is therefore proposed based on these data from the processes of universal methodology, by using the modified approach of Red List Index. The index and its structure have various advantages as: calculation on four geographical levels, visual presentation (graphs and maps) and inclusion of uncertainty. It enables also linkages between species groups and their habitats; therefore identification of key problematic areas is simplified. The proposed index could evolve into very useful policy instrument.

### O4.1.2

#### Rainfall and Volcano Effects on a Tropical Island Endemic Songbird Species

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Trends in bird populations can be influenced by average climatic conditions and by the frequency and intensity of rare events. Species restricted to small islands are often vulnerable to rare natural events, such as floods, hurricanes, or volcanic eruptions, and such rare events may have more profound effects on population trends than average climatic conditions. We assessed the importance of rainfall and volcanic activity on the demography of a critically endangered tropical island endemic, the Montserrat Oriole (*Icterus oberi*), by monitoring reproductive output and adult survival of 42 pairs between 2001 and 2005. Annual productivity of Montserrat Orioles increased with pre-breeding season rainfall. Adult survival probability was 15% lower in years with volcanic ash-fall. We used a population model to simulate the population trajectory over 50 years under realistic future environmental scenarios on Montserrat. Montserrat Orioles experienced negative population growth when rainfall decreased, regardless of whether volcanic activity ceased or continued. By contrast, an increase in rainfall could potentially offset the detrimental influence of volcanic activity and lead to population recovery despite ongoing volcanic activity. This study provides evidence that both climate change and rare events may profoundly affect the viability of tropical island endemics.

### **O4.1.3**

#### **Drivers and Patterns of Local Extinction in Himalayan Galliform Species**

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Galliformes are among the most threatened of bird orders, with a large proportion inhabiting South Asia. We examine localised extinctions of 25 species in the Greater Himalaya. Historical records were used to identify locations where the focal species was present within the past 200 years. Field observations from local experts at the same sites were used to create occupancy models that explored factors important for current presence. The influence of key social and environmental factors including protected areas, forest cover, human population density, and altitude were examined as predictors of local extinction. Time elapsed since the historical occurrence record was an important determinant of extinction probability. The presence of protected areas is positively associated with lower extinction, although many species occur outside them. A higher proportion of forest cover is associated with lower extinction probabilities. We find that higher altitude is positively associated with lower extinction for montane species. Human population density is positively associated with extinction. The results are placed in a practical context for conservationists and decision-makers at the country level and across the Greater Himalaya as a whole.

### **O4.1.4**

#### **Poor Governance as a Problem for Conservation Success - Links to the Development Debate**

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Studies show that protected areas are suffering from inefficient management and both deforestation and population declines inside protected areas are reported. I address the question of whether protected area effectiveness is dependent on good governance. I draw parallels to the debate about development aid and claim that this important factor for conservation project performance has been overlooked in the field of conservation biology. Data on spatial patterns of governance (Worldwide Governance Indicators project) and economic development (the World Bank) are used to identify regions of special concern. The results are discussed in relation to the allocation of conservation budgets coming mainly from the North: should conservation investments be directed to regions with favorable conservation conditions, or should biodiversity needs drive conservation priorities but the effectiveness be enhanced in problematic regions in different ways?

### **O4.1.6**

#### **Temporal Changes in Ecosystem Services: The Case of the North Rupununi, Guyana**

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Significant amount of research has been done on the valuation of ecosystem services. However, there has been relatively little work on the spatial and temporal aspects at which ecosystem services are supplied. There has been a lack of empirical data on ecosystem service flows and how they change over time. This paper presents evidence from field research carried out in the North Rupununi, Guyana on the seasonal flows of freshwater ecosystem services and compares this to previous studies in order to understand temporal changes of these services over a ten year period. Using focus-groups, in-depth interviews, participatory mapping, water quality measurements and secondary data, the results indicate a strong seasonality among the freshwater services and an increased human disturbance on the ecosystem services over time. The main issues identified are the increased level of pollution in the water and the reduced abundance of fish. This highlights the need for a management plan that can ensure sustainable use of the ecosystem services in the North Rupununi- both for the conservation of this highly diverse area, but also for the viability of the indigenous communities all along the Rupununi and Essequibo River whom are heavily dependent on fish for their food supply.

#### O4.1.7

##### Comparative Stress Responses of Two Scleractinian Coral's Innate Immunity-related Gene Expression to Winter Conditions

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The comparative gene expression of *Porites astreoides*, a coral resistant to stress, and *Montastraea cavernosa*, a stress susceptible species, using qRT-PCR was analyzed to determine the adaptability of these species to winter conditions. We performed a factorial transplant between an inshore and offshore site of similar depth in the Florida Keys National Marine Sanctuary with known seawater temperature differences. Zooxanthellae density and population dynamics were determined for all samples. Abiotic factors were monitored monthly at each site, however temperature was monitored hourly. Corals transplanted from offshore to inshore sites displayed a greater sensitivity to winter related stress. Expression of inflammatory response-related genes decreased compared to control colonies while the expression of chaperone like proteins (HSP 70) increased. Apoptotic pathway expression was also found to increase. Although symbiont densities decreased in both coral species, zooxanthellar diversity was maintained only in *P. astreoides*. Hence, resistant corals displayed a greater ability to resist stressors and interactions between host and symbiont appear to mediate host response with respect to seasonal related stressors. Understanding species dependent responses to stress are necessary to understand susceptibility and adaptation given the importance of these species to adapt to climate changes and global warming.

#### O4.1.8

##### Harvested Seaweeds: Species Determination and the Relevance for Management and Conservation of Coastal Areas in Chile

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Kelps are brown macroalgae structuring rocky shores communities. The Chilean species *Lessonia nigrescens* (Ln) and *L. trabeculata* (Lt) are considered as the most attractive and versatile kelps for the industrial use. In the face of increasing global demand, management and conservation plans are crucial for a sustainable harvesting. We first characterized the genetic diversity of these species (> 1,000 individuals). Phylogenies revealed one well-supported clade for Lt, but two for Ln. Further characterization of this cryptic structure within Ln was done combining molecular, ecological and biochemical approaches. Results confirmed Lt as a genetic species, but, in contrast to Ln, the genetic structure was very low. Ln is composed of two cryptic species, genetically distinct, with contrasted geographic distributions, different population dynamics and tolerance to environmental stress. Because the cryptic species are occupying different ecological niches, they are not interchangeable and habitat restoration experiments should consider this to be successful. The efficiency of the conservation and management plans depends on multiple factors; one is the identification of species. Further studies should investigate the response of the three species to the present management plans, and if necessary design species-specific management plan. Indirectly, it will affect also the conservation of the kelp-associated community.

# CLIMATE CHANGE AND TERRESTRIAL AND MARINE BIODIVERSITY

## O5.1.1

### Evidence of Direct Thermal Range Limitation in the Globally Threatened Ethiopian Bush-crow (*Zavattariornis stresemanni*) and the Threat of Climate Change

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The globally threatened Ethiopian Bush-crow *Zavattariornis stresemanni* is a distinctive and enigmatic bird that occupies a peculiarly restricted range in southern Ethiopia. Within this range, it is common within highly modified habitats, is a feeding generalist and even shows evidence of synanthropy. Its restriction to a small range is therefore puzzling, since modified habitats and high rural human population densities are found across much of the region. We modelled the distribution of the species as a function of both land cover and climate variables. Models based on land cover predicted a far wider distribution than that actually occupied, whereas models based on climate predict the distribution almost perfectly, and suggest that the species is limited to a small bubble of climate that is cooler and drier than anywhere else in the region. We suggest that the species is directly limited by climate and discuss the implications of this for the conservation of birds in the face of climate change.

## O5.1.2

### Managing Commercially Important Molluscs under Climate Change: Are Forecast Range Shifts Alone a Good Indicator of Species Vulnerability to Global Warming?

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Recent efforts to improve estimates of spatial distributional shifts and extinction risk under climate change have focused on integrating metapopulation dynamics into forecasts of geographic ranges for terrestrial species. We break new ground by linking species distribution models (SDMs) with population models for two commercially harvested marine molluscs (blacklip abalone, *Haliotis rubra* and greenlip abalone, *H. laevis*) inhabiting coastal reefs of South Australia. We show that although the abundance and distribution of abalone is forecast to increase with global warming according to simple SDMs, population growth and expansion is unlikely to occur because of important biological, seascape and anthropogenic processes. Coupled SDM-population models, which explicitly integrate important demographic and ecosystem processes, show that abalone stocks may, in fact, be highly vulnerable to climate change. Our results underscore the need to consider direct measures of extinction risk (population declines and other measures of stochastic viability), as well as measures of change in habitat or range area, when assessing climate change impacts on biodiversity. By exploring and ranking the cost effectiveness of regional conservation alternatives and demographically oriented management interventions, we outline a strategic response to combat the negative threat of climate change on the persistence of abalone in South Australia.

### O5.1.3

#### What Does it Take to Be a Loser? The Future Loss of Species That Live on the Edge

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Increasing evidence shows that climate change threatens many species. Climates shift polewards, and species have to adapt to new climates or track their current climatic niches in order to survive. It is predicted that most species will shift their geographic distribution polewards following climate warming. Thus, species inhabiting high latitude regions will likely suffer, since for them, there is limited or no area to move to. It is however thus far not known what it takes to be a 'loser' or a 'winner' in high latitude regions. We gathered natural history data and used species distribution modelling to assess the current and future distribution of the majority of breeding birds in (sub)arctic Europe. We show that the currently well-established cold-adapted species with large ranges in the (sub)arctics will be the major losers following climate warming. Although no species was predicted to go extinct, several might lose an extensive part of their range. Our work provides evidence for the vulnerability of cold-adapted species, even those that are currently widely distributed. We show how some cold-climate features make species vulnerable to climate change. Moreover, large turn-over in species communities is likely to occur with cold-adapted species being replaced by more temperate species.

### O5.1.4

#### Comparing Ecophysiological and Species Distribution Models to Project European Reptile Range Shifts

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Projections of global change impacts on biodiversity show continuing species extinctions, loss of natural habitat, and changes in the distribution and abundance of species and biomes over the 21st century. Improved predictive accuracy of species range shifts in the coming decades is needed so that effective mitigation strategies can be developed to sustain ecosystem services and functions. There is greater uncertainty in projections of biodiversity change than has been acknowledged in previous global assessments, which highlights the importance of using model comparisons when predicting species range changes. However, this is still rarely done. Our approach uses the outputs of mechanistic and phenomenological models to assess range shifts of European reptiles in the coming decades due to climate change. We also aim to understand how different modeling techniques can inform each other. Agreement between model predictions varied greatly between species and was dependent on whether or not dispersal ability was considered. We hypothesize that the reliability of predictions is greatest where the predictions of these different types of models converge. Sites where this convergence occurs are characterized by both current high temperatures and significant future temperature increases, and are likely to be hotspots of local extinctions.

### O5.1.5

#### Applying the Potential of an Individual-based Ecosystem Model to Understand How Climate Change and Land Use are Modifying Habitat for Saproxylic Species in Boreal Forest

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At landscape level the array of climate change effects on biodiversity has been identified, but we still poorly know at small scale how the survival of different ecological groups will be affected. Moreover only recently it has been addressed how climate change interaction with land use modification can enhance its negative effects on species survival. This contribution is an attempt to forecast, through a forest simulation model, how the availability of habitat for red-listed saproxylic species groups in boreal forests will be modified in Finland by climate change, under alternative management options. Under climate change in the short-medium term, maximizing timber production will increase habitat availability, especially for species associated with well-decayed dead wood, but in the long term only the provision of fresh dead wood will be maintained. Otherwise the full-conservation option will increase fresh dead wood across time, while reducing well-decayed dead wood in the short term, increasing in medium-long term, and newly decreasing in very long term. Our results demonstrate that different saproxylic ecological groups will not have equal responses to climatic alterations. Their habitat availability will vary at different time lags in the future, and critically it will depend on the management scenario applied in forestry.

### O5.1.6

#### Rising of a Sea-level as a Consequence of Climate Change and its Impact on Endangered Coastal Habitats

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Biodiversity is threatened by habitat degradation and destruction, but climate change already became an additional important driver, which is going to influence habitats and their quality in the next decades. In contrast to many other parameters, predicting climatic changes in near future, rising of a sea-level is occurring already now. Therefore, many seacoast habitats in the Mediterranean, with vulnerable halophyte vegetation, will be flooded. Habitat mapping of the Slovenian seacoast was performed and micro-elevations of each habitat were obtained. A high positive correlation between the micro-elevation levels and the vegetation types were found (Cramer's  $V=0.46$ ). In all modelled scenarios there is a decrease of the habitat with *Salicornia* and other annuals colonizing mud and sand. In the worst-case scenario (sea level rise of 20 cm) the halophyte perennials are moving close to the dikes and are forming a zone where the elevation, soil moisture and salinity ratio represents appropriate growing conditions and the annuals almost disappear. Since protected areas with endangered Natura 2000 seacoast habitats are all bounded with dykes, channels or other anthropogenic structures, the total size of coastal habitats will decline substantially within the studied area, but very likely also in other coastal areas along the Mediterranean seacoasts.

### **O5.1.7**

#### **Conservation of Caribou and Reindeer May Help Mitigate Climate Change Impacts to Arctic Tundra**

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Climate change impacts to arctic tundra vegetation are already observable. Increases in deciduous shrub growth over the past 30 years have been widely reported and correlate with increasing mean annual temperatures. Meanwhile however, many populations of caribou and reindeer (*Rangifer tarandus*) have been in decline, and the potential role of this decreased browsing intensity in arctic shrub expansion has been highly overlooked. Arctic plant growth is most strongly limited by soil nutrient availability, so any impact of herbivory on nutrient pools may either enhance or inhibit shrub growth responses to warming. Here we investigate the relative importance of natural low-intensity caribou browsing and experimental warming on the biomass, productivity, and chemical composition of tundra vascular plants and on soil nutrient pools using caribou exclosures and experimental greenhouses in the central Canadian low arctic. We found that caribou browsing decreased shrub growth by 21-42%, decreased shrub nutrient pools, but did not alter soil nutrient pools. Experimental warming increased shrub growth by 16-41%, increased shrub nutrient pools, but did not consistently alter soil nutrient pools. We conclude that the conservation and management of caribou and reindeer herds may be an important mechanism for mitigating climate change impacts to arctic tundra.

### **O5.2.1**

#### **Anthropogenic Climate Change as the Driver of Sandeel Population Collapse in the Southern North Sea: A Bottom-up Statistical Analysis**

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Despite conservation efforts in the past two decades, the lesser sandeel (*Ammodytes marinus*) population of the southern North Sea has shown dramatic declines, with deleterious effects on both marine predators and on the fishing economy. While the ecological impact of sandeel population collapse is well documented, the effect of climate on this system has not been quantified, as current management efforts have assumed direct extraction of fish to be the main driver of population declines. This paper outlines the mechanism by which anthropogenic warming in the North Sea has disrupted this ecosystem by studying the trophic relationship between plankton, sandeels and seabirds, which formed a representative snapshot of the larger system. Statistical analysis of the relationship between target species revealed that earlier timing of the North Sea plankton bloom due to anthropogenic warming creates a cascade of food shortages throughout the ecosystem, which substantially reduces sandeel availability for marine predators and commercial fishing. The strong relationship between anthropogenic climate change and North Sea fisheries decline indicates a need for marine conservation strategies which focus on mitigating the impact of global warming instead of exclusively regulating extraction.

### **O5.2.2**

#### **Monitoring the Impact of Environmental Change on Penguins in Antarctica**

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Large scale wildlife monitoring in the Earth's most rapidly changing ecosystems is fundamental for making informed conservation management decisions. Observed and predicted changes in climate, and the expansion of fisheries in Antarctic and sub-Antarctic regions are two causes of concern which make monitoring of key species in this remote part of the world critical. We used generalised additive modelling and geographically weighted regressions to perform a temporal and spatial analysis of penguin population trends from Antarctica, including several European overseas territories. We reveal that data from 14 penguin species show an average decline in abundance over the last 37 years. In addition to these large scale changes, we found differences in trends between western and eastern regions of Antarctica which correlate with regional changes in temperature over the same time period. Given the threats posed to the long-term persistence of penguin populations suggested in this study and that currently only a limited monitoring network exists for the Antarctic, the need for broadening coverage is vital. We conclude by reporting on a newly established network of time lapse cameras with which we aim to collect population and phenological information on a large number of penguin species across the Antarctic region.

### O5.2.3

#### Species Traits Explain Recent Range Changes of Orthoptera in Britain

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The accumulation of long-term, large-scale datasets through biological recording, often by volunteers, has made major contributions to recent research on the effects of environmental change. The Orthoptera Recording Scheme of the British Isles has been collating distribution records since 1967 with records stretching back to the 18th century. Using three different methods for trend analysis of such atlas-type distribution data we report range changes of British Orthoptera over the past 50 years. Despite considerable conceptual differences, all three methods yield highly consistent results, giving confidence in their reliability. The calculations show about 25% of species undergoing range expansions; at the same time up to 50% of species show negative trends. The calculated trends were then related to a database of species traits including life history, resource use and phenology. Species with expanding distributions show a concentration of traits favouring rapid response to environmental change: low habitat specificity, high dispersal capacity, but also - interestingly - late phenology. Gathering simple distributional records over time and relating them to species traits therefore not only allows monitoring of the profound changes currently affecting many species, but also gives insights into the underlying ecological processes, with direct relevance to conservation.

### O5.2.4

#### Vulnerability of Butterflies to Climate Change and Nitrogen Deposition

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Butterfly communities have been shown to lag behind in their response to climate change across Europe. High levels of anthropogenic nitrogen deposition has been advanced as a factor contributing to this delay. A focus on trends in relation to species traits may elucidate the observed trends. We show four main PCA axes describing 63% of the variation in species traits among northwestern European butterflies. The first axis groups species according to vagrancy, population density, adult size, reproductive capacity and hibernation mode. The second axis reflects the thermal range and moisture requirements. The third axis contains variables determining the number of generations per year and the last axis describes host plant specialization. The first and third axes relate significantly to species-specific nitrogen indicator values. Nitrogen-sensitive species show stronger declines at high deposition levels. Long-term trends in Butterfly Community Indices in the Netherlands reflect increases of species from both thermophilic and eutrophic conditions. The climatic lag is mainly explained by species from low-nitrogen environments, in particular by species hibernating as eggs or larvae. Cooling of spring microclimates and reduced food quality offer mechanistic explanations to explain the different response of these species.

### O5.2.5

#### Climate Change Impacts and Conservation Responses: A Global Analysis for Birds

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Climate change is projected to cause increases in temperature and changes in precipitation patterns around the world. The impacts of these changes on populations are likely to differ between different species and locations. Understanding these impacts is an important precursor to informing appropriate conservation responses (adaptation). In order to examine this, we have collated information from published studies on the relationships between both temperature and precipitation and demographic parameters for birds from around the world. Firstly, we test whether there are significant latitudinal relationships in the response of species to variation in both temperature and precipitation. Secondly, we test for a number of ecological traits in determining species sensitivity to these variables. The importance and direction of temperature and precipitation effects on populations vary from the tropics to high latitudes, which has significant implications for the likely responses of populations to climate change. We use the findings to identify the types of species most vulnerable to increasing temperatures and changes in precipitation, and illustrate these with examples. Finally, we conclude with some key adaptation options which may be used by conservationists to respond to these different effects.

### O5.2.6

#### The Slavonian Grebe in Scotland: Population Demography and Effects of Climatic Fluctuations at the Southern Edge of its Circumpolar Range

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Climate change poses a pervasive threat to global biodiversity. Particularly at risk are species occurring at high latitudes, whose capacity to track changes in climate space is restricted. The Slavonian Grebe has a circumpolar distribution, occurring in Scotland at the southernmost edge of its range. Drawing on a 40-year, Scotland-wide study, we examine the long-term dynamics of grebes and investigate whether climate fluctuations have driven changes in demography. Slavonian Grebes declined by 71% between 1993-2010. Population changes were positively related to covariates reflecting weather conditions during summer and autumn, with population growth more likely following warm, dry summers or warm, wet autumns. Neither climate variable showed a long-term trend that could potentially account for the decline. Furthermore, breeding success of Scottish grebes was low compared to other populations, although there has been no long-term deterioration that would account for the population decline. A stochastic population model showed that demographic rates calculated for Scottish grebes do not account for recent observed population changes. We speculate that the Scottish Slavonian Grebe population is a demographic sink relying on immigration from external source populations, and that the recent population decline is attributable to reduced immigration, perhaps mediated through climate change-related influences on dispersal.

### O5.2.7

#### Impacts of Climate Change on the Reproductive Ecology of the Wolverine *Gulo gulo*

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Global warming may alter snow accumulation and melt in high alpine mountains shortening the snow-covered period. Species that depend on snow conditions may be affected through disappearance of breeding habitat and reduced breeding success. This was investigated for the wolverine, the only non-hibernating large carnivore of the northern hemisphere giving birth in winter. The climatic envelope of wolverine distribution is limited by the extent of snow cover during spring and an upper limit of thermal neutrality. To investigate den site placement in relation to fine-scale snow cover and exposure, temperature and humidity loggers were placed inside known den sites. The snow-covered period encompassed on average 194 days, rendering stable temperature and humidity conditions inside. Snow depth at den sites was higher than the surrounding territory, and increased with latitude. Variation in weight development in cubs during their first year of life was related to gender, snow duration and growing season intensity. Intensity (and length) of the growing season may affect weight development either through earlier birth or faster growth. Changes in distribution and duration of permanent snow cover in high alpine mountains may thus reduce wolverine access to breeding habitat, shorten denning periods and impede cub growth and survival.

## O5.2.8

### Climate Change Effects on the Distribution of the Great Bustard and the Little Bustard in Europe

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The great bustard (*Otis tarda*) and the little bustard (*Tetrax tetrax*) are two vulnerable steppe-bird species with a Palearctic distribution that often occur sympatrically. We assessed the effect of different climate change scenarios on the distribution of both species at European scale. The estimation of the effect of future climate on species distributions should be performed by combining climate with habitat factors; thus we considered also topographical, land-use and spatial variables. We obtained climatic variables from WorldClim for the XXI century and for three different General Circulation Models (GCM). We modelled the distribution of each species on a 50 km x 50 km grid with current variables and projected their environmental favourability to the periods 2050 and 2080 according to each GCM. We show maps of current and future favourability in each GCM and period of time; these showed that forecasted climate change will not have a likely negative effect on the distribution of these two species. At least at a wide scale, climate in Europe during the XXI century will not produce a contraction on their distributions. Further studies may address the interaction between climate and land use (e.g. through changes in agricultural practices) on these important species.

## CONSERVATION AT THE SCIENCE-POLICY INTERFACE

### O7.1.1

#### Decision Making in Conservation Genetics: Presenting a Web-based Tool Designed to Aid Conservation Practitioners and Policy Makers in Planning Genetic Studies of Conservation Relevance

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It is widely recognised that the erosion of genetic diversity plays a major factor in contributing to species decline and extinction risk. Despite this genetic biodiversity is poorly represented at the policy level compared to species and ecosystems. The ConGRESS (conservation of genetic diversity for effective species survival) consortium aims to rectify this situation by delivering dissemination tools which policy makers and conservation managers can conveniently use to incorporate genetic biodiversity into their policy framework. As part of the ConGRESS project we developed a web-based decision tool which allows the user to explore specific management issues and discover the conservation genetic methods, tools and concepts that will help them address those problems. The decision tool was designed through consultation among researchers and conservation professionals across the EU. This led to the identification of key conservation issues which genetic methods can help to address. It also allowed us to understand the practical information conservation professionals require when considering a conservation genetic study. Here we present the prototype of the decision tool and discuss how it can aid managers and policy makers in planning conservation genetic studies.

### **O7.1.2**

#### **Exploring Science - Policy Communication in Three Case Studies: Lessons for Future Science Policy Interfaces for Ecosystems and Biodiversity**

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It is widely thought that effective science-policy interfaces (SPIs) are critical to supporting sustainable use and conservation of biodiversity. This has driven recent calls, at both global and EU levels, to improve the links between science and policy. In order to achieve this, we must learn from and build on existing efforts and experiences. In this study, part of the FP7 SPIRAL project, we explore communication between science and policy in three case studies: the EU Water Framework Directive, the UK National Ecosystem Assessment, and deer management within Scotland. To explore communication between biodiversity knowledge holders and policy-makers at these different scales we used qualitative analysis of one-to-one interviews with a range of stakeholders. Our results highlight factors hindering communication, e.g. how information relevance, credibility and legitimacy can affect its uptake; the effect of perceived uncertainty; and divergent implicit norms, values and worldviews. We also highlight approaches that have supported communication, including practical tools (e.g. visual methods). On the basis of our findings, we present a framework of key factors that affect communication between science and policy. Our findings have broad relevance for informing and improving new and existing SPIs from global efforts (e.g. IPBES) to more local-scale efforts.

### **O7.1.3**

#### **Measuring the Impact and Relevance of Conservation Research: Whose Science Has Been the Most Useful for Wild Bee Conservation?**

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How much impact is your research having on conservation policy and practice? Governments and conservation organisations are keen to measure the usefulness of their research investments. But linking research to its subsequent impacts is difficult and fraught with confounding factors. We have developed a method to assess likely impact. We score individual pieces of research according to their contribution to answering questions of quantified importance to end-users of research. To demonstrate the approach, we have evaluated research into means of conserving wild UK bee populations. The importance of different questions was scored by 44 conservation practitioners, policymakers and advisers. The contributions of different pieces of research were scored by a panel of three experts in bee ecology and conservation, using a Delphi technique. The process identifies publications that provide high quality evidence relating to issues of strong concern. The two highest scoring publications are both replicated controlled trials of the use of farmland managed under different agri-environment scheme options by bumblebees. Our approach sets research in the context of the full body of scientific knowledge in a policy area. It could be used to evaluate the impact or contribution from a single organisation or research programme.

#### **07.1.4**

##### **Ecopay - Integrating Economic and Ecological Knowledge for Software-based Decision Support for Cost-effective Biodiversity Conservation in Grassland**

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In the EU each year several billion Euros are spent on payment schemes which compensate farmers for carrying out land use measures which are costly to them but have a positive impact on biodiversity conservation. It is of great importance to make such payment schemes ecologically effective (i.e. intended goals like the improvement of habitat quality of endangered species are actually achieved), and cost-effective (i.e. payments are designed in a way that for the available financial budget the level of goal achievement is maximised). For this purpose, we developed a decision support software (Ecopay) for grassland conservation in the German Federal States of Saxony and Schleswig-Holstein. Ecopay consists of a database with species and habitat characteristics for 15 birds, 15 butterflies and 7 grassland types, 475 land use measures, and land use information. It further contains an ecological model to assess the impact of measures on species and habitats and a cost assessment module to estimate the spatially differentiated costs of the measures. The optimisation process is carried out through simulated annealing. Using the example of grassland conservation in Saxony we demonstrate how Ecopay can be used to design cost-effective agri-environmental payment schemes in specific landscapes.

#### **07.1.5**

##### **Habitat Association Models for Peatland Waders Reveal Edge Effects Following Maturation of Plantation Forests**

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The peatlands of northern Scotland (the 'Flow Country') form one of the largest expanses of blanket bog in the world, supporting internationally important breeding bird populations. Large-scale planting of conifers in the late 1970s and 1980s caused direct losses of peatland habitat and their associated nesting birds. Additional edge effects of forestry on peatland nesting birds were predicted based on the suitability of the forests for harbouring generalist predators such as crows and foxes, and the possibility of some nesting waders avoiding high-risk areas close to the forest edge. However, studies in the late 1980s showed little evidence of such effects. Here we use more recent data to quantify the association between habitat, land cover, topography and occurrence of breeding Golden Plover, Dunlin and Greenshank. We show that edge effects have become more evident within 1km of forestry edges for the former two species. We create mapped scenarios of predicted increases in wader distribution following forestry removal. Finally, we show how, together with other considerations such as the greenhouse gas consequences of re-planting on deep peat soils, our results are being used to guide where peatlands may be restored or devoted to a second rotation of forestry planting.

## **O7.1.6**

### **Conservation Experts for a Better Implementation of Natura 2000 in Europe**

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The Natura 2000 network of protected areas is the cornerstone of EU policy to halt the loss of biodiversity. Its implementation was evaluated on the basis of 245 questionnaires filled by conservation experts from 26 EU member states. The main strengths of the network, as reported by the majority of experts (52-64%), are the adequate selection of Natura 2000 sites, the contribution of the network to increase the knowledge on European biodiversity, the efficient EU legal frame and the adequate use of Life+ funds. Reported by more than 80% of the participating experts, the main obstacles for Natura 2000 implementation include the lack of political will of local and national governments to properly implement Natura 2000, the ignorance of local stakeholders for nature conservation, the negative attitude of local communities towards the network, and the insufficient staff employed for the management of Natura 2000 sites. Experts consider the increase of public awareness, the employment of high-quality conservation scientists, the better control of Environmental Impact Assessment studies, the improvement of enforcement mechanisms to halt illegal activities within the network and the establishment of an independent fund dedicated to Natura 2000 as the top five priorities to enhance Natura 2000 success.

## **O7.1.7**

### **Recognizing Practitioners' Needs: A Prioritized Research Agenda for Biodiversity Conservation Science**

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A gap between science and practice hinders the effectiveness of biodiversity conservation. Since scientific study is often impractical for implementation, several surveys have sought research questions relevant to conservation practice. Prioritization of these questions has never been attempted although it would provide invaluable information for steering future research. We surveyed Swiss conservation practitioners to identify and prioritize their needs for useful scientific information. A selected subgroup generated a list of relevant research questions in an inductive survey, which was then submitted through an online platform to all registered conservation practitioners in Switzerland. They were asked to rate the importance of each question, to nominate missing questions and to specify "hot topics" relevant to their field. The results allowed the identification of general and ecosystem-related research priorities. Generally, questions related to economic, societal and stakeholder conflicts were found to be more important than conceptual questions. Questions concerning single-species ranked above ecosystem-related questions. Subsidiary questions and hot topics were integrated into a final catalogue. By identifying and framing questions of both general practical relevance and specific regional importance, this practice-oriented research agenda provides a basis for conjoint activities with the intention of bridging the gap between conservation science and action.

## **O7.1.8**

### **Making Decisions in the Uplands: Managing Multiple Objectives**

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The Scottish uplands provide important public benefits such as biodiversity, food, water, timber, carbon storage and recreation. Large areas are managed as sporting estates which are of economic and cultural importance. An increasing emphasis on the public benefits provided by the uplands has led to a policy focus that requires land managers to achieve multiple objectives. However there is no practical guidance for land managers or agencies on how to achieve this. A set of six management strategies were designed to reflect current upland management in Scotland. We used participatory multi-criteria decision analysis to evaluate how these strategies achieve a set of ranked policy priorities compared to a set of priorities from a representative group of upland managers with a range of objectives including conservation and sporting. Participant land managers gave management strategies based on sporting objectives the highest overall scores for delivering policy priorities for rural communities while nature reserves scored highest for policy priorities for biodiversity, recreation and low carbon economy. Trade-offs and compatibilities among the sets of priorities were identified in relation to different strategies. The method used in the workshop captured the complexity and values underlying how decisions are made when managing for multiple objectives.

## **CONSERVATION GIS**

### **O10.1.1**

#### **Past, Present, and Future Biogeographical Patterns of Herpetofauna from the Iberian and Italian Peninsulas**

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The present biogeographical patterns in species density of herpetofauna have been analysed in the Iberian Peninsula, but not for the Italian one. In order to determine if biogeographical regions and species chorotypes changed along time, we aim to analyse how biogeographical patterns change from past to future, focusing on climate change impacts in future species richness. We measured expansions and retractions in species distributions and identified possible areas of refugia. The study areas were the Iberian and the Italian Peninsulas, excluding the Balearic Islands, Sardinia, and other islands outside the continental platform. We extracted amphibian and reptile records from the respective national atlases. We calculated species' realised niche models with Worldclim climatic variables and Maxent, and projected them to two past climatic scenarios (LGM and LIG) and to three future climatic scenarios (2020, 2050, and 2080). We used a GIS to transform the species' models in presence/absence maps, and to analyse expansions and retractions in species distributions. We used a Hierarchical Cluster Analysis with Jaccard's index to determine species chorotypes. Preliminary results on the evolution of the biogeographical regions and species chorotypes of both Peninsulas show how the Mediterranean areas advance northwards with warmer climates.

## O10.1.2

### Projection of Future Loss of Habitat for Mammals: Priority Species Groups

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Land-use change driven habitat loss is considered the main threat to biodiversity. Because habitat loss is likely to continue into the future at a worryingly fast pace, it is important to assess its future impacts on biodiversity for effective prioritization of conservation efforts. In this context, land use change modeling, is an important method to understand the causes and consequences of these changes on biodiversity, and to assess the implications for alternative socio-economic scenarios.

We use a global Earth-System model, IMAGE, coupled with fine-scale habitat suitability models, to assess the geography and extent of projected future decline of habitat for terrestrial mammals. We highlight the most affected taxa and biomes by 2050 for each scenario. We found a strong heterogeneity among taxa, with Eulipotyphla having the largest proportional loss of habitat relative to their current distribution. Losses of savanna habitat in Africa and South America will determine the large relative decline in habitat for Rodentia and Lagomorpha. Carnivora have intermediate values of habitat decline, Primates have low projected losses. This study suggests that the future battlegrounds for terrestrial mammal conservation will be in tropical savanna and grassland; conservation efforts should focus on mitigating the projected land use changes there.

## O10.1.3

### Use of Habitat Modeling and Remote-sensed Data Analysis to Understand the Causes of Local Extinction in a Wetland Passerine

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The Eastern Iberian Reed Bunting is endangered in Spain (254-360 breeding pairs in 2005). Since then, population has decreased through local extinctions, possibly due to habitat loss. However, little is known about habitat selection in the breeding period and if is habitat loss related with the decline.

From presence-absence data, habitat variables related with the occurrence of the subspecies at several scales were analysed. At landscape scale, the buntings preferred wetlands with high proportion of reed-rush formations, avoiding pure reedbeds. At territory and nest scale reed-rush formations were also preferred, so the occurrence in a wetland seems to be conditioned to the availability of vegetation to settle territories and nests. From remote-sensed data (SPOT-5), variation of the vegetation between 2005-2009 was analysed in a Iberian wetland, where the bunting became extinct in 2007. Proportion of reed-rush formations in random territories declined within these years ( $8.75 \pm 12.26\%$  vs  $3.51 \pm 6.61\%$ ). In two breeding areas, the decline of these formations was not significant, but proportion of pure reedbeds increased significantly (31.16 to 52.36 Ha and 57.66 to 87.09 Ha). The results suggest that the local extinction was not related with changes in habitat, but could be related with changes in the vegetation structure.

#### **O10.1.4**

##### **Assessment of Hunting Pressure on Migrating Raptors along Eastern Black Sea Bottleneck in Batumi, Georgia**

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The Batumi-bottleneck, along the eastern Black Sea coast of Georgia, is crucial for migrating, Eurasian raptors, with autumn totals over >800.000 raptors. The illegal shooting of all raptor species is a common practice. To be able to predict the intensity and distribution of the hunting along the bottleneck, we applied a probabilistic distribution model (MaxEnt), based on hunters coordinates and several geological characteristics of the area. This revealed that hunting is restricted to mountain ridges of certain altitude in the vicinity of the sea. Such hotspots are rare, but at these places very high densities of hunters are expected. Honey and Steppe Buzzard are targeted and killed the most. Their mortality rate is of low conservation significance. But the impact of the shooting of some of the more vulnerable, rare or decreasing raptor species is alarming. Some distinct locations are known Lesser Spotted Eagle could be huge with a reported maximum of 18 eagles shot in one day by one hunter. Sparrowhawk trappers take a special role, also taking their gun to their hides. They make up for most of the harrier (Marsh, Montagu's and Pallid) casualties. 95% of the hunters are locals and reach their hunting spots on foot.

#### **O10.1.5**

##### **Analysing Landscape Connectivity with Open Source GIS Based on Graph-theory**

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Connectivity is regarded as a vital precondition for the survival of meta-populations and is a central concept in conservation planning. Graph-theory has been characterised as a useful and efficient tool for estimating connectivity by many authors. A (short) review of existing examples revealed that analyses using graph theory are often conducted with heavily expensive software (e.g. ESRIs ArcInfo) or lack information on how the network analysis is performed technically. Furthermore, graph theory was only to a small degree integrated into modelling of (wider) ecological corridors. To make graph theory more easily accessible for conservation planners and to integrate it into corridor modelling, the Norwegian Institute for Nature Research (NINA) developed the *r.connectivity.\**-toolchain as an add-on to the GRASS GIS. Applied in different projects, like e.g. an evaluation of the Norwegian Conservation Area Network (CAN) with regards to connectivity, these tools have been tested successfully even with large networks (more than 5000 conservation areas). An application of the *r.connectivity*-tools provides the conservation planner with information about the potential connectivity of a set of patches and the importance of the connection between them. This information helps to identify targeted measures for protection or restoration of connectivity for target species or habitats.

## O10.1.6

### Monitoring Land Cover Change on Sites of High Biodiversity Value to Inform Conservation Management and Assess Protected Area Effectiveness

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Monitoring is an essential part of conservation, allowing problems to be identified, solutions to be developed and the effectiveness of interventions to be assessed. However, field-based monitoring may not always be possible due to remoteness of sites, political instability or a simple lack of resources. Remote sensing (satellite images) has previously been identified as a possible solution to these problems, but there is still no operational system for collecting data on changes in land cover in a comparable and easily interpretable manner for monitoring sites. Here, we describe a web-based tool for assessing land cover change on sites that is simple to use, free, and which produces outputs that are readily interpretable. We go on to demonstrate an application of the tool, namely assessing the effectiveness of protected areas at reducing rates of loss of natural land cover in Important Bird Areas (IBAs) in Africa. Following assessment of changes within protected and unprotected IBAs and in surrounding 20 km buffers, we found that protection did not prevent loss of natural vegetation, but did reduce the rate of loss by about 70 %. Rates of loss around protected IBAs and within and around unprotected IBAs did not differ significantly.

## O10.1.7

### Using Google Earth to Bridge the Gap Between GIS Specialists and Conservation Practitioners

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GIS has become a powerful tool in conservation biology. However, its use is limited by the cost of software licences and a lack of technical expertise amongst many conservationists. This creates a barrier to the flow of spatially-explicit information from GIS specialists to conservation practitioners who could benefit from using it to inform their decision-making. Google Earth is a powerful, freely-available mapping tool that is already widely used by conservation practitioners. Here we use two case studies to demonstrate how Google Earth can be used to allow conservation practitioners without GIS training to access data generated by GIS specialists. Firstly, we show how GIS data layers created for a tropical forest biodiversity survey project at the Manu Learning Centre in the Peruvian Amazon have been converted into a Google Earth compatible format to allow data sharing with staff, volunteers and local people. Secondly, we show how Google Earth is being used to provide marine managers and conservationists with the most up to date information on the global distribution of beaked whales. Through these examples, we demonstrate the power of using Google Earth to bridge the gap between GIS specialists and non-GIS users who would benefit from accessing spatial data.

## **O10.1.8**

### **A Global Analysis of Mammal Population Declines: Introducing Decline-Curve Convexity as an Indicator of Conservation Concern**

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Monitoring the dynamics of wild populations is one direct approach to provide information with which to tackle biodiversity loss, as population disappearance is a prelude to species extinction. However, although reductions in population size are often recorded, on their own they are weak indicators of conservation concern. Changes in the speed at which a population is declining are more useful. I show how decline-curve convexity can be used as an indicator of decline-dynamics. Through population simulations, I identify convex declines as being most severe, as these occur as a result of increasing mortality over time. Concave, exponential declines are the next critical type of decline-curve, associated with constant, proportional mortality. Lastly, concave, quadratic declines with an upwards turn are indicative of reducing mortality. I find these relationships are consistent across a range of life-history speeds, environmental stochasticities and levels of data-quality. Using this new decline-curve categorisation method, I map differences in declining mammal populations at a global scale, using time-series from a dataset of 1339 mammal populations. I identify spatial aggregations of severe mammal population declines and relate these to a range of environmental and anthropogenic factors.

## **CONSERVATION IN A SOCIO-ECONOMIC CONTEXT**

### **O11.1.1**

#### **Landscape Level Wildlife Conservation and Commercial Hunting in Small-Patterned Private Land Ownership - Role of a Local Hunting Club in Kainasto, Western Finland**

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Ownership of Finnish forests and farmland is peculiar; two thirds is owned by private people and average farm is only 40ha. Hunting rights of adjacent farms are leased to a local hunting club, albeit rental being usually other than money (venison, game control, annual feasts).

Average hunting club possesses hunting rights on 5000-10000 hectares, thus utilizing the land of literally hundreds of private landowners. Such club could easily profit of the hunting rights by selling licenses to a third party, but problems would arise because, basically, club benefits from another person's property.

In Finland the number of hunters per capita is Europe's highest, and pastime hunting is totally independent of people's social status. The lack of commercial aspects is traditional and the system works very well. However, being 'free of charge' game is not properly managed. This means that the true potential of a typical Finnish forest-farmland mosaic landscape for conserving wildlife and providing hunting opportunities is vastly underused.

We show that landscape level wildlife management and commercial hunting is possible also in these conditions.

The required selfless acts by the hunters and equal distribution of profits for the whole rural community will eventually benefit the hunters themselves.

## O11.1.2

### Can Cultivation of Over-harvested Plant Species Reduce Pressure on Wild Populations?

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Cultivation of over-harvested plant species has frequently been proposed as a conservation strategy to reduce pressure on wild populations. There is little research to support this assumption. The aim of this study is to understand under what conditions cultivation can reduce pressure on wild populations. I draw upon methods developed in fisheries and bushmeat literature and apply these to harvested plant species. I developed a bioeconomic model and use a palm species (*Chamaedorea ernesti-augusti*) in Guatemala and Belize to parameterise the model. Semi-structured interviews were conducted to estimate costs and benefits of cultivation and harvesting. I identify characteristics of wild species that favour cultivation and demographic predictors of households likely to cultivate or continue harvesting. I show the relative importance of different drivers of the system, including the level of enforcement, changes in opportunity costs and the price paid for the plant material. The results from this study can help guide conservation interventions for wild harvested plant species. With increasing harvesting pressure on many wild populations, cultivation may be one conservation option. However, barriers to establishing cultivation may restrict the feasibility of this as a conservation strategy.

## O11.1.3

### Multiple Objectives in Regional Forest Management Planning: Optimizing Both Harvest Revenues and Conservation Benefits

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Joint production of ecological and economic benefits in forest landscapes is a challenging multi-objective problem because of conflicts that typically exist among different objectives. Our overall goal was in a large boreal landscape to maximize (1) net present value of harvest revenues, yet, at the same time maintain as high as possible (2) species habitat availability and (3) spatial configuration of the habitat that would ensure population persistence. Our focal taxa were red-listed dead-wood associated species and vertebrates with high conservation or economic value. Each forest stand was assigned one out of seven management options ranging from intensive timber production to no management (set-aside). We used multi-objective optimization tools to explore the set of [Pareto] optimal combinations of management options among stands. We assessed the trade-offs among these three goals and observed that while there was a general conflict between the economic goal and overall species habitat availability, considerable conservation benefits can be achieved with very little costs by careful landscape level planning. Likewise, there are promising trade-offs between overall habitat availability and spatial configuration of the habitat (influencing population persistence). Optimal combinations of management actions at the landscape scale varied with the level of the economic goal.

#### **O11.1.4**

##### **Assessing Ecosystem Services Trade-offs in Farmland Abandonment: Looking Back Into the Past**

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European mountain landscapes have been facing important changes for the last decades as a result of rural depopulation and farmland abandonment. Abandoned farmland is being replaced by naturally regenerated systems, such as scrubland and forest. These changes have consequences for the condition and spatial distribution of ecosystem services. Most studies rely on current data and scenarios to assess the impacts of farmland abandonment on ecosystem services. Here, we follow a backcasting approach using temporal series of land cover maps (1965-2007), to assess changes in the condition of ecosystem services in a mountain parish, NW Portugal. We ask the following questions: 1) Did regeneration of natural systems contributed for the improvement of regulating services, such as carbon sequestration and erosion control, or did the biomass increase contributed for a higher flammability and therefore for the degradation of regulating services? 2) What are the trade-offs between the decrease of provisioning services and the condition of regulating services? We used InVEST to analyze landscape changes and produce maps of trade-offs in ecosystem services. We hypothesize that the decrease in provisioning services provided by traditional agricultural systems will be counterbalanced by an increase in regulating services, mainly as a result of natural systems regeneration.

#### **O11.1.5**

##### **Valuing the Economic Benefits of Implementing a National Strategy on Biological Diversity - the Case of Germany**

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The National Biodiversity Strategies and Actions Plans (NBSAP), required under Article 6 of the UN Convention on Biological Diversity, are asking, among other things, for an assessment of the benefits of biodiversity conservation in monetary terms. The objective is to make the benefits that biodiversity provides more visible and build support for conservation activities. So far, however, determining the benefits within the NBSAP has rarely taken place. This paper presents results of a contingent valuation study which quantifies the benefits of implementing a set of measures derived from the German National Strategy on Biological Diversity. Survey respondents were firstly presented randomly selected ecosystem specific conservation programs and secondly a nationwide program comprising all ecosystem specific programs. Results indicate that implementing these measures would generate substantial benefits in Germany. The benefits measured in monetary terms therefore provide important information for decisions on land use in Germany. Public policy would be well advised to take the economic benefits of biodiversity conservation under the NBSAP into account, ensuring that decisions on land uses are not dominated by conventional market values connected, for example, to food or biomass production.

### O11.1.6

#### Reviewing Implementation of the CBD Ecosystem Approach: Empty Label or Useful Guide?

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The Ecosystem Approach (EA) as defined by the Convention for Biological Diversity (CBD), is 12 complementary and interlinked principles that promise “a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way”. As such the EA promises to be key approach to achieving sustainable and fair natural resource management. However, although the EA claims to be useful in many situations and habitats, its principles can seem relatively vague and 'high level'. Is it really useful, given the plethora of existing policies, concepts and recommendations for natural resource management? Is the label just a holistic term retrofitted to existing projects? Over ten years have elapsed since the CBD principles were agreed, so this is a good opportunity to review what has been learnt. In this presentation we trace the evolution of the concept and synthesise experiences from the UK, Europe and beyond. We ask if and how the EA can add to our understanding and practice, beyond existing concepts. We suggest that it can be useful to conservation, particularly as regards promoting systems thinking, but this is hindered by the current lack of clarity surrounding the concept.

### O11.1.7

#### Patterns of Habitat Loss in Mediterranean Coastal Dunes

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In the last 50 years dunes located on the Northern edge of the Mediterranean Basin experienced high levels of land consumption and degradation due to mass tourism development, urban sprawl and invasive alien species propagation. We aimed to determine if the degree of habitat loss mainly due to land use change and dissection (i.e. urbanization and infrastructure network) and alien species diffusion was evenly distributed on the landscape or demonstrated a specific distribution pattern. We analysed the sandy coasts of a Mediterranean island (Sardinia, Italy) by interpretation of aerial photographs, field surveys and GIS analysis in order to determine if the pattern resulted 1) homogeneous 2) higher in biodiversity poor areas 3) higher in biodiversity rich areas. Surprisingly, we found higher levels of infrastructure development and alien species spread (mainly *Carpobrotus acinaciformis* and *Acacia saligna*) in sites considered of high conservation concern because of the presence of several habitats and rare vascular plants (as *Anchusa crispera* and *Linaria flava*) listed in the Directive 43/92/EEC. The higher impoverishment of areas of great value for biodiversity poses a big problem to conservation biologists and land managers, that should be solved before habitat and species loss become irreversible.

### O11.1.8

#### Modelling the Determinants of Organic Consumption Diffusion Based on Sales Data: The Role of Social Imitation and Cultural Influence

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As agricultural intensification is a major cause of biodiversity decline, transformation of agricultural practices is crucial for biodiversity conservation. By changing their ways to consume, it is highly recognized that civil society plays a key role in the transition to more sustainable agri-food systems. Nevertheless, consumption habits are particularly delicate to change as it comes from routine and cultural behaviors. Thereby, understanding the mechanisms that lead people to buy more green products is essential. Studies on this topic have proposed that social influence is a crux factor, but general and quantitative analysis are strongly limited with questionnaire methods. Analyzing the last five years-geographically located retail data from one of the French hypermarket leaders (554 stores in France), we drew the temporal and spatial evolution of organic consumption. We firstly adapted the analytic and spatial models of innovation's diffusion to daily consumption products and tested the assumption of social imitation as a major determinant of the diffusion. Then we modelled spatial variability of the diffusion over French cultural regions, and assessed the impact of spatial factors like the urbanization rate and the state of local environment. To overcome saying-doing gap, we concluded by comparing our results to previous survey studies.

### **O11.2.1**

#### **Conservation Implications of the Socio-economic Exploitation of Invasive Non-native Species**

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Many invasive non-native species have established in habitats around the world. Although predominantly associated with detrimental impacts, some invasive species may also offer potential benefits to local communities that can complicate management efforts. For example, an invasive species may provide a source of food, fur, building materials or fuel. Here, we review available literature on the exploitation of invasive species and use case studies to explore the implications for conservation. Socio-economic exploitation occurs both in developing countries, where it takes place predominantly at a subsistence level, and in developed countries, where the focus tends to be on income or energy generation. In most cases where invasive species have been utilised, there are multiple conflicting interests involved. Utilising invasive species can be detrimental to conservation if the preservation of the invasive species becomes desirable to those involved. However, in some circumstances, exploitation of an invasive species may be beneficial for conservation efforts due to reduced impacts associated with harvesting or because the invasive species focuses destructive activities away from native species. The socio-economic exploitation of invasive species is a complex issue, but whilst there are risks associated with utilising established detrimental species, there may also be multiple benefits for conservation.

### **O11.2.2**

#### **Long Term Effectiveness of REDD+ Projects in the Brazilian Amazon: Opportunity Costs to Local Participants**

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In a recently implemented REDD+ programme (*Bolsa Floresta*) in the Brazilian Amazon, local communities receive undifferentiated financial rewards under a payment for ecosystem services (PES) scheme that inhibits agricultural conversion of primary forests. Yet manioc yields, the main component of subsistence livelihoods in this area, is positively correlated with age of regenerating secondary forest, which may affect per capita agricultural productivity given likely trends in population growth. A reduction in manioc production is therefore expected, since greater cropland demand under the *BF* deforestation avoidance scenario would result in either smaller agricultural plots or shorter rotation cycles. Based on interviews at 25 local communities along Juruá River, we assessed the relationship between secondary forest fallow age and agricultural yields, and used model projects in population growth to 2050 and 2100. Although most households had a positive perception and were generally supportive of the scheme, we predict an escalation in economic opportunity costs as village sizes or village proliferation increases. *Bolsa Floresta* is a groundbreaking large-scale PES initiative in tropical conservation, but a comprehensive assessment of long-term consequences to households suggests that this reward system can become more effective through adaptive changes that take into account the economic portfolio of local participants.

### **O11.2.3**

#### **Large Carnivore Conservation Challenge - Community Support on Illegal Killings of Large Carnivores**

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In Finland, the conservation of large mammalian carnivores, brown bear, lynx, wolf and wolverine, is undermined by illegal killings that have commonly taken place after the implementation of national carnivore management plans. This hidden form of criminality cannot occur in such extent without a strong support of local community. We examined the support and judgement of close-by groups by collecting data from hunters and women. In collecting data we used non-active role-playing with empathy based fictitious stories. A given story tells about illegal killing of 'a carnivore' and killers' neighbour finding it out. There were two versions, where the neighbour either reports or does not report the act to the authorities. We used argumentation analysis to reveal the assumed species, background of the poacher and especially the justifications of community support and judgment. Most often it was suggested that the killed animal is Wolf. Various justifications for and against illegal killings arised from the narratives. Current large carnivore management seems to lack tools for assessing the societal sustainability. In the policy development public hearing prosedures must be developed further and the grassroot level opinions must be visible in sustainable management. Conservation of large carnivores will not succeed without them.

#### **O11.2.4**

##### **Ghosts in the Landscape: Reintroductions and the Cultural Environment**

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Reintroductions are an increasingly popular tool in the conservation tool box. Since the 1970's Scotland has seen the return of such species as red kites (*Milvus milvus*), white tailed sea eagles (*Haliaeetus albicilla*) and most recently the European beaver (*Castor fiber*). Many of those species eligible for reintroduction under the Habitats Directive became extinct due to human persecution and so their return inevitably resurrects old conflicts, whilst creating new ones.

This paper examines the social, political and cultural discourses surrounding reintroductions and discusses how competing visions of land and nature lead to conflict. Using in-depth interviews with landowners, conservationists and those involved in natural resource management, this paper reveals how people's perceptions of reintroductions and their place in the Scottish landscape are constructed. Key themes identified include: Individual beliefs regarding local history - both environmental and social; past relationships with governments and other organisations and arguments surrounding the moral responsibility of humans to act as stewards of the land and what this entails.

The paper concludes by drawing on these observations to provide advice for future reintroductions on how to reduce such conflict, both human-wildlife and between opposing groups of stakeholders.

#### **O11.2.5**

##### **Connecting Tropical Forest Protected Areas via High Carbon Stock Corridors under REDD+**

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Protected areas have been the dominant strategy for tropical forest conservation, and have increased substantially in recent decades. Even so, deforestation outside PAs continues, further fragmenting and isolating critical tropical forest habitat. The Convention on Biological Diversity sets goals for integrating PAs into surrounding ecosystems by 2015 and recent ecological frameworks have highlighted the importance of ecological flows in maintaining biodiversity. At current funding levels and with increasing pressures on forests, however, conservation efforts are unlikely to prevent significant connectivity loss. The emergence of REDD+, a mechanism for reducing carbon emissions from deforestation, suggests an alignment of goals for forest carbon protection and habitat connectivity. In particular, developing countries preparing for REDD+ need to identify forests that offer multiple ecological benefits including maintenance of connectivity. Using a new, high resolution above-ground biomass data set of the pantropical region, we mapped corridors that preferentially traverse areas with high carbon stocks between existing PAs. We report on the methods used and results of this analysis, and discuss the network of high carbon habitat in the context of guidance for national and international policies that aim to maintain ecological connectivity and reduce carbon emissions from deforestation.

#### **O11.2.6**

##### **Conservation of Natural and Cultural Heritage in the Cévennes National Park (South of France): Traditional Log Hives and Black Bees**

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Cevennes region has been reknown for centuries as a "land of honey". Beekeeping in this region is characterized by a traditional beehive made out of hollow chestnut-trunks. Apiary using log-hives is an extremely old and rustic beekeeping practice which was originally exclusively populated by local black bees (*Apis mellifera mellifera*). This sub-species is currently threatened by the global decrement of bees and their genetic homogenization. In order to preserve its natural and cultural heritage, the Cevennes National Park launched an interdisciplinary study-combining ecological and social sciences-to record this traditional ecological knowledge related to beekeeping. The goal is a better understanding of apiaries and black bees distribution. The study is based on a systematic inventory of traditional log-hives and bees sampling. To understand the log-apiary distribution, variables related to cultural, ecological, micro-geographical and conservational status are documented for each apiary. Data obtained allowed us to draw a precise map of traditional apiaries in Cevennes; the sampling of bees indicates that the black bee persists as one of the dominant bee subspecies in the Cevennes log-hives. Collected information will be used by the National Park as a basis for the implementation of a conservation policy.

## CONSERVATION IN AGRICULTURAL LANDSCAPES

### O12.1.1

#### Predicting the Fate of French Bird Communities under Agriculture and Climate Change Scenarios

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The development of forward scenarios is a useful method of envisaging the environmental implications of potential changes in climate and land use, as a tool for policy development. Here, we estimated abundances of 34 bird species according to both climate and crops variables. Model outputs were used to predict relative abundances across French agricultural areas. Three scenarios of agricultural changes were created (current trends, biofuel development and agricultural extensification) and developed at different scales of policy making. We further considered two climatic scenarios (A1 and B1) from IPCC 3rd assessment scenarios. Changes in bird communities were assessed on the basis of the predicted changes in agricultural land use and climate niche, using different indicators: the farmland bird index (FBI), the community specialization index (CSI) and other indicators. We found that species responses to land use changes is first forced by bird thermal characteristics. Declining species or/and species with small ranges will be especially vulnerable to climate change and agriculture evolution. Moreover, we found that trends in the different indicators are contrasted pending on agricultural scenarios and scale of policy-making. These results provide a readily accessible visualization of the potential impacts of land use and climate change on bird communities.

### O12.1.2

#### Assigning Priority Areas for the Conservation of Meadow Birds in the Netherlands: The Last Chance to Stop the Decline?

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Despite the deployment of around 30 Million a year for the protection of meadow birds, the decline of most species goes on. Dutch governmental organisations are therefore considering to preserve meadow birds, in particular the Black-tailed Godwit, within core areas and prevent dilution of money to less suitable habitats. Here we explore the possible impact of core areas and how these can be implemented. For all meadow bird species national abundance were made with spatial statistical models. From these abundance maps we derived core areas. In almost all of these areas the trend appears to be negative. In order to counteract this negative trend we studied the characteristics, like water management and land use, of areas that have at least a stable meadow bird population. From these we derived the minimum characteristics to be implemented in core areas if we are going to stop the decline. Apart from the high-quality cores with proper drainage and management, attention is needed for the quality of the surrounding landscape. This urges for serious regional policy and a guided implementation of the core areas if we want them to succeed in halting the decline of meadow birds in The Netherlands.

### **O12.1.3**

#### **The Credit Point System: A Market Approach to Enhance Biodiversity on Farmland**

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Farmland intensification is one of the major threats to biodiversity in Central Europe. A promising strategy to halt biodiversity loss could be to provide economic incentives which guarantee an outlet for wildlife-friendly products. We developed a credit point system to assess "wildlife-friendliness" at farm scale. Farmers can choose and gain points from 32 habitat management measures, most of which account for quantity, quality and spatial distribution of ecological compensation areas. Additionally, points can be scored with specific arable and grassland measures. Farmers are free to decide which measures to implement.

We evaluated the credit point system on 96 farms (2009-2010). The scored points were positively correlated with species richness of birds, butterflies and plants, but not of grasshoppers.

A large farming organisation integrated the credit point system in their production guidelines. All its producers have to reach a defined score of points within a specified time period. As a consequence, most farmers have to (substantially) increase their ecological performance.

The products are labelled by a major retailer and are well received by consumers. Farmers benefit from bonus payments by the retailer and an improved public image. The credit point system clearly helps to improve the situation for farmland biodiversity.

### **O12.1.4**

#### **The Impact of Agri-environment Schemes on the Biodiversity of Ditches**

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Biodiversity data from ditches in intensively managed agricultural land are exceptionally scarce, however ditches have the potential to provide islands of biodiversity within relatively species poor landscapes. As such, environmentally sensitive management of ditches is promoted under UK agri-environment schemes. We determined the impacts of agri-environment schemes at the farm and individual ditch scale on plant and invertebrate communities of ditches. We surveyed the plant and aquatic invertebrate diversity of ditches (n= 175 and 49, respectively) in farmland in the Upper Thames area of the United Kingdom during 2010 and 2011. Land managers were interviewed about the management of surveyed ditches, and the farm in general. The inclusion of an individual ditch into an agri-environment scheme had little impact. Specific management actions, such as hedge management and dredging, affected terrestrial plant communities and aquatic invertebrates, respectively. These data indicate that encouraging beneficial management would increase the biodiversity value of this ubiquitous landscape feature.

### **O12.1.5**

#### **The Effect of Herbaceous Ground Covers on Bird Communities in Olive Groves of Southern Spain: Influence of Landscape Context**

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In the last decades agricultural intensification and landscape simplification have dramatically affected the Mediterranean region where olive groves is a dominant crop types. For instance, olive grove surface in Spain has increased in 300,000 ha from 1996 to 2008. Conventional olive farming involves intensive herbicide use to avoid water competition between crop and swards. However, to prevent erosion many farmers maintain swards within crops, which may benefit farmland biodiversity although this effect might depend on the heterogeneity of the surrounding landscape. We evaluated the effect of such herbaceous covers on bird abundance and species richness in 6 matched pairs of ground-cover and bare-ground olive groves in two contrasting landscapes (homogeneous vs. heterogeneous) over a 3-yr period. We predicted 1) that both factors, ground cover and landscape heterogeneity, would positively affect songbird communities, and 2) that this effect should be greater in more homogeneous environment. Ground cover had a positive effect on bird abundance and richness, including some sensitive species, but no effect of landscape heterogeneity was found. Our results highlight the role of agricultural practices in preserving farmland bird communities, while the role of landscape heterogeneity may not be as relevant in Mediterranean agro-ecosystems after a long intensive human management.

## **O12.1.6**

### **Improving the Effectiveness of Agri-environment Schemes with Spatial Prioritization Tools**

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Agricultural intensification is a major reason for biodiversity decline throughout Europe. The European Union spending on agri-environment schemes is immense (22.2 billion € allocated for 2007-2013), but evaluations of the effectiveness of the schemes have produced mixed results. Various subsidies are allocated at the farm level independently of any landscape context, subsidies given to other farms in the region, or of any measure of quality of biological values at the location. This suggests that the subsidies could be much more effective if targeted at locations with high biodiversity value, and if coordinated across the landscape to enhance ecological processes, such as dispersal. We show with an example of semi-natural grassland conservation in South-Western Finland how spatial conservation planning software could help in allocating management actions more effectively. We discuss potential mechanisms that could encourage farmer participation to these voluntary programs. Current EU policy is too inflexible to support e.g. differentiating payments on the basis of conservation value, but in order to adhere to its commitments toward halting the biodiversity loss, the EU will have to make dramatic changes in how biodiversity conservation is implemented across different sectors.

## **O12.1.7**

### **Old MacDonald Has a Meadow, EE-I-EE-I-O! Understanding stewards of Endangered Meadow and Grazed Forest Biotopes - A Case Study from Finland**

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Throughout Europe, agricultural intensification has resulted in massive decline of grasslands and other traditional rural biotopes (TRBs). Finland has lost over 99% of its semi-natural meadows and grazed woodlands in the past 100 years. Understanding the values and motivations that underpin management decisions by stewards (farmers) is essential to improving policy and extension for conservation. We used a survey method to identify farmers with TRBs (N=59) in Raasepori Municipality in SW Finland. 27 farmers who own or manage TRBs were interviewed. We looked at whether these stewards are a homogenous group, with similar values and motivations for TRB management, or if there are subgroups based on variables such as the role of TRB on the farm, farm:TRB area, etc. These variables were limited in explaining steward values and motivations. However, stewards with direct sales or services that bring visitors to the farm favoured "soft" values (landscape aesthetics, animal welfare, conservation) over the "hard" values (fodder production & agri-environmental schemes) identified by those without farm visitors. Stewards also identified the direct use ecosystem services of their TRBs. Although highly diverse, TRB stewards are a subgroup of farmers that share common values favouring open landscape, nature conservation and cultural heritage.

### O12.2.1

#### **Agri-environment Management for Corncrake *Crex crex*, Cirl Bunting *Emberiza cirlus* and Stone Curlew *Burhinus oedicanus* Deliver Higher Species Richness and Abundance across Other Taxonomic Groups**

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Agri-environment schemes (AES) deployed in the interests of single species have been criticised in terms of their use of limited resources, and whether habitat improvements aimed at a target species can provide general benefits to biodiversity in the agricultural landscape. We studied AES that have been successfully targeted at three bird species (corncrake, cirl bunting and stone curlew) in the UK to test whether such management is associated with higher diversity or abundance of other taxonomic groups relative to similar land outside AES management. Paired AES-control fields were surveyed for a range of other biodiversity, including vascular plants, foliar invertebrates, carabid beetles, butterflies, bumblebees, bats and non-target birds. There were positive effects of AES for most groups studied on one or more measure, in terms of abundance, frequency of occurrence and/or species richness, and few negative effects. Although most positive effects were for common species, benefits were also found for some rare and/or habitat-specialist species. These benefits resulted from the reduction in farmland management intensity associated with AES. While bird-targeted AES should not be considered a means to reverse the decline of other rare species, they do lead to a general improvement of the farmed landscape.

### O12.2.2

#### **Impacts of Post-Soviet Land-use Change on Steppe Biodiversity**

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The dissolution of the Soviet Union in 1991 triggered massive changes in agriculture across the Eurasian (Pontian) steppes. Over 15 million ha cereal cultivation were abandoned, livestock numbers declined dramatically and grazing patterns changed. The impacts of these processes on the biodiversity of this vast region, which contains over 10% of the world's remaining grasslands, are poorly understood.

We assessed which factors affect the restoration of abandoned farmland to steppe using vegetation-ecological methods, and modelled steppe bird abundance and habitat use along land-use gradients.

Plant species richness and diversity were higher on grazed compared to ungrazed abandoned land, where biomass accumulation led to frequent fires and slowed immigration of steppe species.

Long-abandoned arable fields and pristine steppe were the most important habitats for birds, suggesting that many (often biome-restricted) species have enjoyed a period of significant population growth due to abandonment during the 1990s. Livestock concentration effects, leading to high grazing pressure in small areas, are also likely to have benefitted several bird species of high conservation concern.

However, analysis of land-use statistics and socioeconomic surveys among land managers suggest an increasing reclamation of abandoned areas and agricultural intensification, which may lead to new loss of steppe biodiversity.

### O12.2.3

#### **Identifying the Drivers of Vegetation Change on the Machair of Scotland**

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Machair is a globally rare habitat of high conservation and national heritage importance and it is restricted to the Atlantic fringe of Scotland and Ireland. It is a cultural landscape formed by the interaction of climate, soils and traditional low intensity agricultural. Combining data from an extensive survey of Machair sites from 1975-76, a resurvey of a sample of these points in 2009-10 and interviews with local land managers we identified a range of potential drivers of vegetation change. Analysis showed that diversity losses and gains were not consistent across the resource, and in particular differed between islands and between areas farmed or crofted (part-time, tenant small holders). In particular, declines in diversity of key indicators of habitat quality were evident where rotational cultivation had declined or had been abandoned as a land use practice.

#### **O12.2.4**

##### **The Role of Intra and Interspecific Relationships in the Conservation of Farmland Bird Assemblages**

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The knowledge of factors affecting the abundance and distribution of individuals, and thus their habitat selection, are useful to adjust appropriate conservation measures for species and communities. We evaluated the influence of both conspecific and heterospecific interactions, and landscape features on habitat selection by two sympatric species, the Calandra Lark and the Corn Bunting, during the breeding season. Both species were censused in three localities in Central Spain using transects. We used a model-averaging approach to determine the weight and effect of landscape and interaction variables, and a deviance partitioning to determine the relative contributions of these two sets of predictors. Calandra Lark showed a preference for relatively simplified landscapes with low density of field margins and, consequently, small land-use diversity. Corn Bunting selected highly heterogeneous landscape with high density of field margins. Attraction between conspecifics was found in both cases. However, the effect of proximity of heterospecifics differed between species, reflecting diverse tolerances and resources division. Deviance partitioning showed that interactions were more important for Calandra Lark, while Corn Bunting was equally affected by both components. Conservation measures should combine the requirements of different species to achieve effective conservation at the bird assemblage level.

#### **O12.2.5**

##### **Temporal Connectivity in Fragmented Landscapes**

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Seed banks of remnant habitats, should these conserve substantial amounts of grassland species, are a valuable asset in conserving species diversity of grassland species in fragmented landscapes. Temporal dispersal may relieve spatial isolation of remnant habitats when the seed bank reservoir replaces the loss of spatial dispersal. Using historical maps and aerial photography, we studied the historical trajectories of remnant grassland patches as a proxy for historical habitat fragmentation. These trajectories were linked to 134 seed bank and vegetation records to understand how seed banks temporally connect remnant grassland patches, conserving the flora of their ancestral semi-natural grasslands.

We uncovered seed banking grassland species in all remnant habitats. The remnant habitats' seed banks displayed a significant compositional shift, triggered by the increase of ruderal seed banking species with time since fragmentation. Nonetheless, a consistent proportion of grassland species and specialists remained present. The temporally nested structure in the seed bank suggested a deterministic loss of species, generating subsets of the seed banking community of large semi-natural grasslands.

With proper management, the seed bank legacy will partly fuel restoration of grassland diversity in fragmented landscapes. The key determinant of restoration success will be remnant habitat age, i.e. time since fragmentation.

#### **O12.2.6**

##### **The Importance of Incorporating Both Species and Functional Diversity Metrics to Fully Understand the Impacts of Land Use Change Upon Plant Communities**

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The impacts of land use change upon biodiversity are commonly investigated using species diversity metrics. While important in the determination of species gains or losses, species diversity metrics can be of limited relevance in detecting the functional, evolutionary or ecological consequences of land use change in plant communities. We compare species and functional (trait based) diversity metrics in real landscapes among organic and conventional farms and along a landscape complexity gradient to ascertain the importance of species identity and functional composition in plant community response to land use change. Plant species richness did not differ in organic and conventional farms but was positively associated with increasing landscape complexity. Differences in functional community composition however, resulted in greater average seed size and specific leaf area on conventional than organic farms. These plant traits were unaffected by land use complexity. Our study highlights the importance of investigating the composition of communities using both species and functional diversity metrics in order to more accurately assess the impacts of land use change on plant distribution patterns.

## O12.2.7

### Little Owl Juvenile Survival in Agricultural Landscapes: The Role of Food Availability

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Little owl (*Athene noctua*) populations declined throughout Central and North Western Europe over the last decades. Many of them remain vulnerable despite rigorous conservation efforts. Until now conservation measures mainly focused on providing artificial nest boxes to compensate the lack of natural cavities. Although it is known that annual variation in prey availability results in differential breeding success, it remains unclear whether juvenile survival rates in agricultural landscapes are also food limited. Using food supplementation, we experimentally manipulated the food supply during the nestling period and investigated the effects on survival of juvenile little owls from hatching to the onset of dispersal. During two breeding seasons, the survival of 176 fledglings (102 fed and 74 unfed) was determined using radio-telemetry. Survival rates were substantially higher for little owls raised in food supplemented broods. These results suggest that food availability during the nestling period affects post-fledging survival of little owls. Thus, measures to improve food resources in little owl habitats may considerably increase post-fledging survival and thus, recruitment and expansion of populations.

## O12.2.8

### Turtle Doves, Trial Plots and Trichomonas: Conservation of the UK's Only Migratory Dove

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UK Turtle Dove populations have declined by 91% since 1970, paralleled by a 69% decline across Europe since 1980 (PECBMS). The number of breeding attempts has halved since 1960, sufficient to explain the population decline, and a dietary switch from arable plant seeds to cereal grains over the same time period suggests food limitation may be responsible. Here we describe early results from a trial of arable seed plots sown on farms across East Anglia. The trial seed plots showed a combination of high provision of seeds important in Turtle Dove diet, and good accessibility (low vegetation cover and density combined with a high % bare ground) compared to currently available agri-environment (AE) options, suggesting that early, accessible, seed provision is a current gap in AE management. We also discuss results of disease screening, showing a very high proportion (~100%) of Turtle Doves to be carrying the parasite *Trichomonas gallinae*. We emphasise the importance of reducing the reliance of Turtle Doves on anthropogenic food sources to reduce disease transmission.

### O14.1.1

#### Measuring the Effect of Whalewatching Boats on Minke Whale Behavioural Budget Using a Multivariate Hidden Markov Model

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Human disturbances of wildlife, such as tourism, can alter the activities of targeted individuals. Repeated behavioural disruptions can have long-term consequences on individual's vital rates. To manage these sub-lethal impacts, we need to understand how activity disruptions can influence variation in individual's vital rates. This study informs the mechanistic links between whalewatching boat exposure and behavioural variation and vital rates for Mysticetes. We compared Minke whale *Balaenoptera acutorostrata* behaviour on a feeding ground in the presence and absence of whalewatching boats in Iceland, using individual focal follows. Activity states were inferred from movement metric data and multi-state models were used to estimate the relative proportion of different activity states. Spatially explicit mark-recapture models were used to estimate the seasonal exposure rate of individual whales to whalewatching activities. Whalewatching interactions disrupted the foraging behaviour of Minke whales, causing a decrease in proportion of time whales spent foraging. The cumulative exposure was sufficiently large to cause changes in the animal's seasonal behavioural budget. Minke whales are capital breeders, so a decrease in foraging success on feeding grounds due to whalewatching could lead to a decrease in energy available for lactation on breeding grounds, which could have negative effects on calf survival.

### O14.1.2

#### A Long-term Experimental Assessment of Grazing and Prescribed Burning on Plant Species and Vegetation Communities of Blanket Bog

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Blanket bog communities in the UK are a very important conservation resource; many are degraded as a result of past management and atmospheric pollution. Many are often managed using prescribed burning on rotation for sheep and grouse management, although our voluntary code of practice contains a presumption against burning this ecosystem type. Nevertheless, there is very little evidence on which to base such policy decisions. Here, the results of an experiment set up in the mid 1950s are presented. We test the effects of two sheep grazing treatments (grazing *versus* no grazing) in interaction with three burning rotations (every 10 years, every 20 years and recovery after burning in the 1950s) using mixed-effects models and multivariate analysis. We show that there is some divergence as a result of burning rotations with the no-burn since the 1950s trending to more *Calluna* dominance and the 10 and 20- year rotations trending to more *Eriophorum* dominance. The difficulties in analysing data from long-term experiments will also be highlighted.

### O14.1.3

#### Modelling Carbon Budgets in Moorland: Prescribed Burning Versus Wildfire

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Blanket bog communities in the UK have a high conservation value in terms of plant communities, and because they sequester large amounts of carbon providing a valuable ecosystem service. Many such ecosystems are managed using prescribed burning, which releases carbon into the atmosphere. However, these ecosystems can be subject to highly damaging wildfire. Therefore, it is useful to assess the relative amounts of carbon released under different burning rotations and in wildfires. We present a Markov chain model that predicts the stable age structure of *Calluna vulgaris* vegetation under a range of prescribed burning rotations, we then calculate overall biomass using growth equations derived from field-survey data and mass of released carbon using a bootstrapping approach. When prescribed burns are considered over a 50 year period followed by a wildfire, released carbon does not change markedly between 5 and 15 year rotations (30-31 t C ha<sup>-1</sup>) but then jumps sharply to 33t C ha<sup>-1</sup> on a 25 year rotation and 36t C ha<sup>-1</sup> at 50 years. Thus, burning rotations of 25 years could produce a potential carbon loss from above ground vegetation of 38% more in a 50 year period than a 15 year rotation when subject to wildfire.

### O14.1.4

#### Human Disturbances on Wintering Chamois - The Effect Is Surprisingly Small

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Wild ungulates facing Alpine winter have a remarkable ability in adapting physiological functions and behaviour to minimize energy expenditure. They lower heart rate, a close correlate of metabolism, to 50- 60% of summer frequency and tolerate lower body temperatures. Body temperature drops to particularly low levels during late winter nights. Human disturbances are blamed for increasing energy consumption of wild ruminants in winter and having an influence on winter survival. We equipped 14 wild chamois (*Rupicapra r.r.*) with a telemetry system recording activity, body temperature, heart rate and GPS-positions over a period of 3- 18 months in the northern Alps of Austria. During the body temperature nadir in the morning either a skier or a hiker approached and chased the collared chamois away. The animals returned to the primary location within a few hours. Body temperature and heart rate of the resting animal increased for a period of 2-4 hours. The additional energy expenditure of one single disturbance seems to be negligible in comparison to variation in winter length. We conclude that single, short-term disturbances have no relevant effect on energy consumption in respect to survival of wintering Alpine chamois.

### O14.1.5

#### Can We Use Himalayan Pheasant (*Phasianidae*) in Habitat Quality Monitoring in the Temperate Forest of Western Himalaya?

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Pheasants (Family *Phasianidae*, Order *Galliformes*) are large body size, long tail, ground dwelling birds. They are most charismatic and conspicuous faunal species that found in Himalaya. They are regarded as the most distinctive bird family of the Himalaya due to their high endemism and brightly coloured plumage. They are considered shy and sensitive to anthropogenic disturbance. We attempted to monitor their populations in three different habitats (primary forest, moderately disturbed forest and disturbed forest) to evaluate their response to varying level of human disturbance. We conducted this study in temperate forest of Jiwa Valley, Himachal Pradesh, from 2009-11. We used 'Call count' and 'Line transect method' to estimate their abundances. Cheer pheasant (*Catreus wallichii*), Himalayan Monal (*Lophophorus impejanus*), Western Tragopan (*Tragopan melanocephalus*) and Koklass Pheasant (*Pucrasia macrolopha*) responded negatively to anthropogenic disturbances and avoided disturbed habitats. Therefore, we suggest the use of Himalayan Pheasants in habitat quality monitoring in Western Himalaya.

## O14.1.6

### Building Evidences for Wilderness Restoration and Re-wilding Initiatives

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Wilderness restoration is a conservation strategy where interventions are minimised so natural disturbances dominate ecosystem dynamics. In many cases, our understanding of the future effect of restored processes like grazing is limited in Europe, because too few areas exist where they naturally occur. In order to establish the potential contribution of wilderness and re-wilding initiatives to reduce biodiversity loss, additional examples thus appear necessary. With this aim in view, we have been developing a novel methodology in palaeoecology allowing us to reconstruct past densities of large herbivores. The abundance of dung fungal spores in modern samples were calibrated to known population sizes of large grazers and browsers in the nature reserve of the Oostvaardersplassen, The Netherlands, and the New Forest National Park, UK. We find that the concentration of those spores allows the identification of past level of grazing pressure leading to the maintenance or disappearance of open habitat. For instance, projects like those initiated by the foundation Rewilding Europe would benefit such knowledge in order to fully appreciate the impact of rewilding on ecosystems, and thus better inform the various stakeholders partaking. Our novel methodology is an important tool to establish evidence-based policies with regard to wilderness restoration.

## O14.1.7

### Effects of Light Pollution on Daily Activity Patterns of European Blackbirds (*Turdus merula*)

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We live in the urban millennium, the age of cities and urbanization. Animals which attempt to settle in such man-made ecosystems must cope with novel environmental conditions. One of the most apparent environmental factors in cities is artificial light at night. The goal of our research was to investigate how urban sprawl has change the temporal life of European blackbirds, and to correlate this change with light pollution. We quantified daily activity patterns of blackbirds along an urban/rural gradient in Munich, Germany, with the use of an automated telemetry system. Simultaneously we tagged the same individuals with micro light loggers to measure light irradiance to which the birds were exposed to. Diurnal and nocturnal noise levels were also recorded in the territory of each individual. We found that urban birds started their activity consistently earlier than forest individuals, and also extended their activity later in the evening. Light at night exposure explained most of this difference, while noise and weather conditions had a minor effect. However, noise levels at night were significantly correlated with amount of nocturnal activity. We believe that our contribution will boost new interest in asking fundamental questions about the fitness consequences of light pollution.

## PLANNING, MANAGEMENT...

### O17.1.1

#### **Using Species Distribution Models to Allocate Active Conservation Measures: A Case Study of Red-footed Falcon Breeding Site Management in the Carpathian Basin**

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The Red-footed Falcon is an enigmatic colonial raptor of high international conservation concern. One of the identified threatening factors responsible is the shortage of suitable colonial nesting sites, however this problem can easily be resolved in theory with establishing artificial colonies. A recent international project aimed to establish such nesting facilities in Northern Serbia; though, the lack of full scale habitat surveys hindered the designation of the locations of these artificial nesting sites. We used five Species Distribution Models from the Machine Learning group to model the distribution of nest-sites on a 10x10 km grid in Hungary, and in Romania. We then used the ensemble predictions of the best performing models to project the probability of Red-footed Falcon nest-site presence in Northern Serbia. The models showed that three variables (grasslands, pastures and broad-leaved forests) had the highest importance in describing the spatial pattern of nest-sites in the modeling area. Predictions classified all the currently known colonies in the predicted area correctly. We reduced the extent of target areas to 11.5% allowing to pin-point locations for these future nest-box colonies, and also provided a fundament for future conservation measures like allocating monitoring efforts and designating future Natura 2000 sites.

### O17.1.2

#### **Nature Conservation beyond the Boundaries: The Case of French Nature Reserve System**

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During the last four decades, nature conservation has been characterized by major evolutions. If the past protected areas (PAs) were often perceived as exclusion areas, more and more modern PAs try to move away from this old-fashioned cliché. PAs managers favour more integrated conservation projects: they take into account interactions between in-situ and ex-situ territories, and investigate spheres of economical and social development. Here, we focus on French Nature Reserves, one of the main regulatory tools of France's policy to nature protection. On an analysis of 10 case studies, we illustrate how Nature Reserves are able to legitimize ex-situ actions. Through different strategies and institutional changes, Nature Reserves managers have proposed responses to extend their influence area into a larger and integrated conservation project. The analyse details the main functions assumed by managers in-situ and ex-situ, and describes the institutional arrangements that support or constraint their actions beyond the spatial and functional boundaries of the Nature Reserve. Three issues are predominant in explaining this in-situ from ex-situ transition: (i) local settings, (ii) supporting institutional arrangements, and (iii) flexibility of national law. As a conclusion, we propose a typology of Nature Reserves trajectories.

### **O17.1.3**

#### **Protected Areas in Selected Arab Countries of the Levant Region (Syria, Lebanon & Jordan): An Evaluation of Management and Recommendations for Improvement**

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One of the main approaches to halting biodiversity loss is the establishment of protected areas (PAs). Despite a prolific growth in terms of both number and spatial extent of PAs worldwide, biodiversity loss continues even within some of these areas. One factor being investigated to account for this is the effectiveness level of PAs management. Here, based on the IUCN-WCPA Framework and 33 effectiveness indicators developed by Leverington et al. (2010), we evaluate the current management of 18 established PAs and/or Biosphere Reserves in Lebanon, Jordan, and Syria. Overall, the management effectiveness scores across the PAs ranged from 3.58-9.18 (mean=7.01±1.54). Jordan consistently showed management effectiveness scores in the *sound* management range, while Syrian scores were concentrated in the *basic* range, and Lebanon showed the greatest variability encompassing all performance ranges. Effectiveness is influenced by both year of establishment and previous experience with management effectiveness monitoring. The most effective aspect of management is *planning*, consistent with global survey results, whilst *input* indicators scored relatively weakly. We offer recommendations for management improvement based on the unique PA management systems within the region, and socio-political contexts of each country.

### **O17.1.4**

#### **Assessment of Planning for the Conservation Australia's Threatened Birds**

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Over the last two centuries 11 endemic species and 16 subspecies of Australian birds have become extinct. In the last ten years 5.5% of Australia's extant bird species have been uplisted, i.e. gone to a category of increased risk of extinction, and 1.4% have been downlisted despite substantial amounts having been spent on attempting to keep them from becoming extinct. Currently 17% of species require conservation action. In this study I investigated the planning approaches used for conserving Australia's threatened birds to determine which approaches enhance conservation. This was done by undertaking content analysis of legislation, policies and plans at a broad level as well as zooming in on case studies. For the latter, semi-structured interviews were undertaken with key players, and analysed. Findings include: Planning processes of different jurisdictions vary in quality with some progressive approaches; Reviews are slow in coming and if they are done, there are greater lags in recommendations being implemented; Individuals, as champions, play an important role; Among the players there are diverse perspectives highlighting the influence of social elements of conservation planning and the need to focus on organisational and leadership skills to improve decision-making.

### **O17.1.5**

#### **Use of Changing Commercial Forestry Habitats by the Threatened Black Grouse *Tetrao tetrix* in Scotland**

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Commercial forestry makes up most forests in Scotland. Current policy means this habitat will undergo a large cyclical change and expansion in coming decades. Black grouse *Tetrao tetrix* is a threatened species inhabiting Scottish moorland-forest ecotones. The future conservation of the species may be closely linked to how forestry management is adapted. We investigated how lek occupation in the landscape had changed with forestry between 1992 and 2010 in a highland region, and used radio-telemetry data over three years to examine individual-scale selection of forestry habitats and movements across moorland-forestry boundaries. Forestry maturation between 1992 and 2010 excluded leks from large areas and increased reliance on moorland habitats. But leks with more forestry in their vicinity were generally larger, suggesting a population-level benefit. This may arise from benefits to females, who both showed a higher degree of selection for forestry in autumn-winter, particularly areas left unplanted around stands, and a greater degree of movement into forestry from moorland. Birds also showed a high degree of selection for larch within forestry, particularly prior to the breeding season. Adaptation of forestry planting regimes both at a landscape scale and locally along moorland edges could potentially benefit Scottish black grouse populations.

### **O17.1.6**

#### **Conservation and the Sustainable Harvest of Marine Species: Can We Eat our Stocks and Preserve Them?**

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Seafood is a source of high quality protein which much of the world's population is reliant on for nutrition, but with an ever increasing desire to protect and preserve marine ecosystems are we really able to eat our stocks and preserve them? Here we present the results of a pre-assessment of the East Coast Brown Shrimp Fishery, which demonstrates how an integrative approach to marine management can work to best effect. The pre-assessment tested the sustainability of the fishery against the Marine Stewardship Council (MSC) environmental standard, highlighting a number of impediments preventing the fishery from being certified under this scheme in its current mode of practice. This resulted in several recommendations to reduce the fishery's impact on the ecosystem, improve sustainability of the stock and associated by-catch species, as well as highlighting ways in which to develop an effective management plan to ensure environmental impacts are monitored effectively. This pre-assessment has not only served to improve the sustainability of this fishery but has also opened a dialogue between conservation authorities, fishermen, environmental consultants and government advisors which has already led to an improved cross-sectoral understanding and looks set to lead this fishery towards an environmentally sustainable future.

## O17.1.7

### Development of a Regional Risk Framework for *Phytophthora sp.* Pathogen Spread and Infection in Scottish Heathlands

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Understanding how the spatial coincidence of hosts and pathogens affects disease infection and spread in natural habitats is an important conservation concern. In the UK, exotic *Phytophthora sp.* are a class of highly destructive fungus-like pathogens responsible for considerable damage to woodland and heathland species, and for 'Sudden Oak death' in the USA. Whilst this disease has primarily affected heathlands in England, there is considerable concern as to the potential infection and spread of these pathogens in Scottish heathlands, which play a key role in maintaining UK biodiversity and encompass major land use considerations. We identify areas of Scottish heathland of significant conservation importance at risk from infection and spread by *Phytophthora kernoviae* and *P. ramorum*. A risk framework is developed that overlays predictive layers for *Phytophthora sp.* climatic suitability, heathland host species abundance, potential channels of spread, and the presence of plant nursery and trade premises with and without confirmed *Phytophthora* infection. We develop a novel statistical method for parameterising species distribution models with widely collected class interval data, dealing with diverse data sources from multiple spatial scales. In summary, we provide a robust methodology for prioritising preventative and remedial action for management of this important conservation issue.

## ECOSYSTEM SERVICES

### O18.1.1

#### Beyond Win-Win: Interrogating Ecosystem Service Dynamics

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Ecosystem service-based conservation is often applied under the assumption that it delivers win-win outcomes. However, although the ecosystem services framework offers the potential for developing approaches that simultaneously provide ecological stability and livelihood security, there are often trade-offs associated with the pursuit of multiple objectives, by multiple stakeholders, across multiple spatial and temporal scales. Using methodology from the Centre for Evidence-Based Conservation, we carried out a systematic review of the literature on where ecosystem service interventions had the potential to, or had resulted in, synergies and trade-offs. Of 699 potentially relevant articles highlighted using our search terms, 254 were selected for the review. We find there is a wealth of research literature on tradeoffs in ecosystem-based conservation, and that the literature covers a diverse number of research fields, geographical areas and ecosystem services. However, there is little evidence that this is facilitating an informed dialogue, or even closer collaboration between specialist disciplines. We also demonstrate that despite the diversity of research fields, trade-offs tend to fall into three main categories: trade-offs between services, users and natural capital versus other forms of capital. We discuss these different trade-off types with reference to the economic and policy implications that they have.

## O18.1.2

### Between the Ecosystem Services and Biodiversity Conservation: A Case of the Białowieża Forest

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The Białowieża Forest (BF) is considered the only remaining large patch of a near-natural lowland temperate forest in Europe. During last two decades there is an ongoing conflict in the Polish part of the BF between those promoting an enlargement of the national park that presently covers just a small part of the BF and those who want to keep the status quo with most of the forest managed by the State Forest organization. In this study we conducted a questionnaire survey among the local people to investigate their use of ecosystem services and their perceptions of how the national park enlargement would influence them. The results clearly show that the BF is essential for the local people's overall economy. The respondents are to a large extent dependent on the local resources, and believe that the enlargement of the national park would negatively influence the use of the services they are dependent upon due to both restricted timber supply and limited access to the BF. The perceptions of local people of the use of forest-related ecosystem services seem to underlie the persistent conflict and any scheme aiming to solve it needs to take these issues into account.

## O18.1.3

### Effects of Woody Elements on Wild Bee Population in *Brassica napus* Fields

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Pollinators play an important functional role in ecosystems and they are declining rapidly in some developed countries. This decline is mostly related to the loss of semi-natural habitats, including forests, which provide both floral resources and nesting places for bees. Several studies show that the pollination service are greater in crops adjoining forest patches or other semi-natural habitats than in crops completely surrounded by crops. In France in 2010 and 2011, we used coloured pan traps to measure (i) the effects of forest edges on bees at different distances into *Brassica napus* fields (0m, 10m, 50m, 200m) and (ii) the contribution of different edge types (forest, fallow, cereal field) to bee assemblages in the crop. Indeed, even if 70% of rapeseed seeds are produced by self-pollination, native bees are known to contribute to the pollination by improving yields and reducing the blooming period. We demonstrated significant effects of edge type and distance from forest on bee assemblages and abundances in crops, with contrasting effects depending upon bee size, sociality and sex. Here we highlight the importance of habitat diversity at a small spatial scale to maintain native bee populations and the pollination service in crop fields.

#### **O18.1.4**

##### **Pollination Services in Mediterranean Agro-natural Ecosystems: The Contribution of Wild Bees to Pollination of Almond, Sunflower and Watermelon in Central Israel**

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In Modern agriculture, most pollination is done by honeybees, despite the significant potential of wild bees. Reliance on honeybee pollination is problematic due to recent declines, and because of potential harm to surrounding ecosystems. We conducted a two-year survey in central Israel, that included active and passive bee collecting and flower observations, to measure visit frequencies and identify main species of wild bees visiting almond, sunflower and watermelon. We used single-visit fruit set experiments to quantify pollination efficiencies of key visitors and their overall contribution to pollination in comparison with honeybees. Our findings show that honeybees are the main visitor and pollinator of all crops examined. Wild bees contributed 0.7, 7, and 15% of bee visits in almond, sunflower and watermelon, respectively. *Lasioglossum malachurum* and *L. politum* were the two main wild bee visitors of sunflower and watermelon. In single-visit experiments, both species successfully pollinated watermelon, but not sunflower. Overall, wild bees' contribution to pollination was negligible in almond and sunflower, and around 5-15% of the total bee contribution in watermelon. Our results show that the potential for pollination services in diversity-rich areas is not easy to predict; more studies are needed to evaluate such services in different ecosystems.

#### **O18.1.5**

##### **Functional Profiles of Vegetation of Environmental Fallows in Finland for Pollination and Weed Infestation**

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It is established that effects of biodiversity on ecosystem processes and associated services are attributed to functional rather than taxonomic diversity. The presentation introduces a method for calculating functional profiles of semi-natural vegetation as a foraging resource for pollinators (ecosystem service) and source of weeds (dis-service). Indices reflecting the frequency and abundance of vascular plants important for diurnal butterflies and wild bees have been developed based on pollinators' usage of plants, their foraging niche breadth, and population status. These and an index of agrotolerance (reflecting weed status) have been applied to data on environmental fallows. None of the indices correlated significantly with the total species richness, but indices for two pollinator groups correlated at 30%. Similar to the taxonomic richness, the pollination indices were lowest for the game fallows and highest for meadows. Unlike species diversity, all indices related positively to high and dense vegetation structure, and the butterfly index also negatively related with the age of the fallows. Use of indices therefore reflected fallow characteristics different from those based on taxonomic diversity. The example also demonstrates that the current fallowing scheme requires development to optimise sward establishment and management for the best environmental output with the least agronomic problems.

#### **O18.1.6**

##### **Perspectives on Ecosystem Services in the Forest Biodiversity Hotspot - A Spatial Approach**

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The Białowieża Forest (BF) is an important forest biodiversity hotspots representing Middle European broad-leaved forest type, an ecosystem having at present only about 0.2% of its original area in relatively undisturbed condition. We examined how the spatial proximity to BF affects the perceived use of ecosystem services (ES) by local communities in the Polish part of BF. We performed a survey among 719 respondents from villages situated within BF defined by the border of Natura 2000 (Zone 1; 7 villages; 172 respondents); up to 3 km from BF (2;15;224) and within a belt located >3 to 15 km from BF (3;13;323). We found that declared use ES was generally declining along the above gradient with particularly high difference between zone 3 and other two zones. Both the perceived influence of ES on household's economy and the average amount of different ES used decreased with this gradient from zone 1 to 3. However, the share of intangible cultural ES was quite similar across the zones. Additionally, we found the apparent difficulties in perceiving indirect benefits from BF among local population. We argue that mapping perceptions concerning ES may be of great help in preparing management strategies for areas important for biodiversity.

### **O18.1.7**

#### **Social-Ecological Systems and Ecosystem Services of an Urban Salt Marsh: Cultural Ecosystem Goods and Services Are Influenced by Conservation Management**

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Social-ecological systems provide a bridging conceptual framework between social and natural sciences. In such systems, ecosystem services are changed by dynamic interactions between components of the social-ecological system. As the ecosystem service concept evolves within environmental planning, a clarion call has been made to integrate ecological planning and ecosystem services. Our study examines changes in cultural ecosystem services provided by a previously unmanaged urban salt marsh on the Upper Mersey Estuary, Cheshire, United Kingdom, following the introduction of cattle grazing.

A complex social-ecological system encompassing governance, ecological processes, and urban actors has been identified. In the summer of 2011, feedback between the ecological processes and urban actor components was quantified using unobtrusive visitor surveys. During these surveys, informal interviews recorded visitors' perceptions. Results show travel direction related to nearby urban centres and visitors' activity influenced visitors' behaviour. Interviews revealed the conservation managed area creates cultural ecosystem goods and services. This research demonstrates the practical implementation of integrating ecosystem services with open green spaces' conservation. Results show practical conservation creates a positive interpretative experience of nature. As urban centres expand in conjunction with a growing global population, recognition of the value of these nearby natural surroundings should not be overlooked.

### **O18.1.8**

#### **The Function of the Urban Tree Infrastructure; Cultural or Regulating Systems?**

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Urbanised environments only contain a small fraction of the total area of productive ecosystem required to support the 'urbanite' population. In particular, how is the urban tree infrastructure functioning? Do tree infrastructures prevent urban systems from becoming halo-parasitic, keeping them hemi-parasitic, or are trees maintained as social and cultural service providers, therefore existing as cultural ecosystems rather than supporting and regulating ones?

To address these questions, a study has assessed the structural diversity and connectivity of the urban tree infrastructure of the City of Salford, Greater Manchester, using GIS software, LIDAR data, and field walking. Structural traits were defined.

Different economic and land use areas were found to support different degrees of structural diversity, supporting different levels of biodiversity, and providing varying levels of ecosystem services.

The study examined spatial variation in the urban tree infrastructure within Salford. The findings open a dialogue around the definition of ecosystems in urban areas. How should urban areas be viewed: as a system that reduces the cities eco-paratism (by providing services that reduce the need of importing 'carrying capacity' from the countryside), or as a cultural, socio-ecological system, where structural diversity dissipates due to social concerns and to create cultural services?

## FROM VALUES...

### O19.1.1

#### **From Attitudes to Action: How Understanding Public Values Can Increase the Success of Threatened Bird Conservation**

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Since European settlement 234 Australian bird taxa have become extinct, are threatened with extinction or are near threatened. Habitat loss due to human development is the major cause and addressing this conservation challenge is as much a social matter as it is ecological. Yet government funding in Australia remains inadequate and the role of conservation is ever more dependent on participation by the broader community. Community attitudes and behaviours are driven by a wide range of values eg: aesthetic, utilitarian, scientific and anthropomorphic. Using socio-psychological techniques based on Kellert, Campbell and Smith my research aims to understand which of the values held by Australian society for threatened birds drive conservation action. In 2011 I surveyed 3,000 members of the Australian public about their attitudes towards birds. Results will demonstrate a range of values that support threatened bird conservation including a willingness to pay; however, participation in conservation activities is low. By better understanding public values we can develop more targeted communication strategies and more relevant opportunities for participation in threatened bird conservation projects. The results and conclusions of this research will be of interest to policy makers and conservation managers from countries facing similar ecological, economic and social challenges.

### O19.1.2

#### **Tell Me a Story about the Birds and the Bees: Using Computer-generated Personalised Feedback to Foster Public Engagement in Nature Conservation Projects**

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Conservation programmes are increasingly reliant on volunteers, who, collectively, have come to represent an unpaid workforce of considerable size and importance. Particularly for large, long-term schemes with more complex tasks, it is important to keep volunteers well informed to retain them. We present three case studies investigating the importance of personalised feedback to volunteers and the use of state-of-the-art computing science tools, notably Natural Language Generation (NLG) and Crowd Sourcing, therein. Focal projects dealt with distinctive conservation topics, namely invasive species control, reintroduction and biodiversity recording. The use of NLG allowed automated generation of informative and contextualized feedback in which species 'came to life'. For example, data from satellite-tagged reintroduced birds were turned into affective texts that would automatically update and tell new stories with new observations coming in. Moreover, NLG-generated feedback could be developed to train volunteers in identifying species, which, when combined with Crowd Sourcing, allowed us to obtain valuable species distributional data. Collectively, our studies point at the considerable long-term use of employing computing science tools such as NLG and Crowd Sourcing to motivate, train, and retain volunteers. A future challenge is to develop a sufficiently general NLG-based feedback system that can be employed across conservation initiatives.

## FROM VALUES AND ATTITUDES TO POLICY

### O19.1.3

#### **Ponds with Life: A Portuguese Environmental Awareness Campaign on Ponds Ecology and Conservation**

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Ponds with Life is a Portuguese national pond conservation and environmental education campaign that aims the conservation of these critical habitats for biodiversity and to raise public awareness on ponds' importance. The campaign provides ample information through its website [www.charcoscomvida.org](http://www.charcoscomvida.org) regarding ponds importance, ecological services and biodiversity, pond construction and management and a vast set of pedagogical activities for pond exploration. Registered entities are invited to perform pond surveys, adopt a pond for pedagogical exploration and conservation or create new ponds. All ponds surveyed are mapped in the National Pond Survey available online. One year since the campaign started, the 100 registered entities have inventoried and mapped 850 ponds, adopted 25 and created at least 15 new ponds. From an educational standpoint, ponds revealed to be excellent models for environmental education as they allow a variety of outdoor exploration activities and a close contact with numerous life forms, flagship and bio-indicator species almost anywhere, including in urban areas and schools gardens. This proximity relation with biodiversity, its importance and threats is essential to raise public awareness and engage the population in community-driven biodiversity conservation and monitoring programs.

### O19.1.4

#### **Conserving a Thief: Which Outreach Strategies Change Attitudes towards the Perceived Poultry Predator *Leopardus guigna***

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*Leopardus guigna* is one of the most threatened felines in South America. Unflattering myths and its perceived status as a poultry predator result in retribution killings. In 2008 students from 8 rural schools in the Araucaria district of Chile attended workshops designed to increase their knowledge of *L. guigna* ecology and its role within local ecosystems. 24 students also had an interactive experience with captive *L. guigna* at a wildlife rescue and breeding centre. In 2010 the long-term impact of the two education techniques on childrens knowledge and attitudes towards *L. guigna* was assessed. Students who attended the workshop had significantly better factual knowledge than a control group whilst students who had an interactive experience of *L. guigna* showed improved knowledge and more positive attitudes towards the species. Student's knowledge and attitudes are correlated ( $F_{1,121} = 58.42$ ;  $p = 5.379e-12$ ;  $R^2 = 0.3182$ ) and multivariate analysis identifies knowledge and social norms as significant predictors of attitude scores supporting the use of the theory of planned behaviour in investigation of the effectiveness of environmental education programs. Our results support increased interactive contact with captive *L. guigna* as the most effective method of removing exaggerated stigmas associated with the species.

### O19.1.5

#### The Reintroduction of Charismatic Animals to Scotland: A Discourse Analysis of Supporting Expert Documents

Arts K.<sup>1,2</sup>

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Political decisions on environmental issues are increasingly required to be 'knowledge based', which has led to a wealth of (scientific) expert documents that aim to inform decision-making. However, the roles of rhetoric and argumentation in those documents have received relatively little scientific attention. We studied 111 expert documents in support of reintroductions to Scotland and identified the elements that constituted the discourses of white-tailed eagle, beaver and lynx. Similar building blocks (so-called storylines) were found in all three debates. The pro-reintroduction discourse as a whole bore resemblance with other contemporary environmental management discourses: In what could be termed 'win-win logic', positive storylines were combined to point at the necessity of a management intervention, in our case a reintroduction. Yet, additional mechanisms were also at work which suggests that downplaying negatives can be as important as dwelling on positives. Crucially, we found that the Scottish pro-reintroduction discourse might have become increasingly 'reflexive' in terms of its rhetoric and argumentation. The latter development may have major implications for political decision-making. A more critical use of rhetoric and argumentation in expert documentation is needed to achieve environmental political decision-making that is open to any possible outcome of deliberation (including non-reintroduction).

### O19.1.6

#### Selection of an Endangered Amphibian for Ex-situ Conservation in Northern Italy: Conflicts between Threat Reversibility and Conservation Values

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Ex-situ conservation has a mixed record of success and failure, but it is increasingly considered as the last resort for several amphibian species that are facing sharp, quick declines. The Apennine yellow-bellied toad *Bombina pachypus*, endemic of peninsular Italy, has undergone such a decline, with more than 50% of its populations disappearing during the last 30 years. In 2010, the species was relisted from "Least concern" to "Endangered" in the IUCN Red List. However, explicit inference about the drivers of the decline has not been attempted until recently. We found that at the northern limit of the species' range habitat loss caused by land use changes correlated with local extinctions between 1998 and 2010. Climatic changes can also affect populations, particularly with high-intensity rain events increasing in frequency and impacting tadpole survival. On the other hand, we found no evidence of infection by *Batrachochytrium dendrobatidis* on the remaining populations, shown by models to be relatively stable. Given these results, we use an explicit decision tree to assess whether the species should be selected for ex-situ conservation, considering trade-offs between the low reversibility of threats and the high cultural value of this endemic species.

## O19.1.7

### The Role of Bushmeat in Ghana's Rural Communities

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Unsustainable hunting of wildlife in the humid tropics of Central and Western Africa is a threat to biodiversity and also impacts human livelihoods. However there is little information on the changing role of hunting in the agricultural areas of West Africa, where wild game are depleted. We assessed the status and role of bushmeat hunting in two communities in Ghana, through a combination of household surveys (n= 177) and interviews with hunters (n=51).

Hunting was embedded within a mosaic of dynamic livelihood strategies, with 28% of households reporting hunting in the last year. Two groups with hunting-based livelihoods were identified; a group of younger men who hunted with dogs to control crop pests for farmers. Other, predominately older, men pursued more traditional hunting strategies with guns. These men were members of Hunting Associations and had seen hunting revenues decline as bushmeat species abundance declined. Unlike in previous studies, few men self-identified as primarily hunters, although bushmeat hunting still played an important role in the rural economy. This study highlights its importance for crop security in this region. Conservationists might consider targeting efforts on the forest-based hunters, who are more likely to damage forest ecosystems than the crop pest hunters.

## FOREST ECOLOGY AND MANAGEMENT

### O23.1.1

#### Human Disturbance through Forestry Alters Crop Contents and Foraging Efficiency of Aphid-tending Red Wood Ants, *Formica aquilonia*

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Forest management alters species interactions, behaviours and distributions. To evaluate forestry effects on ant foraging performance, we compared the quality and quantity of honeydew harvested by ants among clear-cuts, middle-aged and mature spruce-dominated stands in boreal forests in Sweden. We analysed honeydew chemical composition with gas chromatography-mass spectroscopy and compared the quantity of honeydew collected by individual ants. The concentration of trehalose in honeydew was significantly lower in clear-cuts compared with middle aged and mature stands, and similar trends were shown for sucrose, raffinose and melezitose, indicating poorer honeydew quality on clear cuts. Concentrations of the amino acid serine were higher on clear-cuts. The same trend occurred for glutamine, suggesting that increased N-uptake by the trees after clear felling is reflected in the honeydew of aphids. Ants in mature stands may be more efficient foragers because they had larger heads and carried proportionally more honeydew. We show that human alternation of habitats through clear-cutting affects food quality and worker condition in *F. aquilonia*. This is the first study to show that honeydew quality is affected by anthropogenic disturbances, likely contributing to the reduction in size and abundance of *F. aquilonia* workers and mounds after clear cutting.

## O23.1.2

### Trait-based Analysis of Ancient Woodland Herbs in Primary and Secondary Woodlands in a Central European Beech Forest

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Common ancient woodland herbs that adapted to natural disturbance regimes can be threatened by current management practices as well as past forest use in temperate deciduous forests. The present study is aimed at exploring how the shelterwood cutting system and former land-use history affected the understory layer of beech forests. Differences in the composition of herbaceous species of old primary, old secondary and young primary forests in Western Hungary were analysed using their ecological traits. Old secondary and young primary forests differed in a contrasting way from old primary stands as evaluated by PcoA and MRPP. Species that showed significant preference for one of the land-use history groups were classified by eight ecological traits including clonal growth and seed traits. The resulting four species groups differed in abundance in the forest types. Early flowering, heavy seeds with low dispersal abilities can be associated with ancient woodland herbs. Secondary forests contained less ancient woodland species and in lower frequencies, whereas only two such species appeared in higher abundance in young shelterwood stands. We concluded that current shelterwood management negatively affected ancient woodland herbs and their reintroduction to secondary stands might be necessary for their conservation.

## O23.1.3

### Effect of Heat on Interspecific Competition in Wood Fungi

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Forest fire is a critical process maintaining boreal forest biodiversity. Since fire regimes have drastically changed, species associated with fire have decreased. However, the biological processes behind this decrease are still poorly known. Several boreal species of wood inhabiting fungi have shown a remarkable resistance to heat. Species common after forest fires or in open dry habitats can tolerate higher temperatures than species with broader habitat demands or species found in mesic forests. Thus, it has been hypothesized that extreme temperature-stress caused by a forest fire will favour species adapted to heat and ultimately change the species composition of the log. In this experiment the competitive interaction of species pairs was tested in relation to exposure to high temperatures; 3 species associated with fire was tested against tree species not associated with fire. There was a clear difference between the fire associated species and the non- fire associated species in competitive strength at these conditions. All fire associated species had a clear advantage after heat treatment, conquering a large volume of wood from its competitor. This exemplifies the need to better understand the links between species interactions, community change and the loss of critical ecosystem processes like forest fires.

## O23.1.4

### Long-term Artificial Forest Drainage Affects Terrestrial Forest Biodiversity by Cumulative Indirect Effects

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In northern temperate forests artificial drainage is widely used to increase timber yield. We sampled various terrestrial taxon groups in 20 natural and 24 artificially drained swamp forest plots that represented 4 management types (old-growth; mature commercial forests; clear-cuts; retention cuts). Drainage effects on cryptogam assemblages were only observed in forest stands, probably because the influence of final felling overrode drainage effects on cutovers. Cryptogam species richness was especially high in undrained old-growth forests (on average, 85 lichens and 74 bryophyte species per 2 ha), while in drained forests mature managed and old-growth plots did not differ (73 lichen and 64 bryophyte species). Species richness of vascular plants was generally similar in drained and undrained plots, but drained forest stands supported notably many orchids and the highest plant richness was recorded in drained retention cuts. Drainage effect on snails was only pronounced in commercial mature forests, possibly due to the management-driven replacement of deciduous trees with conifers and the resulting change in litter characteristics. In conclusion, drainage appears to influence forest biota in concert with other accompanying management techniques; without these, old artificially drained forests can provide valuable habitats for many moisture-dependent species.

### **O23.1.5**

#### **The Dying Legacy of Green-tree Retention: How Should It Be Managed for Wood-inhabiting Fungi?**

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The widely used practice of live-tree retention could provide, after death of the trees, valuable habitat for dead wood (DW) dependent organisms in regenerating forests. To assess the effectiveness of such 'lifeboating' function of dying retention trees, we described early succession of polypore and epixylic lichen assemblages, using chronosequences of fallen trunks and snags on 46 cut areas in Estonia, hemiboreal Europe. Already in the first post-harvest decade, such DW provided habitat for a species rich polypore assemblage, including several species of conservation concern. In contrast to polypores (which were most species-rich on fallen aspen trunks), epixylic lichen colonization of retention trees was slower and most species were found on pine snags. At the tree level, cryptogam richness was highest on retention trees that had died by trunk breakage creating both a snag and a log. However, at the cutover scale different substrates (as defined by tree species, DW type and time since the death) hosted different assemblages. Thus, lifeboating tree-dwelling biota with retention trees is a complex task that includes predicting and affecting the causes of tree death, and linked management decisions about the diversity, size, and longevity of the trees in particular landscape context.

### **O23.1.6**

#### **Land Ownership Drives Ecosystem Services Provision from Forests in Germany's Swabian Alb Biosphere Reserve**

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In the central European cultural landscape, forest management has a decisive influence on the provision of biodiversity and ecosystem services. This study hypothesizes that forest ownership is an indirect driver of forest management and is thereby of vital importance for biodiversity conservation and carbon sequestration. We compared forest clusters of different ownership types, namely state-owned, communal and small-scale private forests, in Germany's Swabian Alb Biosphere Reserve. Structure and composition of the tree layer, saplings and regeneration, the abundance of dead wood, and the composition of ground vegetation were recorded. Although close-to-nature management has been practiced in public forests over years, the floristic diversity does not vary significantly between the forest ownership types. Rather, our study demonstrates that small-scale private forests comprise significantly higher levels of structural diversity, dead wood and carbon storage capacity than large public forests. This is in contrast to the global trend, where continued ownership fragmentation threatens forest sustainability. The elevated ecological value of small-scale private forests seems due to a less intensive and more diverse forest management and may be jeopardized through forest conversion and wood mobilization initiatives. To safeguard forest biodiversity and ecosystem services, ownership-specific incentive schemes should be designed.

### O23.1.7

#### **Spatial Distribution of Carbon Stocks in Forest Biomass and Soils in Madagascar: A Key to Implementing REDD+ Mechanism “Reducing Emissions from Deforestation and Forest Degradation”**

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Variations of CS across landscapes and forest types are important sources of uncertainty due to scarcity of reliable estimates. Accurate analyses of carbon stocks (CS) in soil and forest aboveground biomass are needed if the REDD+ mechanism is to become an important tool in forest conservation. For that purpose, a typology of CS across spatial patterns (climate, altitude and land use) was performed in the southern region of Madagascar using allometric relationships and partial least squares models. Effects of climate, altitude and land use on CS were significant at  $p < 0.05$ . The CS of above ground biomass were  $193 \pm 56$  and  $31 \pm 9$  MgC.ha<sup>-1</sup> in moist and dry forests, respectively. At a depth of 100 cm, soil CS averaged  $56 \pm 29$  and  $19 \pm 50$  MgC.ha<sup>-1</sup> in semi-arid and humid climate areas, respectively. Soil CS were positively correlated with the altitude. Differences of soil CS between forests and farmlands of about  $52 \pm 30$  MgC.ha<sup>-1</sup> and  $30 \pm 13$  MgC.ha<sup>-1</sup> were observed in humid and semi-arid climate areas respectively. This study demonstrated the main factors determining the spatial distribution of CS which are fundamental in guaranteeing the effectiveness of REDD+ in tropical forest management and conservation.

### O23.2.1

#### **Wood-inhabiting Beetles (Coleoptera) Highlight the Conservation Value of Mediterranean Oak Forest in Israel**

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Conservation of Mediterranean habitats should be a major focus of interest, because the Mediterranean region is considered one of the global biodiversity hotspots. Oaks (*Quercus*) are the dominant tree species in semi-natural Mediterranean forests, but the insect fauna associated with Mediterranean oak forest is poorly known. Species richness and composition of the saproxylic beetle assemblage, including its seasonal variation, of a stand of old oaks (*Quercus calliprinos*) in Israel were investigated using flight-interception traps. Fifty-two saproxylic beetle species were found associated with oaks in the field study. These included two saproxylic click-beetle species that are new for science and six saproxylic species recorded for the first time in Israel. A literature survey conducted on twelve beetle families and our own data revealed that at least 111 saproxylic beetle species are associated with oaks in Israel. Seventy-three species are known to have a Mediterranean distribution range, and fourteen species are restricted to the Levantine region or are endemic to Israel. This highlights the value of oak forests for the conservation of autochthonous species in Israel and in the whole Mediterranean region, although the forests of this region have suffered from long-term devastation and degradation.

## O23.2.2

### Influence of Herbivore-mediated Seed Dispersal on Plant Diversity

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Endozoochorous seed dispersal by herbivores can affect plant spatial dynamics and macroecological patterns. We have investigated the viable seed content in the dung of European bison, moose, red deer, roe deer and wild boar and followed the fate of seeds dispersed by bison in the forest ecosystem. The guild of ungulates dispersed 201 plant species (18.2% of Białowieża Primeval Forest flora). Only four plant species were common for all studied herbivores, and close to 50% of plant species were dispersed exclusively by one animal species. Establishment and seed production by endozoochorically dispersed plants occurred only on poor habitat, but this involved almost exclusively species of fertile habitats. This asymmetric effect was produced by the temporal local fertilization of soil by animal manure. Some seeds stayed viable in dung for longer than three years. After decomposition of dung seeds passed to the top layer of the soil. They increased soil seed bank richness and density (by 33% and 63% respectively). We conclude that (1) the role of large herbivore species in plant dispersal is complementary; (2) endozoochoric seed dispersal influence plant and seed bank diversity; (3) depletion of the guild of ungulates may lead to local depletion of flora.

## O23.2.3

### Linking Forest History and Conservation Efforts: Long-term Impact of Low-intensity Timber Harvest on Forest Structure and Wood-inhabiting Fungi in Northern Sweden

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Throughout the northern hemisphere old forests with high abundance of dead wood are rare features in most landscapes today, and the loss of dead wood constitutes a serious threat to the existence of many species. This study, using field surveys and dendrochronology, examines the relationship between wood-inhabiting fungi and past forest utilisation along a gradient of early logging activity. Data were collected in three late-successional Scots pine forests in northern Sweden. Our results show that minor forest logging carried out a century ago may have continuing effects on forest characteristics, including dead wood dynamics and the wood-inhabiting fungal community - especially the abundance of red-listed species. The most important effects are lower numbers of logs in early and intermediate stages of decomposition. Contrary to expectations, the impact of logging did not increase with logging intensity; more important factors were the sizes and types of trees that were logged. Additionally, numbers of species, including red-listed species can be high in forests that have been subject to low levels of logging. We conclude that the formation of a framework linking forest history and environmental data is vital for understanding the ecology and formulating goals for future management of these forests.

#### **O23.2.4**

##### **To Shoot or Not to Shoot, That Is the Question: Vegetation Changes after Prolonged Reduction in Deer Population**

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Prolonged browsing by uncontrolled ungulate populations can dramatically reduce forest understory vegetation as well as insect and songbird populations. We tested the reversibility of these changes on a set of islands in the North Western Pacific by studying the vegetation response to prolonged reduction in deer populations through hunting.

We used a 13 year long experimental cull to compare by vegetation surveys changes in the vegetation between culled and non culled sites. We combined functional trait methods and spatial analyses to understand the mechanisms that govern deer-vegetation interaction.

Results indicate a strong potential for vegetation recovery, even in the most severely affected sites. Although the initial trajectory of recovery will be affected by past browsing history, overall plant communities of the treated islands will ultimately tend towards those observed on reference islands that never had deer.

Ungulates overbrowsing have altered plant species diversity throughout forest understories in North America and Europe. Our results suggest that these modifications are reversible. However the current decline in number of hunters suggests the need for conservation practitioners to find other means to regulate ungulates.

#### **O23.2.5**

##### **Chain-sawing for Conservation: Effects of Partial Cutting on Seven Organism Groups in Oak-rich Mixed Forests**

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Oak-rich forest in Europe is a species-rich forest type that has become denser and darker, mainly due to ceased grazing. This development may have caused a decrease in biodiversity. Habitat restoration and traditional management in such woodlands are expensive, but since the demand for biofuel has increased, it might be possible to finance restoration actions with careful biofuel extraction. To evaluate the biological effect of such actions, we delineated 25 oak-rich forest stands in Southern Sweden; each stand with a treatment and a reference plot. In the treatment plots, about 25% of the basal area was removed (small, intermediate-sized, and some large trees). All plots were surveyed before, and after cutting (2-7 years). The richness of vascular plants, forest floor bryophytes, wood-inhabiting and epiphytic lichens, and wood-inhabiting and herbivorous beetles increased; the richness of molluscs and wood-fungi (basidiomycetes) decreased; and the richness of wood fungi (ascomycetes) and mycetophilids were indifferent to partial cutting. In addition to this overall increase in biodiversity, also the diversity of red-listed and indicator species increased. Thus, the management action was positive, but it is valuable to save some of the closed canopy forest for the species that decreased due to the management.

## O23.2.6

### Biotic Risks to EU Forest under Climate Change - A Growing Threat? Assessment and Solutions for Manager

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A key question for policy-makers and managers is whether the risks caused by biotic agents to EU forests are likely to increase under climate change, and what can be done to avoid or mitigate those risks. We provide a synthesis of the current knowledge for all biotic agents in the different EU forest types. This review confirms that biotic agents can cause significant socio-economic and environmental damages, although the extent of these largely depends on the forest management aims (e.g., nature protection vs. wood production). We highlight a lack of reliable long-term trends on the occurrence and scale of biotic outbreaks, making it difficult to assess the severity of biotic risk. While climate change is likely to increase the spread of biotic agents, it is not yet clear whether these will cause a growing threat. Given these uncertainties, we suggest improving the match between forest natural dynamics and management systems in the EU, and simple decision-trees to help managers prioritise action. Lessons-learned from different types of outbreaks suggest early action is essential. However, current monitoring systems are largely inefficient for detecting biotic outbreaks. We show how multi-functional systems, integrating an early-warning function, may be better suited while still cost-efficient.

## O23.2.7

### Wolf and Lynx Occurrence in the Czech-Slovak Border: Wolf Hunting as a Sustainable Management?

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The Beskydy Mts. located in the Czech-Slovak border are the edge area of the Grey wolf (*Canis lupus*), the Eurasian lynx (*Lynx lynx*) and the Brown bear (*Ursus arctos*) occurrence in the West Carpathians. Because wolves are a subject of legal hunting in Slovakia, we were interested in differences of area occupied by the endangered carnivores in last 8 years.

During 2003-2010, the monitoring of large carnivore occurrence was conducted mainly by snow-tracking surveys and collection of scats, footprints and other signs of large carnivore occurrence whole-year.

Data analysis shows a significant difference between the observation of tracks and other signs of wolves and lynxes. A wolf is very rare species and it was recorded almost six times less often than a lynx, a whole-year protected species in both countries. The difference is most likely a consequence of a legal wolf hunting in Slovakia, where 74-159 wolves (about 50 % of estimated numbers) were yearly shot during the study period. The situation, when a management of a strictly protected species threatens the stable occurrence in a neighboring country seems to be a clear violation of European Habitats Directive. European Commission already deals with the case after NGO complaints.

## O23.2.8

### Effects of Intensified Forestry on the Landscape-scale Extinction Risk of Dead-wood Dependent Species

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In the future, a significant proportion of northern forests may become intensively managed through the planting of monospecific stands, and the use of multiple silvicultural treatments such as forest fertilization. Such an intensification of management in selected parts of the landscape is suggested by different zoning models, for example the Triad approach, which is under evaluation in some regions of North America. In this study, based on Fennoscandian conditions, we predicted landscape-scale extinction risks of five hypothetical model insect species dependent on dead wood, by simulating colonizations and local extinctions in forest stands. Intensified forestry applied to 50 % of the stands led to strongly increased extinction risks during the following 150 years. The negative effects of intensive plantation forestry could be compensated for by taking greater biodiversity conservation measures in other managed forests or by setting aside more forests. This is consistent with the Triad model, which is according to our analyses an effective way to decrease extinction risks. A zoning of forest land into intensive forestry, conventional forestry, and set asides may be better at combining increased timber production and maintenance of biodiversity in comparison to landscapes where all production forests are managed in the same way.

## GRASSLAND ECOLOGY AND MANAGEMENT

### O26.1.1

#### Foraging Habitat Preferences, Movements, and Diet of the Yellowhammer (*Emberiza citrinella*), in an Intensive Grassland Dominated Agricultural Landscape in South West Scotland

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Farmland birds across Europe have declined with agricultural intensification, with granivorous species, including yellowhammers, disproportionately affected. Farmland bird research has focussed on mixed and arable farms, despite pastoral farming being widespread. Pastoral yellowhammer habitat requirements, diet, and movements were studied using boundary surveys, ringing, radio-tracking, faecal analysis and a small scale winter supplementary feeding trial. Breeding density was low, 0.11 pairs/hectare, half the densities reported in arable and mixed regions. Invertebrates dominated summer adult and nestling diet, orders Diptera, Coleoptera, and Lepidoptera most important. Less cereal was eaten compared with previous studies. Yellowhammers preferentially foraged within 10m of field margins. Grassland foraging sites held significantly more invertebrates >2.5mm and greater invertebrate diversity than controls. Winter distribution differed from summer with the dominant habitat, intensive grassland, avoided. Surveys and radio-tracking found yellowhammers selected stubbles, moving furthest in early winter, increasingly using farmyards, gardens and game feeders as winter progressed. Mist-netting suggests low first year survival. High numbers utilising feeding trial suggests winter food is limiting. Winter diet was predominantly cereal, with grass seeds accounting for < 1%. This study highlights the importance of arable fields in pastoral regions for granivorous birds in winter, and suitable invertebrate rich foraging habitat in summer.

## O26.1.2

### Temporal Effects of Agri-environmental Schemes on Ditch Bank Plant Species

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In the Netherlands, many of the Agri-environmental schemes (AES) aim at the conservation of valuable plant species in ditch banks. In our research we investigated the effects of AES on ditch bank plant species in the Western Peat District of the Netherlands, using a large dataset of plants monitored by 377 farmers during a 10-year period in 2597 kilometres of ditch bank. No effect of the duration of management was found on the number of target species on which the management focuses. However, the composition of the plant species changed from species characteristic of hay meadows to species of tall-herb damp grasslands. Furthermore species with a lack of capacity to disperse over long distances show negative trends over time. These results suggest that the ongoing measures prescribed by AES are not able to decrease productivity in ditch banks and that the lack of dispersal from species rich sources is a limiting factor in promoting species richness. We found large differences between farmers, both in the initial species richness of the ditch banks and in the response to management. This also suggests that more detailed research, using an interdisciplinary approach, is required into the factors determining whether AES succeed or fail.

## O26.1.3

### Leafhopper Diversity Can Profit from Moderate Mowing and Fertilization in a Grassland Biodiversity Experiment

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Current studies on trophic interactions in biodiversity experiments have largely relied on sown gradients in plant diversity. Here, we analyzed leafhopper (Auchenorrhyncha) responses to grassland management and functional group composition in a >200-year old grassland in northern Germany. Our plant functional group removal experiment, based on monocot vs. dicot herbicides to promote herb vs. grass dominance, was coupled with different management treatments (fertilization, mowing) in a full factorial experiment (N = 72 plots). We sampled leafhoppers three times between May and September 2010, using a standardized sweep netting procedure. Leafhopper diversity was significantly affected both by plant functional group composition and by land-use intensity. Increased food resource availability (grass cover) resulted in a higher diversity of leafhoppers. We also found a positive effect of management intensification (i.e. mowing and fertilizing) on leafhopper diversity, which was highest in fertilized plots mown three times a year. We conclude that leafhoppers may benefit from nutrient-rich, freshly mown plant tissue in grasslands with high abundance of monocots. Leafhopper diversity can profit from moderate mowing and fertilization in extensively used grasslands, where conservation can be accomplished by moderate utilization.

## O26.1.4

### Effects of Different Management Regimes on the Herb Layer of Grassland Community

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Seminal grasslands are species rich communities that have formed and maintained as result of long-lasting low-intensity management like mowing and grazing. Due to drastical changes in agricultural land use practices the area of such grasslands has decreased and their diversity is in seriously threathened. We experimenatally studied during 8 years the changes in species richness and the composition of plant traits in dry acidophilous grassland plant community to understand the effect of traditional and modern management regimes. Four management variants have been applied:

- 1) once raked, once mown and hay removed;
- 2) once raked, twice mown, hay removed;
- 3) once mown, hay not removed (mulching);
- 4) twice mown, hay removed.

Mulching had the most important negative effect on species richness, while that has often used as cost-effective management method of grasslands. The mulching supressed the growth of rosette and hemirosette growth form plants. Raking favoured the growth of graminoids. Raking, mowing twice during summer and hay removal favoured plants with belowground vegetative propagation. The results of the experiment confirm that traditional methods of grassland management are the most effective for conservation of their biodiversity.

## O26.1.5

### Grassland Management in Alpine Regions: Direct Effects of Fertilization and Irrigation on Biodiversity

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Recent changes in land-use in alpine regions have led to a decline of biodiversity. One of the main reasons is the intensification of well accessible areas and a gradual abandonment of isolated hay meadows. In the inner-Alpine valleys, intensification operates with two factors: fertilization and irrigation. However, knowledge about these practices in sub-alpine meadows, especially regarding the irrigation, and their impact on functional biodiversity is still lacking. To investigate the influence of the intensification factors on biodiversity, we used a factorial design with the following treatments: control (no input), irrigation, fertilization and combination thereof. We measured species richness, structure and biomass of the vegetation in spring, early and late summer 2011. The abundance and biomass of arthropods were measured in early and late summer. Being aware that spring was extremely dry, irrigated plots harbored the highest vegetation structure and biological diversity while delivering a competitive yield. The results show how these management practices play an important role in the maintenance of biodiversity through changing the structure of the vegetation. We conclude that application of fertilizer and irrigation increases the abundance of arthropods, can improve the source of food for insectivores and may affect biomass and abundance at higher trophic levels.

## O26.1.6

### Grazed Vegetation Mosaics in Salt Marshes Do Not Promote Unique and Species-rich Arthropod Communities on the Long Term

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In semi-natural grasslands, grazing with moderate stocking densities will create a vegetation mosaic of tall and short vegetation, the effects that this mosaic structure has on arthropod diversity has however rarely been investigated. We tested two hypotheses: 1) Vegetation mosaics harbour more species than homogenous swards, and 2) vegetation mosaics harbour a) a unique species assemblage or b) an assemblage comprised of species from abandoned and from intensively grazed areas. We sampled vegetation mosaics by suction sampling on three salt marshes along the German Wadden sea coast, and, for reference, also sampled homogenous swards of abandoned and intensively grazed marshes at the same sites. Contrary to our expectations, abandoned salt marshes harbour more species than the mosaics or the intensively grazed treatments. Analysis of species occurring under the different treatments showed however that only few species were unique for the vegetation mosaics, and that most of those were ubiquitous species with no conservation interest. We conclude that the creation of a vegetation mosaic through grazing with intermediate stocking densities cannot substitute other management types and especially abandonment, in salt marshes. Some species might benefit from this management however and we surmise that this pattern may be general for productive grasslands.

## O26.1.7

### Conserving Dry Grassland Diversity through Controlled Grazing Management

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Dry grassland communities in the cultural landscape of Central Europe have been traditionally subjected to grazing. In the 20<sup>th</sup> century pastures have been widely abandoned and colonised with woody vegetation. We observe the effects of re-established rotational grazing management on selected former pastures with valuable dry grassland communities. The aim of grazing management is to conserve high levels of species richness and promote often threatened species of open habitats. Since 2005 we collected data on vegetation cover and species composition and richness on grazed and control permanent plots. After seven years, collected data show significant difference between the development of grazed and control plots. On two sites with high initial species number per 1 m<sup>2</sup> we show a decrease in species richness on ungrazed plots. On one site with lower initial species richness we show a significant increase in species number per 1 m<sup>2</sup> on grazed plots. On each site we can see then either an effect of grazing absence or an effect of grazing presence, depending on initial species richness. In addition we show increasing homogeneity on a large scale (between plots and sites) and increasing heterogeneity on a small scale (1 m<sup>2</sup> plots) with continuing grazing.

# HABITAT FRAGMENTATION AND METAPOPOPULATION DYNAMICS

## O27.1.1

### Meta-analysis of Susceptibility of Woody Plants to Loss of Genetic Diversity through Habitat Fragmentation

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Shrubs and trees are assumed less likely to lose genetic variation in response to habitat fragmentation because they have long lifespans and extensive pollen flow. To test this assumption, we conducted a meta-analysis with data on 97 woody plant species derived from 98 studies of habitat fragmentation. We measured the weighted response of four different measures of population-level genetic diversity to habitat fragmentation with Hedge's *d* and Spearman rank correlation. We tested whether the genetic response to habitat fragmentation was mediated by life-history traits. Habitat fragmentation was associated with a substantial decrease in expected heterozygosity, number of alleles, and percentage of polymorphic loci. The largest proportion of variation among effect sizes was explained by pollination mechanism. Wind-pollinated trees and shrubs appeared to be as likely to lose genetic variation as insect-pollinated species. In comparison with results of previous meta-analyses on mainly herbaceous species, we found trees and shrubs were as likely to have negative genetic responses to habitat fragmentation. We also found that the genetic variation in offspring was generally less than that of adult trees, which is evidence of a genetic extinction debt and probably reflects the genetic diversity of the historical, less-fragmented landscape.

## O27.1.2

### The Benefits of Interpopulation Hybridization Diminish with Increasing Divergence of Small Populations

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Genetic deterioration of small and isolated populations is a serious conservation problem. Increasing gene flow between populations may provide a "genetic rescue" for isolated populations, but may also lead to outbreeding depression. The outcome of interpopulation hybridization can depend on the level of genetic divergence between the populations. Further, the effects can change between generations, making long-term studies important. We studied the long-term effects of interpopulation hybridization at two levels of population divergence in experimental *Drosophila littoralis* populations. We found that hybridization significantly improved population viability at the lower level of population divergence. At the higher level of divergence, however, the benefits of hybridization were markedly lower. The results indicate that hybridization between isolated populations can yield long-lasting fitness benefits for populations suffering from inbreeding and drift, but the benefits may be reduced when populations are more diverged, even when the populations exist in similar environments. The study has important implications for understanding the dynamics of genetic load in isolated populations, and for the use of genetic management strategies in conservation.

### O27.1.3

#### **Both Climate and Habitat Availability Influence Population Dynamics and Distribution of a Rare Butterfly at its Northern Range Margin**

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To predict species distributions in a warmer climate we need knowledge about factors that limit them today. Species distributions can be limited by habitat availability, biotic interactions or by climate. At climatic range margins, micro-climate is expected to be particularly important and influence habitat suitability. I have studied the importance of habitat quality, including micro-climatic conditions, and spatial habitat configuration for the distribution and population dynamics of the threatened Oberthür's Grizzled skipper *Pyrgus armoricanus* at its northern range margin in Sweden. At a small spatial scale, females prefer to oviposit on host plants situated in particularly warm spots on south-facing slopes. At a larger scale, small and isolated habitat patches as well as patches with a cold micro-climate remain unoccupied, even if they are of high enough quality, indicating both dispersal and habitat quality are limiting the distribution. The dispersal limitation was confirmed by a translocation experiment where experimentally established populations survived approx. 50 km north of the northernmost existing populations. In conclusion, both micro-climate and habitat isolation seems to limit the distribution of *P. armoricanus* at the northern margin of its distribution.

### O27.1.4

#### **Implications for the Future Distribution and Viability of a Scandinavian Red Listed Plant Species (*Primula Scandinavica*) due to Declined Land Use?**

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The Scandinavian flora includes only a few endemic species, but in mountain habitats some plant species with small geographic ranges occurs. The Scandinavian endemic *Primula scandinavica* is one of them. *P. scandinavica* occurs in alpine vegetation and agricultural landscapes in mountains. Since the mountain semi-natural habitats are in decline, the species is included in both the Swedish and Norwegian Red Lists. However, as this presentation aim to discuss, little is known about its viability and possible future distribution. Occurrences, population-densities and seed-production were registered in a mountain landscape in Eastern Jotunheimen, South-central Norway. The vegetation mosaics in the same landscape have been mapped as well as scenarios of the mosaic given different agri-environmental policies. Modeling procedures using these data, showed that occurrence of *P. scandinavica* was positively correlated with both naturally as well as land use induced disturbance; the endemic species preferred open habitats. Local population densities were higher in human disturbed habitats, but seed production in the populations did not differ; the viability was equal between the two categories of habitats. However, when predicting future distribution, it was shown that what land use that will be practiced, will have high impact on the metapopulation in this mountain landscape.

### **O27.1.5**

#### **Effects of Roads on Wildlife: Spatial Analysis of Road-kill Patterns**

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Roads induce landscape fragmentation and create barriers to wildlife movement. A most prominent effect of roads is road-kills. We aimed to identify variables (determinants) that shape road-kill patterns. We hypothesized road's attributes, its spatial context and species' characteristics independently and synergistically influence these patterns. We surveyed three roads located in central Judea lowlands, Israel. Road-kill surveys were conducted by low-speed driving at dawn, 4-10 days per month. Landscape heterogeneity was incorporated into GIS, using orthophotos and field measurements. We documented about 500 road-kill observations. Statistical analysis revealed spatial aggregations of road-kills in all three roads. Spatial range in which aggregations were found differed between the two less and the more intensive road (400 m and 800 m, respectively). We found significant effects of the spatial context, with determinants from different scales affecting road-kill patterns. At a local scale, illumination and road conjunction were positively correlated with road-kills. At a broader scale, proximity to settlements and road intensity were positively correlated with road-kills. Our results relate to two processes: risk of getting hit by a vehicle and wildlife activity levels, affected by road permeability and spatial context. Consequently, these processes need to be considered when dealing with road-induced fragmentation.

### **O27.1.6**

#### **Effects of Scale Dependent Habitat Factors on the Extinction and Colonization Dynamics of Butterfly Species Inhabiting a Biodiversity Hotspot**

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The persistence of species in spatially structured populations is determined by extinction and colonization processes assumed to depend on patch characteristics, such as size, isolation, and quality, but simultaneous empirical evidence of this prediction for a large number of species has seldom been reported. Here we analysed a 17-year dataset containing detection-nondetection data on 38 butterfly species for 26 sites in NE Spain, to model local extinction and colonization processes. Using multiseason occupancy models, which take into account species' detectability, we were able to obtain robust estimates of local extinction and colonization probabilities for each species and relate them to site covariates such as the area of suitable habitat within the patch, landscape diversity around the patch and topographic variability.

Our results revealed a general pattern across species where the area of suitable habitat within the patch strongly influences local extinction and colonization dynamics in a manner consistent with predictions based on metapopulation theory. Increased topographic variability reduced extinction risk significantly whereas landscape diversity performed worse as a predictor of extinction and colonization probabilities. Our research demonstrates the importance of patch size and quality for the persistence of many coexisting butterfly species living in spatially discrete populations.

## INTEGRATIVE/INTERDISCIPLINARY APPROACHES TO CONSERVATION

### O31.1.1

#### **Toward Incorporating Human Dimensions Information Into Large Carnivore Management Decisions - The Case of the Rodna Mountains National Park, Romania**

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An increase in the frequency and intensity of conflict between people and wildlife has been observed in many parts of the world. Often protected areas are sites where biodiversity conservation values clash with human interests for safeguarding life and livelihoods. Large carnivore conservation is particularly challenging for a plethora of ecological and socio-political reasons. In this study we present a comparison between fundamental life values and attitudes held by key stakeholders (local people, sheep farmers, and hunters) toward large carnivores (bears, wolves and lynx) and the beliefs of Rodna Mountains National Park (Romania) staff about these groups. A questionnaire was used to explore stakeholders' values and attitudes while in-depth interviews were conducted with park staff. The interviews also explored park staff's views on the importance of using human dimensions information in decision-making regarding large carnivore management. We assessed the hypothesis that differences in attitudes are related to differences in values held by various groups. Attitudes toward large carnivores were relatively negative among sheep farmers and were positively correlated with values of security and tradition. Several discrepancies between stakeholder attitudes and values and staff beliefs about them were identified. These could be addressed by including systematically collected human dimensions information.

### O31.1.2

#### **Strange Bedfellows? Techno-fixes to Solve the Big Biodiversity Conservation Issues**

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The 21st Century conservation challenges facing mega-biodiverse regions of the planet are enormous. For millennia, these regions were only lightly modified by human endeavour, yet now face heavy deforestation, biofuel cropping, invasive species expansion, and the synergies of climate change. Although small-scale conservation management might assist some species and habitats, the broader sweep of problems requires big thinking and some radical solutions. Given the long expected lead times between progressive economic development and stabilisation of human population size and consumption rates, 'technological fixes' cannot be ignored if we are to address social and fiscal drivers of environmental degradation and associated species extinctions in rapidly developing, highly populated regions. Cheap and abundant 'clean' energy is fundamental to this goal. This permits pathways of high-tech economic development, such as intensified (high energy-input) agriculture over small land areas, full recycling of material goods, a transition from fossil fuel use for transport and electricity generation, a rejection of tropical biofuels that require vast areas of arable land for production, and a viable alternative to the damming of major waterways for hydroelectricity. Rational approaches that work at large scales must be used to deal with the ultimate, rather than just proximate, drivers of biodiversity.

### **O31.1.3**

#### **Assessing Spatial Priorities for Carbon Forestry and Biodiversity Conservation**

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A carbon economy provides incentives for reforestation to reduce net carbon emissions. Carbon forestry has the potential to benefit biodiversity, but the extent of these benefits depends on the locations of and approaches to carbon reforestation. Here we demonstrate a continental-scale approach for assessing the spatial trade-offs and opportunities for carbon sequestration and biodiversity conservation through reforestation. Using Australia as a case study, we compare profitable areas for carbon forestry under a carbon price of \$20/tonne with optimal areas for meeting a biodiversity goal of restoring ecosystems to 30% of their original extent. Our analysis shows that biodiversity benefits accumulate following a diminishing returns curve as more areas are planted for carbon forestry, but that many biodiversity goals will be unmet under a forestry landscape designed for carbon alone. A biodiversity fund has the potential to shift carbon forestry landscapes to meet biodiversity restoration goals. An integrated planning approach enables the design of a carbon forestry landscape that meets combined carbon and biodiversity goals more efficiently.

### **O31.1.4**

#### **Changing Organisms in Rapidly Changing Anthropogenic Landscapes: The Significance of the "Umwelt"-concept and Functional Habitat for Animal Conservation**

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There is a growing recognition for the significance of evolutionary thinking in ecology and conservation biology. However, ecology and conservation studies often work with species-specific, fixed traits that ignore intraspecific variation. The way the habitat of a species is considered is an example of typological thinking biased by human perception. Structural habitat units (e.g., land cover types) as perceived by humans may not represent functional habitat units for other organisms. Human activity may also interfere with the environmental information used by organisms. Therefore, the Umwelt-concept from ethology needs to be integrated in the way we think about habitat and conservation. It states that different organisms live in different perceptual worlds dealing with specific subsamples of the environment as a result of their evolutionary and developmental history. The resource-based habitat concept is a functional habitat model based on resource distributions (consumables and conditions) and individual movements. This behavioural approach takes into account aspects that relate to the perceptual world of organisms. I will illustrate this with work on birds and butterflies in a context of habitat selection and dispersal in anthropogenic landscapes. This approach offers new opportunities for conservation and may help avoid failures with habitat restoration.

### **O31.1.5**

#### **Beyond Species: Integrating Functional and Phylogenetic Diversity to Conservation**

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It is now acknowledged that conserving biodiversity should no longer only focus on species diversity but also maintain functions and evolutionary processes. This more integrative view of conservation needs a rapprochement between different disciplines of ecology. Community ecology, strengthened by recent developments using functional ecology and evolutionary ecology, provides a conceptual and methodological framework favorable to this rapprochement. Using high-resolution data on the spatial distribution and abundance of birds I show a substantial amount of spatial mismatch between taxonomic, functional, and phylogenetic diversity. Moreover, I also show a temporal decoupling in the dynamics of each facet: species diversity can increase in some places while other components are declining in these places. I further show concrete applications of this multifaceted approach to biodiversity. These results challenge the use of any one diversity component as a surrogate for other components and stress the need to adopt an integrative approach to biodiversity conservation.

### **O31.1.6**

#### **Estimating Volunteer Retention Rates Using Capture Recapture Methodologies: A Valuable Tool for Volunteer Management**

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The use of volunteers in local and landscape scale ecological and conservation projects is increasing. To date no robust framework exists to monitor volunteer retention rates and validate volunteer management practises. To this effect, we present the novel use of the mark-recapture framework widely used in animal demography in order to explicitly quantify trends in volunteer retention probabilities. This highly versatile family of techniques is ideally suited to deal with both data structure and questions related to volunteer retention. The techniques accommodate imperfect knowledge on the status of individuals who often self-report, and facilitate modelling of the how interventions by project managers, volunteer experiences and their progression to higher tiers of involvement influence retention probabilities. We illustrate the power of the approach using a project which used volunteers to remove an invasive non-native mammal species from a large area in Scotland. We demonstrate how the method revealed both temporal and vocational trends in volunteer retention probabilities, and highlighted specific factors which influenced volunteer retention. Wide scale adoption of the mark recapture framework will give project managers the power to ensure current volunteer management practises are effective, provide real-time feedback on current project health and maximise economic efficiency.

### **O31.1.7**

#### **Lion Killing by Sukuma in Western Tanzania: Traditional Practices, Changing Attitudes and Project Implementation**

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The cost imposed by carnivores to local communities, particularly livestock keepers, has often deeply ingrained hatred towards lions and resulted in lion killing becoming a celebrated part of many pastoralist's traditions. The Sukuma, agro-pastoralists from northern Tanzania, reward those that kill lions in response to livestock loss. The Sukuma have moved in large numbers into the Katavi - Rukwa Ecosystem (KRE) an area important for lions. It has been suggested that Sukuma lion killing maybe contributing to the suppressed lion populations in the area - this we investigate.

Structured interviews with Sukuma households (n=302) within the KRE about the lion killing activities of young Sukuma men has revealed a curious case of cultural manipulation. We found that lions are now actively hunted in the KRE. We present data on the number of lions estimated to be killed by Sukuma, the changing motivations for killing lions and the changing attitudes of households towards lion killers.

In conclusion we discuss how our research results are being used to inform a mitigation campaign that through the use of participatory approaches to mobilize the independent and informal Sukuma policing body, the profitability of lion killing can be reduced and the trend in hunting curbed.

## MEASURING BIODIVERSITY (INVENTORY, MONITORING)

### O33.1.1

#### **Rapid Species Abundance Monitoring and Species Richness Estimation for Biodiversity Inventories and Conservation**

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In a bio-diverse world with an accelerating risk of species extinction there are many claims being made on scarce conservation resources. This creates an urgent need for survey methods that can produce reliable and comparable scientific data rapidly on which to base assessments of the conservation importance of different areas. The high diversity and structural complexity of many tropical ecosystems mean that existing scientific methods, developed and tested in less species rich temperate ecosystems, are often poorly suited to gathering the sort of data needed to make rapid conservation assessments. Here we use data collected in bird communities in the tropical forests of the Andes of Bolivia to show that a new analysis method, the Mackinnon Lists Technique, can provide robust species abundance indices that are consistent between observers of different experience and between assessments carried out in different periods, while also providing community species richness estimates. We suggest that the methodology has the potential to be a highly useful conservation monitoring and inventory tool for many taxonomic groups in tropical and other species rich environments where there is a need to estimate species richness and assess intra-specific variation in abundances between sites and over time.

### O33.1.2

#### **Taxonomic Bias in Species Conservation Policy: Testing the Effectiveness of the UK Biodiversity Action Plan Priority Species as Figureheads for Threatened Biodiversity**

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Species-specific conservation has been focused on a subset of species, frequently vertebrates and a few invertebrate groups with effective advocates. In the UK, much conservation effort and funding is targeted to Biodiversity Action Plan (BAP) species, selected due to international threat and/or knowledge of UK decline. The list is not exhaustive with species designation skewed towards taxon with strong advocates and where data allows assessment of trends. How well do these represent other threatened biodiversity? We collated species records for all taxa in two UK biogeographic regions, Breckland (2300km<sup>2</sup>) and Broadland (2300km<sup>2</sup>). We compared the taxonomic composition of BAP and UK Red Data Book (RDB) listings, both regionally and nationally. We examined multi-taxa assemblages (Biodiversity Audit guilds, ISIS) to assess niche-bias in BAP listings. High proportions of angiosperm and beetle species were RDB compared to BAP; in contrast, vertebrates were greatly over-represented as BAP. Whilst most assemblages contained at least one BAP species, there were notable exceptions. The spatial distributions of assemblages and BAP species across the regions demonstrated considerable non-congruence. These findings emphasise the taxonomic discrepancy between threatened biodiversity and actions for their delivery, and suggest caution is needed in using BAP species as surrogates for wider conservation.

### **O33.1.3**

#### **The Eco-geographical Division of Eastern-European Broadleaved-coniferous Forests for Improvement of Network of Key Territories of a Natural Framework**

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Broadleaved-coniferous forests on East European plain borrow extensive territory. In meridian direction in their structure from the north to the south there is a gradual change in the ratio coniferous and broadleaved species of trees that allows to allocate some strips. On Map of the Natural Vegetation of Europe, scale 1:2 500 000 (Bohn et al., 2004) broadleaved-coniferous forests are considered in structure of mesophytic and hygromesophytic coniferous and mixed broadleaved-coniferous forests (Formation D). In structure of ecoregions the biogeographic region of broadleaved-coniferous forests is presented East European ecoregion of the mixed forests and has the bioclimatic characteristic and geography of a biodiversity. The combination of various forms of a relief and motley structure of soil causes the big variety of habitats that defines a typological variety of each of forests formations and, accordingly, greater diversity of a vegetative cover. As a result of geographic analysis in GIS within the biogeographic region have been allocated seven basic chorological unit of account ecosystem diversity biogeographic region broadleaved-conifer forests. To characterize the regional characteristics of typological diversity and structure of vegetation designed passport of biogeographic region, which is the basic tool for assessment and optimizing the network of key areas.

### **O33.1.4**

#### **Changes of Grassland Use and their Effects on the Breeding Bird Population in a Large Alpine Valley**

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In Switzerland, grassland use in high alpine valleys has been intensified markedly over the last 20 years, and several grassland bird species have said to be negatively affected by this change. Grazing area has increased substantially. Nutrient-poor habitat declined by 20% and extensively used grassland by 15%. On the other hand, intensively used areas increased by 20% and fallow land by 21%. In 71% of the study plots we noticed an earlier mowing date. At lower altitudes (1000-1400 m a.s.l.) the amount of hedges increased while higher up, hedges remained largely unchanged. Farmland ground-breeding birds have suffered great declines (Skylark *Alauda arvensis* -58%, Tree Pipit *Anthus trivialis* -47%, Whinchat *Saxicola rubetra* -46%). At medium elevations (1500 - 1700 m a.s.l.), however, some of these populations are still strong, probably due to late mowing dates that have been negotiated with the farmers. Overall, the decline of meadow species was largest where where vegetation change was greatest. We conclude that the Swiss agri-environmental scheme urgently needs modification: Larger contributions for the maintenance of low-input and species-rich habitat must be payed while all incentives for intensification of the alpine agricultural Greenland should be cancelled.

### **O33.1.5**

#### **Contrasting Changes in Taxonomic, Phylogenetic and Functional Diversity during Secondary Grassland Succession**

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Applying comparative analysis of phylogenetic, functional and taxonomic diversity to successional communities allows to study how multiple facets of biodiversity change after disturbance and should also provide insights into the processes that generate biodiversity over time. Taxonomic, phylogenetic and functional diversity were estimated for four stages within a more than 300-year-long chronosequence, representing an arable to semi-natural grassland succession. Null-models were used to assess the extent to which phylogenetic and functional diversity differed from random expectations. The three facets of biodiversity showed contrasting patterns of change over time. Short-term grazing management promoted taxonomic diversity (species richness), but did not enhance phylogenetic or functional diversity. Only long-term grazing management (>270 years) promoted phylogenetic and functional diversity without further increases in species richness. Functional diversity in early and mid successional communities was lower than expected given the taxonomic diversity, suggesting deterministic community assembly with respect to species traits. The results suggest that changes in biodiversity in future environments may be predicted on the basis of functional traits. The incongruent patterns of change in different facets of biodiversity also suggest that it may be misleading to base assessments of biodiversity change after disturbance on a single facet of diversity.

### **O33.1.6**

#### **Biodiversity Hotspots House Most Undiscovered Plant Species**

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For most organisms, the number of described species considerably underestimates how many exist. This is itself a problem and causes secondary complications given present high rates of species extinction. Known numbers of flowering plants form the basis of bio-diversity “hotspots”—places where high levels of endemism and habitat loss coincide to produce high extinction rates. How different would conservation priorities be if the catalog were complete? Approximately 15% more species of flowering plant are likely still undiscovered. They are almost certainly rare, and depending on where they live, suffer high risks of extinction from habitat loss and global climate disruption. By using a model that incorporates taxonomic effort over time, regions predicted to contain large numbers of undiscovered species are already conservation priorities. Our results leave global conservation priorities more or less intact, but suggest considerably higher levels of species imperilment than previously acknowledged.

### **O33.1.7**

#### **Valid Data for Biodiversity Research**

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Biodiversity is nowadays a hot topic for researchers as well as society. Distribution and field records are fundamental tools for biodiversity. Researchers gather their data from local databases and fieldwork, assuming that their data is valid and complete. This requires a solid data system with a good structure.

The Dutch data warehouse 'National Database Flora and Fauna' (NDFD) contains the distribution data of plants and animals in the Netherlands. Over 50 million Dutch biodiversity records are gathered by researchers, volunteers and projects. This warehouse contains data entry portal(s), a basic archive, a validation service, a delivery database and data export portal(s). Since everybody can post their observations in the different entries, validation by expert teams is implemented to make sure that the output of the database consists only of approved records. Sharing public information is more accessible with web applications. The Dutch initiative [www.observe.org](http://www.observe.org) is a public website for international records. The goal is to cover all species groups and show the biodiversity of the World. High quality is attempted and quality control is executed by experts as well. These additional data are very informative and yield new insights of local biodiversity, that NGOs and researchers can interpret by themselves.

### **O33.1.8**

#### **Time to Detection: Comparing a New, Cost-effective Method to Estimate Detectability with Capture/Recapture Methods**

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Detection of rare species is difficult and seldom perfect, even for sessile organisms, such as plants, mosses, and lichens. Detection probability, or detectability, is therefore a critical but overlooked parameter in surveys especially as many species occur only at low abundances. Not accounting for detectability has severe implications for nature conservation by overestimating extinction probabilities, missing first occurrences of invasive species, biasing inference on habitat preference, etc. Time to detection has been recently proposed as a cost-effective alternative to capture/recapture methods to estimate detectability because it does not require repeated surveys by a second observer. For the first time, we compared the performance of these two methods in the field. Two observers searched independently for 17 plant species in 44 quadrats of 100 m<sup>2</sup> and recorded the time needed to detect the first individual for each species (i.e. time to detection). Both estimates of detectability were well correlated with each other ( $r=0.81$ ), but time to detection consistently overestimated the detectability compared with capture/recapture method. These findings suggest that time to detection is a valuable and efficient method to account for imperfect detection and should be included in future monitoring activities to assess their reproducibility.

## LANDSCAPE ECOLOGY AND CONSERVATION

### O35.1.1

#### Old Traditional Orchards as a Habitat for Natural Bird Diversity within Fragmented Landscape

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Traditional fruit orchards are considered to be rich in species and highly valuable habitats of European importance. Today, these habitats are threatened with destruction, the change of use or on the contrary with neglect. The aim of this work is to characterize the bird communities of old orchards, to look for the relationship among structure, habitat quality, type of management, size, location and isolation. For the analysis of the bird communities were selected 68 old orchards in the region of Vysoké Myto, Eastern Bohemia (total size of the examined area is about 380 km<sup>2</sup>). There was defined a square 50 x 50 m in the middle of each orchard, where the qualitative and quantitative characteristics of the bird communities were collected by an accelerated mapping method in the nesting season of 2011. In total, there were observed 801 pairs of 51 bird species. Hierarchical partitioning showed that nearly 55% of independent contribution of study variables as a percentage of total explained variance was explained by tree species composition, followed by ageing with nearly 40%, while stratification (< 6%) and surroundings (< 1%) had surprisingly only marginal effect. Location, type of management and stratification are significant for bird species composition.

### O35.1.2

#### Delivering Land Management Advice for Marsh Fritillary *Euphydryas aurinia* in Scotland

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The Marsh Fritillary is a species of the highest conservation concern and is designated a UKBAP Priority species and listed on Annex II of the EC Habitats Directive. The butterfly has a limited distribution in Scotland, occurring in the western fringes of Argyll, these colonies represent some of the most important in Europe. Maintenance of suitable habitat is best achieved through light grazing. The butterfly's future is therefore linked to that of traditional agriculture in a very marginal and remote corner of the UK.

Due to the varied nature of occupied sites a standard grazing prescription is not appropriate, management advice has to be site-specific. This was delivered by teaming up with local agricultural consultants and providing plans that took into account habitat type, availability of stock and condition of the site. This close collaboration ensured that the resulting plans were deliverable.

We have currently been involved with around 200 sites, contributing to 140 plans, over 90% of which have been implemented across the species entire Scottish range, totalling around 3000ha. This success is due to the partners combined knowledge of the butterfly's requirements, the current agri-environment scheme and the farmers willingness to work together.

### **O35.1.3**

#### **No Effect of Habitat Connectivity on Realized Dispersal Up to 10 Km for a Spore-dispersed Bryophyte**

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An efficient dispersal is crucial to species inhabiting transient substrates to be able to persist in a landscape. Bryophytes, pteridophytes, lichens and fungi have all wind-dispersed small diaspores and might have efficient dispersal if the diaspores reach higher air masses. We investigated how well an acrocarpous colonist moss *Disceium nudum* were able to disperse and establish at the scale of 1-10 km. The establishment rate on introduced substrate was measured at 14 sites with different connectivity (a high amount of suitable substrate [acidic clay] in the surroundings) within a landscape of 200 x 200 km in a region (Västerbotten) where the species has a substantial population. On each site 100 pots with clay were used as spore-traps. The colonization rate ranged from 4- 48%. There were no significant differences in establishment rate among the sites with high connectivity and those with low connectivity or between sites with and without the species within a radius of 1 km. The result implicate that a large population of a species with small diaspores (20 µm) in open landscapes can result in a spore deposition over extensive areas. This indicates that connectivity is not the main bottle neck for this kind of species.

### **O35.1.4**

#### **Applying Measures of Non-equilibrium Thermodynamics to the Assessment of Ecosystem Function in Landscapes Subjected to Rapid Change**

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Rising problems of human-induced climate change coupled with continued declines in global biodiversity challenge scientists with developing more effective strategies for the sustainable use of ecosystem goods and services. The theory of non-equilibrium thermodynamics offers a useful framework for evaluating landscape integrity and for understanding the dynamics of ecosystems that are subject to direct disturbances as well as to modified regimes of energy input and other climate change-related impacts. To substantiate this theory requires empirical measures of landscape functionality, for instance the dissipation and storage of incoming solar energy, defined as eco-exergy. In this study, eco-exergy is assessed for a range of land cover types at local, landscape and global scales by measuring three proxy indicators of non-equilibrium thermodynamics - biomass, networks and information. Surface temperature readings are also used to test the thermodynamic efficiency of ecosystems at different states of succession and degradation. In forests, values for biomass and vegetation functional index increase with age and management release with a corresponding rise in temperature attenuation. Global biomes that record high values in all three thermodynamic attributes but low for human disturbance appear more efficient at dissipating energy. A global systems map for thermodynamic efficiency is generated.

### O35.1.5

#### Biodiversity Enhancement and Landscape Restoration at the Stonehenge World Heritage Site, UK

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As part of the Stonehenge World Heritage Site Management Plan, over 500 hectares of chalk grassland have been restored in Wiltshire, UK. This aimed to re-connect the isolated fragments of ancient chalk grassland and provided an opportunity to investigate the ecological benefits of landscape restoration and what factors affect the re-colonization process of target taxa.

In collaboration with the National Trust, field surveys were undertaken using Lepidoptera (Butterflies and day-flying moths) as bio-indicators of restoration success. Surveys located within and across the edges of the different habitat types showed that restored grasslands can approach the ecological conditions of the target ancient chalk grassland habitat and increase in biodiversity value within 10 years. Additionally, results suggest that even recent restoration (1 or 2 years old) may reduce the functional isolation of ancient chalk grassland fragments.

Ancient chalk grassland fragments had higher Lepidoptera densities compared to adjacent habitats and specialist species such as *Lysandra bellargus* (Adonis blue) for example, were absent from restored grasslands and restricted to ancient chalk grassland fragments.

These results suggest that although apparently rapid restoration success is achievable for some habitats and species, additional management will be needed to assist the re-colonization of specialist species to restored sites.

### O35.1.6

#### The Cumulative Impact of Windfarms on Two Bat Species, *N.leisleri* and *P. pipistrellus*: A Regional Landscape Approach

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Because of the massive expansion of windfarms in Europe, impact assessment should look at cumulative impacts on sensitive wildlife besides considering local effects. To tackle this goal we developed a regional scale analysis for the Molise region (central Italy). We generated habitat suitability maps (HSM) for two bats especially exposed to windfarm impact, *Nyctalus leisleri* and *Pipistrellus pipistrellus*. We built 1) a combined HSM for the two species; 2) a map of 150-m buffers around existing and planned wind turbines, estimating the short-range area of impact. Maps were overlaid to assess the degree of habitat loss and fragmentation caused by windfarms. HSMs were statistically robust (AUC = 0.80 for *P. pipistrellus* and 0.83 for *N. leisleri*), and revealed that 41% of the region was suitable for both species. Over 51% of planned turbines and 67% of existing ones affected respectively 1092ha and 699ha of habitat suitable for both species. Compared to the map with no turbines in such areas habitat patch size decreased and fragmentation increased. These results indicate significant large scale impacts bearing serious conservation consequences and a high risk of interference with long-range movements of bats such as those observed along flyway corridors.

### **O35.2.1**

#### **Assessing the Zone-specific Management Effectiveness in a Central European Biosphere Reserve**

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The conservation strategy of Biosphere Reserves (BR) aims at integrating biodiversity and ecosystem service conservation with economic development by designating zones of different protection and use intensities, and seems to be predestined to manage valuable cultural landscapes.

Using the example of the German BR "Oberlausitzer Heide- und Teichlandschaft", I developed a framework to assess the effectiveness of central European BRs in meeting their land cover related management goals. Based on digital biotope maps of 1992 and 2005, I defined and assessed the land cover change processes relevant to the BR management and compared the changes in the core-, buffer-, and transition zones and in the surrounding landscape by means of a geographical information system. Findings include i.a. that land cover development differs in parts more between the different zones inside the BR than between inside and outside the BR. Some desirable processes such as semi-natural forest conversion and gain of valuable biotopes covered even more area outside than in the transition zone. I conclude that for the transition zone to show more concrete conservation effects beyond a greater acceptance and consciousness by land users, incentives for conservation-oriented land use change like market-based policy instruments should be advertised more proactively.

### **O35.2.2**

#### **The Influence of Forest Edges on Foraging Behavior of Mountain Hares (*Lepus timidus*) in a Natural Forest Mosaic**

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We examined foraging patterns of mountain hares (*Lepus timidus*) along transects crossing edges between unmanaged mountain birch (*Betula pubescens ssp. czerepanovii*) forest and open areas (mires and lake ice). The objective was to understand and predict how habitat fragmentation may influence behaviour and population dynamics of herbivores. Foraging activity was measured as the amount of artificially-placed food that the hares consumed at varying distances from forest edges. A negative correlation between distance from edge and the amount of consumed food existed along transects that extended onto lake ice, while correlations were weaker along transects on mires and within forest. Difference in consumption of the offered food was also evident between transects in forest as well as in open areas. As foraging response to edges was found only in parts of the study area, we infer that additional factors influencing foraging behaviour occurs over other and possibly larger spatial scales than we considered in this study.

### O35.2.3

#### Conservation of Metapopulations - Challenges for Developing Sustainable Conservation Strategies for Riparian Plants Associated with Dynamic Floodplain Habitats

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Riparian habitats are characterized by a high turn-over of patches due to disturbance by floods. Numerous studies have documented the importance of seed dispersal by water for riparian plants, leading to unidirectional gene flow patterns and an accumulation of genetic diversity in downstream populations. Using the example of the threatened riparian shrub *Myricaria germanica* which is capable of wind as well as water dispersal, we quantified patterns of gene flow and genetic diversity and we tested alternative hypotheses on population structure. We found a strong geographic trend in allelic richness, with low diversity populations being situated in southeastern Switzerland, and statistical modeling showed that the genetic variability differed substantially between genetic clusters.

Contemporary migration was bidirectional within the studied catchments, implying that dispersal vectors other than water are important for *M. germanica*. The lack of a relationship between population size and genetic diversity, as well as the nonlinearity of the relationship between differentiation and geographic distance supported the conclusion that populations of *M. germanica* are not in equilibrium, but the species forms metapopulations, similar to several other rare riparian plants. These findings have important implications for our understanding of riparian flora, and for the conservation of threatened riparian plants.

### O35.2.4

#### Grasshopper Warbler *Locustella naevia* Breeding Habitat in Britain

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The Grasshopper Warbler is currently red listed as a UK bird of conservation concern on account of rapid population decline for unknown reasons. This study sought to identify universal habitat features used by Grasshopper Warbler; provide greater understanding of how habitat change may have driven population declines, and point to potential management solutions. We quantified how to best detect singing Grasshopper Warblers and characterised breeding habitat at 210 singing and comparison positions across 22 sites in England and Scotland. We assessed whether predicted breeding habitat was being filled, and what the current habitat was at known vacated sites. Breeding habitat across a variety of landscape types was characterised by: dense, dead vegetation, vertical structure; less dense vegetation at or above 2 m; softer soil, and potential song posts. Not all of the apparently suitable habitat was filled, but almost all of the vacated habitat had succeeded or been managed beyond suitability. It seems likely that the breeding habitat of Grasshopper Warblers is somewhat limited and there was good evidence for the importance of the structural aspects, of their preferred habitat. The area of preferred Grasshopper Warbler habitat could be increased through strategic and active management in a number of settings.

### O35.2.5

#### Landscape Context Affects the Relative Importance of Grassland Fragmentation and Management for Insect Communities

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Habitat loss and degradation through abandonment or unsuitable management are among the major threats to European high-biodiversity grasslands. Recent studies suggest that grassland biodiversity can be negatively influenced by the degradation of its surrounding agricultural matrix. Habitat loss, management and matrix composition are often correlated, and a clear separation of their individual contributions to biodiversity loss has therefore remained a challenge. Here, we disentangled the effects of management (grazing, mowing and abandonment), patch connectivity and proportion of agricultural land (at radii of 500 and 1000m) based on a priori selection of orthogonal gradients. We sampled bees, syrphid flies and grasshoppers in 30 grasslands and analyzed abundance and diversity with generalized linear and generalized least squares models. Pollinator community diversity was consistently reduced by high proportion of agricultural land, and high connectivity enhanced bee and grasshopper diversity. In contrast, grazing and mowing increased diversity and abundance only for bees. We provide evidence that patch isolation by hostile surrounding agricultural land use and local grassland management can independently and interactively contribute to species loss in grasslands. These factors can work at different spatial scales, which should be considered in future conservation decisions.

### O35.2.6

#### Functional Connectivity of Pool Frog (*Rana lessonae*) Habitats

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In fragmented landscapes, functional connectivity between habitats is considered important for species persistence. Here, we apply network-based modeling (incorporating least cost path modeling) to analyse habitat connectivity of 167 localities of the red-listed pool frog (*Rana lessonae*) along the coastline of northern Upland, Sweden.

Connectivity was analysed, considering the pool frog's potential dispersal distance and preferred and avoided habitats. The pool frog localities were divided in three areas (Gårdskär, Hållnäs and Gräsö) that do not show any exchange of frogs between the areas in recent times.

Connectivity of pool frog localities varied between the three areas. Overall connectivity (Integral Index of Connectivity, IIC and Probability of Connectivity, PC) was highest in the Hållnäs area, whereas the Gårdskärs and Gräsö area showed highest connectivity in terms of the number of components (linked localities). Overall connectivity in all three areas depended on a few localities that accounted for a majority of links to other localities. Based on the connectivity analyses, we identify localities that are doomed to extinction and we suggest habitats that should be prioritized for restoration. We discuss the potential to extend the analyses by identifying future pool frog habitats on the rising seashores of the study area.

### **O35.2.7**

#### **Implementing Biotope Networks in Highly Fragmented Landscapes: A Forest Corridor System for the European Wildcat in Germany**

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Globally and especially throughout central Europe, landscape fragmentation is one of the main reasons for the loss of biological diversity. To counteract this process, the German environmental group Friends of the Earth Germany/BUND is developing 20,000 kilometers of migration corridors for the endangered European wildcat (*Felis silvestris silvestris*) by planting trees and bushes between isolated forest patches. Migration routes were calculated by combining a comprehensive wildcat habitat model with cost-distance analyses. Although the wildcat is the target species of the initiative many other species benefit, thereby improving the health of entire forest ecosystems. Since 2004, corridors have been realized in Thuringia, Lower Saxony and Rhineland-Palatinate. Five new corridors are scheduled. Furthermore, an open database with wildcat DNA samples from ten monitoring regions throughout Germany will be established, to characterize the population structure and migration patterns of individuals throughout Germany. In order to raise public awareness and gain support for this large conservation project, the BUND started an accompanying publicity campaign in 2010. Stakeholder dialogues and public relations are major parts of the campaign, which is funded by the EU (LIFE+). The BUND is now searching for partners for the next stage of the wildcat network - the international linkage.

### **O35.2.8**

#### **Landscape Connectivity Affects the Composition of Plant Communities in Urban Areas**

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Landscape connectivity, defined as the degree to which the landscape facilitates or impedes movement among resource patches, appeared as an important issue for biodiversity conservation. However, the use of landscape connectivity measures has been strongly criticized due to uncertainties in the estimation of those metrics and the lack of validation. Moreover, measures are always restricted to population level whereas management is generally carried out at the community level. Here, we used satellite imagery and network metrics to predict the landscape connectivity at community level for semi natural herbaceous patches in an urban area near Paris (France). We tested different methods, taking or not into account the spatial heterogeneity of matrix resistance estimated by the Normalized Difference Vegetation Index (NDVI), and quantifying the link strength between patches with shortest path and flow metrics. We assessed the fit of these connectivity predictions to empirical data on plant communities. Our results indicate that connectivity estimated with the flow metric and taking into account the matrix heterogeneity produce the best fit to the empirical data. Overall our study helped to estimate the landscape connectivity of urban area and we proposed recommendations to optimize landscape planning with respect to conservation of urban biodiversity.

## MARINE CONSERVATION

### O36.1.1

#### The Importance of Considering Uncertainty When Modelling the Population Viability of By-catch Species: An Application to Deepwater Elasmobranchs

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Conservation is increasingly developing an ecosystem based framework. Managing the ecosystem as a whole requires description of its different levels, consideration of species conservation as well as economic returns, all based on best use of biological knowledge. Therefore, when assessing the effect of fisheries on an ecosystem, by-catch species should be considered beside target species. Because data collected for non commercial species are often incomplete or absent, development and utilisation of techniques that consider uncertainty in population assessment is vital. We use a Leslie matrix model to explore population viability, accounting for uncertainty around input parameters (the species' life history traits), and to better understand the biology of the study species. Here, we focus on elasmobranchs, which are often a fisheries by-catch, in order to suggest management advices. Survival was found to be the parameter mostly contributing to the overall uncertainty. The particular importance of juveniles' survival is suggested from stable stage distributions and elasticity analyses. Our study suggests obtaining greater information on survival should be a major priority for conservation assessments of elasmobranchs. The method we have for exploring parameter uncertainty in models can have widespread applicability in helping to prioritise future data collection.

### O36.1.2

#### Morphological and Molecular Characterization of a Possible Hybrid among Diploria Genus Species

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*Diploria strigosa* and *Diploria clivosa* distributed in the Western Atlantic biogeographic region of the Caribbean. In Veracruz Reef System (SAV) is not possible differentiate as the number of escleroseptos in *Diploria spp.* varies from 11 to 38 escleroseptos/cm. In the present study use morphological and molecular markers for determination of the species *D. clivosa* and *D. strigosa*. Morphological studies we use the number of escleroseptos per centimeter, escleroseptos series and morphology of the colonies collected. Genetic analyses of two mitochondrial gene: Cytochrome Oxidase Subunit I (COI), Cytochrome b (cytb) and  $\beta$  Tubulin nuclear gene for molecular identification of the genus *Diploria*. Through BLAST analysis, we analyzed the sequences obtained with those reported in GenBank, reveals in each of the sequences were similar to those reported for *D. strigosa*, and *D. clivosa* but the morphology of the colonies not corresponded to molecular results, showing high phenotypic variation with possible hybrids formation. Potential SAV biogeography isolation limited gene flow between other populations reefs with SAV and the presence of morphological variability in *Diploria spp.* of SAV might be the probable result of hybridization between these species.

### O36.1.3

#### Conservation Issues for *Nautilus pompilius*: Separation and Speciation

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As the sole extant cephalopod with an external shell, *Nautilus* are subjected to extensive overexploitation by the shell trade. Their numbers are declining and as a consequence, populations are becoming increasingly isolated. East and west Australian clades of *Nautilus pompilius* have already been shown to demonstrate significant divergence, the pattern of which reflects their geographic separation. To elucidate the phylogenetic and systematic relationships between populations, within evolutionary clades, molecular analysis was undertaken on 7 extant populations. Fragment amplification and partial sequencing of the Cytochrome c oxidase subunit I gene region was conducted on individuals from both east and west Australian populations. Phylogenetic analysis demonstrated inter-population variation is correlated to geographic distance; west Australian populations appeared as one panmictic population unlike those sampled from the east Australian clade. The data reveals a much greater degree of separation between clades than within them, thus contributing to the reconstruction of *Nautilus* taxonomic history and enabling a greater understanding of their biogeographic dispersal. The unique genetic variation, both within and between clades, highlights the need to manage each discrete group as a single conservational unit.

### O36.1.4

#### Turning the Tide: Can Built Environments Expand the Spectrum of Conservation Choices and Ecological Trajectories for Marine Intertidal and Subtidal Communities?

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Centuries of industrialization has incrementally transformed coastal-marine shorelines from extensive marsh and reef systems into rocky shore mimics world-wide. Could the upgrading and re-purposing of these post-industrial waterfront cities, along with new cities and coastal defenses, offer opportunities to re-think how science and policy are practiced at the marine edge? To develop an understanding of the interplay of evolving marine science, policy and engineering design over time, a review of development histories and outcomes for 3 large-scale marinas in Seattle, Washington developed between the early 1900s - 2000s was conducted through archival research and field visits. While ecological knowledge increased over time, two biases limited the potential of ecological enhancements in all 3 cases: a) little agreement on habitat equivalency for mitigated replacement of intertidal-subtidal systems, and b) policy biases for endangered species, e.g. salmon, resulting in interesting, but ecologically skewed habitat creations. This has broad implications for reviews, permits and designs of marine infrastructure. In addition to conservation and restoration actions, we conclude that a network of in-situ coastal laboratories are also required to test how natural-built environment hybrids may generate ecologically positive habitats, and to help shift the ecological trajectories of coastal-marine developments from degradation to enhancement.

### O36.1.5

#### Can the Convention on Biological Diversity's "Aichi" Targets Turn Back the Tide of Marine Biodiversity Loss?

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The conservation of marine biological diversity necessarily requires a strong and uniform global governance response. However, the text of the Convention on Biological Diversity (CBD) deals only generally and indirectly with marine biodiversity conservation. Nevertheless, its new "Aichi" targets (agreed in the strategic plan negotiated at Nagoya, Japan in 2010) expressly sets marine conservation targets to be achieved in some cases within the next ten years. This presentation evaluates the likely impact of these marine targets by, first, comparing them with the previous "2010" targets which, by the CBD's own admission, failed to achieve their goals and, second, by evaluating whether the chosen trajectory of the CBD, to develop its strategy through "soft" voluntary targets rather than through "hard" legal obligations, is an appropriate strategy for global marine conservation.

### **O36.1.6**

#### **The PISCES Project: Ecosystem Approach Guidelines Developed Through Multi-sector, Multi-national Stakeholder Engagement and Collaboration in the Celtic Sea**

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The Celtic Sea is under growing pressure from human activities and lack of coordinated marine planning and management. The ecosystem approach (EA) is being increasingly advocated as the solution for delivering sustainable marine management, and is now embedded in European marine policy (e.g. the EU Marine Strategy Framework Directive). However, there is little understanding of how the EA should be delivered, and what it means in practice for policy implementation and marine users. PISCES, a three-year, EC funded project led by WWF UK, is working with a multi-sector, multi-national group of stakeholders from the UK, France, Ireland and Spain, to develop practical guidelines on the implementation of the EA in the Celtic Sea. PISCES stakeholders have identified actions needed to deliver the EA including: a future model for stakeholder participation in Celtic Sea management; communication of the EA; current and potential sustainable practices; and recommendations for Celtic Sea governments. The guidelines, aimed at policy-makers, sea-users, and marine managers, will be launched in late 2012 for application in the Celtic Sea, other EU waters and beyond. The PISCES project's innovative, stakeholder-led approach demonstrates the benefits of stakeholder involvement in helping to foster multi-sector, trans-boundary working based on trust and mutual understanding.

### **O36.1.7**

#### **Predicting Interactions between Recolonising Marine Mammals and Fisheries and Defining Precautionary Management**

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Interactions between fisheries and marine mammals have created costly and unresolved issues throughout the world. This study examines the spatial and resource overlaps between recolonising New Zealand sea lions, *Phocarctos hookeri*, and local fisheries on the Otago coast, New Zealand. We obtained foraging areas of sea lions from satellite tracking data and determined their annual prey consumption from diet and energy content of prey. Spatial fishery catch data were obtained from the Ministry of Fisheries. We extracted areas where fishing took place and annual amounts of fish taken by fisheries within foraging areas of sea lions. In a GIS, sea lion and fishery results were compared. We predicted that incidental deaths in fishing gear (bycatch) and resource competition will arise as the sea lion population increases. Preventive management methods (e.g. marine protected areas) and monitoring studies (e.g. fish stock assessments) are proposed. The use of precautionary management could ensure sustainable profitable fisheries and successful recolonisation by sea lions at Otago and it could be used as a case study for other areas with recovering marine mammal populations that interact with fisheries.

### O36.1.8

#### Ingested Microplastics in the Norway Lobster (*Nephrops norvegicus*) from High Intensity Fishing Regions of the Clyde Sea Area

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Ingestion of plastic debris has been recorded in a range of marine organisms occupying a variety of habitats. Growing interest in the impacts of plastic on invertebrates has been driven by observed increases in the proportion of microplastic debris, measuring less than 5mm in diameter. *Nephrops norvegicus* (L.), a species of high economic importance in both Scotland and wider Europe, has been previously observed to accumulate microplastics. In this study, analysis of the gut contents of 842 *Nephrops* sampled from high intensity fishing regions of the Clyde Sea Area showed 87.8% occurrence of plastic. The most frequently observed plastic type was fragmented plastic filaments, recorded in all but two of the contaminated individuals. No significant difference was found between the median carapace lengths of groups of individuals at each level of plastic aggregation, suggesting ingested plastic may be eliminated by some method and not accumulated over an organism's lifespan. The significant differences found between both moult stage and stomach fullness and the amount of retained plastic indicates that *Nephrops* may be able to expel plastic during ecdysis. The observed level of plastic contamination exceeds that reported in previous studies and indicates high microplastic exposure in the regions sampled.

## METHODS AND ANALYTICAL TOOLS

### O37.1.1

#### How to Choose an Efficient and Effective Sampling Strategy for Conservation Genetics Studies: A Software Tool for Scientists and Managers

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Genetic data for threatened species is commonly incorporated into conservation activities (e.g., detecting poaching, assessing admixture, quantifying differentiation). However there are few guidelines for planning a conservation genetic study and choosing the number of genetic markers, samples, and populations to incorporate. Thus many studies are undertaken without clear knowledge of the statistical power and reliability of results, making interpretation and application of data difficult or vague. We present a web-based, highly user-friendly software package developed to optimize sampling for a variety of conservation scenarios, providing straightforward, evidence-based advice for the project planning stage. The simulation-based tool includes several modules (bottlenecks, connectivity, assignment, hybridization, and temporal sampling) that are customizable for species-specific genetic and demographic parameters. Using case studies, we demonstrate situations in which small sample effort is sufficient, as well as situations in which genetic effects can be difficult to detect. We further show how to choose between using more markers and more individuals. The flexible yet simple tool is targeted to conservation managers and project planners who may not have expertise in genetics. This package is a deliverable of ConGRESS ([www.congressgenetics.eu](http://www.congressgenetics.eu)), a FP7 EU project to produce tools to incorporate genetic biodiversity into policy and management activities.

### **O37.1.2**

#### **Calculating Collision Rates with Power Lines for Bird Species of Special Conservation Concern**

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Effects of man-made objects like power lines include death of birds due to collisions. However, a lack of information on species-specific rates may hamper conservation efforts for species with an unfavorable conservation status, including species relevant in Natura 2000-legislation. Based on Environmental Impact Assessments presently carried out for Dutch power lines, we report collision rates with power lines of 35 bird species relevant in Natura 2000-legislation, of which 22 are included on the Dutch Red or Blue List. Among these, Black-tailed Godwit and Eurasian Curlew are near-threatened worldwide. Our new method to calculate species-specific collision rates is based on collision victim numbers in the past and population size and distribution during that time. Black-tailed Godwit and Eurasian Curlew are among the species with highest rates, perhaps due to their display flights over open areas or their flocking behaviour in winter. Our calculated rates compare well with either those calculated from other sources or with predictions from theory on manoeuvrability of species. Future modelling research with species-specific collision rates will indicate Dutch sites where species of high risk fall victim to power lines. This enables us to suggest main sites and ways to mitigate power lines using bird flight diverters.

### **O37.1.3**

#### **Estimating Connectivity in Fragmented Landscapes with the *Stochastic Movement Simulator (SMS)***

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It is now well established that species will need to move their ranges in response to climate change. However, for many species, their ability to relocate may be severely restricted or prevented by habitat fragmentation. Conservation action has the potential to mitigate in this regard, but only if it is well informed as to which species are most affected, and how habitat connectivity should be improved for the benefit of affected species. Functional connectivity estimates, such as least cost paths (LCP), have been shown to be a slight improvement on structural measures, but have several limitations. Here, we present an alternative individual-based modelling approach, designed to predict dispersal of animals in fragmented landscapes. We show that connectivity can be highly sensitive to a species' perceptual range, as well as to its movement behaviour. We applied the model to real landscapes and species and assessed its performance by comparing its predictions on movement quantities and directions with those inferred from population genetics. We show that our model is a better predictor of genetic connectivity than LCP, and thus has the potential to inform management of fragmented landscape for conservation of endangered species.

### **O37.1.4**

#### **Population Size Estimation for Capercaillie (*Tetrao Urogallus L.*) Using DNA-Based Individual Recognition and Spatial Capture-recapture Models**

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Estimation of key population parameters is important in ecology, evolutionary biology and conservation biology. Recent advances in both molecular identification of individuals and statistical modeling have opened up new opportunities to study the state and the dynamics of animal populations. We conducted a survey of an endangered and cryptic forest grouse, the capercaillie *Tetrao urogallus*, based on droppings collected on two sampling occasions in eight forest fragments in central Switzerland in early spring 2009. We then used molecular methods to sex and individually identify birds. To account for imperfect detection, we built a spatial capture-recapture (SCR) model that jointly modeled detection error and the clustering of individual detections around activity centers of individual birds. A total of 127 capercaillie genotypes was identified (77 males, 46 females, and 4 of unknown sex). Bayesian analysis of the SCR model yielded a total population size estimate of 137.3 capercaillies (posterior sd 4.2, 95% CRI 130-147). The observed sex ratio was 0.63 and appeared to be skewed towards males. Our study suggests that the combination of modern approaches of data collection and data analyses greatly enhances assessment of population parameters in elusive species such as the capercaillie.

### **O37.1.5**

#### **Cardiac Activity of Mussels for Control of Water Quality and Conservation of Aquatic Ecosystem**

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The physiological status of aquatic animals is an important tool for assessment of water quality and ecosystem health. Original fiber-optic noninvasive method for registration and analysis of cardiac activity in macroinvertebrates with shells was elaborated in 1990s (Kholodkevich et al., 1999). This method is based on infrared light remote registration of the heart muscle volume change. Aim of this study is developing of this methodological approach for bivalve mollusks. We estimate heart rate in the three species of freshwater bivalves (*Unio pictorum*, *Anodonta cygnea*, *Dreissena polymorpha*) collected from the Neva River estuary and Rybinsk Reservoir, northwestern Russia. For the first time, we found that recovery time of the heart rate in mollusks after functional loading (increase of water salinity) to the reference heart rate is new biomarker of their physiological status. We found significant difference in the heart rate of unionids between contaminated and reference sites. The recovery time of mollusks was 20-30 min in reference sites and reached 90 min in contaminated sites. We conclude that the cardiac activity in mollusks is good physiological biomarker for assessment of health, management and conservation of freshwater ecosystems.

### **O37.1.6**

#### **Computational Methods for Allocation of Habitat Management, Maintenance, Restoration and Offsetting, When Conservation Actions Have Uncertain Consequences**

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We introduce computational methods for conservation resource allocation, to help with decisions about targeting of protection, habitat management, maintenance and restoration or biodiversity offsetting. We construct a framework, where conservation actions have different responses for different biodiversity features in different environments, and in which the time perspective and uncertainty in responses are explicitly considered. We also account for variable costs of actions in different environments. Both negative consequences of uncertainty (robustness analysis) and positive aspects of uncertainty (opportunity analysis) are addressed. We integrate scoring and complementarity approaches in a unified approach to conservation resource allocation. We optimize the combination of actions to maximize conservation value given uncertainty, costs, limited resources, different robustness requirements and limits to the area in which different actions can be undertaken. Accounting for the uncertainty in responses to actions or accounting for time can significantly change the optimal combination of actions. The proposed methods have been implemented in a software package called RobOff (originally the "Robust Offsets calculator"). Thereby it is possible for the first time to effectively find solutions to a significant set of conservation resource allocation problems. These analyses can assist conservation scientists and managers in decision making based on quantitative analysis.

### **O37.1.7**

#### **Meta-analysis: Need for a Well-defined Usage in Conservation Biology**

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Meta-analysis is a powerful statistical method to summarize research findings across studies. Originally developed and applied in medical, physical, and behavioral sciences, there have been published several articles on meta-analysis in the field of conservation biology since the 90s. However, conducting a meta-analysis is still not common in conservation, and, moreover, the term is not well-defined. Consequently, the specific methodology of a meta-analysis is often confounded with other approaches to summarize research findings across studies, e.g. vote counting. We conducted a literature search for meta-analyses in the Web of Knowledge and found about 160 studies. We analyzed articles regarding their usage of the term meta-analyses and found that almost half of the articles did not apply the term correctly. Rather meta-analysis was used to refer to narrative and quantitative reviews or to vote-counting. We encourage scientists to apply the advantageous methodology of a meta-analysis in their studies and call for a clear and correct usage of the term meta-analysis, i.e. referring to the specific methodology used in the medical sciences.

### **O37.1.8**

#### **How Much Do Life History Traits Explain Plant Dispersal Patterns in Highly Fragmented Urban Landscapes? Insights from Stochastic Patch Occupancy Models (SPOMs)**

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Urban landscapes are highly fragmented, i.e. small, isolated habitat patches embedded in a hostile matrix. Improving connectivity requires a better understanding of how organisms disperse in cities. To address this issue, we focused on the spaces around the basis of street trees, considered as a quasi-experimental patchy system (single, small, regularly spaced patches vs. impervious matrix). We collected data on the spontaneous flora around 1500 street trees in Paris (France) in 2009, 2010 and 2011. For all species occurring often enough, we used stochastic patch occupancy models (SPOMs) to estimate colonisation and extinction rates and to calculate dispersal kernels. We compared dispersal patterns among species according to their characteristics (including life history traits). The spatial distribution of occupied patches was quite stable over years for some species, while for others it was reshaped every year through high local extinction and colonisation rates. Dispersal kernels were significantly correlated with seed dispersal vector, but also with other life history traits (e.g. pollination) and with urban affinity. It has been recently suggested that street trees might play as “stepping-stone” corridors in an urban green network. Our results suggest that this could be right not for all, but for a subset of species.

## **POPULATION ECOLOGY AND CONSERVATION**

### **O40.1.1**

#### **The Role of Social System in the Extinction Threats in Primates**

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Nowadays, more than half of the Primate species are threatened by extinction mainly due to habitat alteration and overharvesting. However, Primates do not all respond in the same way to these threats. In parallel with the determination of extrinsic factors of extinction, it is also necessary to identify the factors constituting the intrinsic vulnerability. Life history traits associated with a slow life-cycle, and low ecological flexibility increase primates vulnerability to extrinsic factors, but little is known of the potential impact of social systems, albeit the fact that several of its components may result in a social Allee Effect. Here we studied how the social system could affect species intrinsic vulnerability in terms of their global extinction risk, and in terms of their response to particular anthropogenic pressures (hunting, logging and agriculture). To do so, we performed a comparative analysis using Generalized Estimating Equations and found several effects of the social system variables on intrinsic vulnerability for both specific threats and global extinction risk. Our results indicate that social systems affect species vulnerability, but the traits implicated depend on the type of anthropogenic pressure and their interplay.

## O40.1.2

### **Living on the Edge: The Influence of Winter Haul-out Locations on Tenure Length in Male New Zealand Sea Lions**

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The New Zealand sea lion, *Phocarctos hookeri*, is a large threatened polygamous pinniped, endemic to New Zealand. Breeding occurs annually during the austral summer on subAntarctic islands, the edge of their historic range, including three colonies at the Auckland Islands. During breeding, males compete to establish territories on the breeding beach within the female aggregation. Outside the breeding season, some males disperse up to 930km away from the Auckland Islands. We hypothesize that the males that undertake seasonal migrations gain an advantage in their ability to access females at the breeding colonies by exploiting better food resources. During the 2010 and 2011 breeding seasons, we recorded the daily status and position of permanently marked adult males (n=170) at the Sandy Bay breeding colony. Of the marked males, 120 did not appear to migrate and 75% of these never held a territory with females, whereas 74% of males that migrated did. Migrating males held territories with females 4.1 days longer on average (5.3 days) than males that did not migrate (1.2 days). This infers that the Auckland Islands are marginal habitat for the species and food resources made available to males that seasonally migrate increases their chances of becoming successful breeders.

## O40.1.3

### **A Viability Analysis of the “Last Surviving” and Declining Moroccan Dorcas Gazelle Population (*Gazella dorcas massaesyia*) from M'Sabih Talaa, West Central Morocco: Implications for Conservation and Management**

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The M'Sabih Talaa dorcas gazelle in the mid-Atlantic plateau's coast are the only wild dorcas gazelle population in Morocco north of the Atlas range and is currently in the focus of conservationists and wildlife biologists. In addition, we carried out a preliminary population viability analysis (PVA) with demographic and life-history data available from other populations, simulating different management scenarios. and was indicative of inbreeding. The PVA yielded a generally poor outlook but at the same time showed that suggested management measures could significantly increase population viability. A sensitivity analysis revealed that inbreeding depression and possible catastrophes had a huge impact on the population's prospects and that the establishment of two subpopulations and successful attempts at reducing the consequences of catastrophic events were able to significantly mitigate the harmful effects of both inbreeding and environmental stochasticity. These results, in particular the splitting of the population, may be of general interest to conservationists dealing with unique threatened populations.

#### **O40.1.4**

##### **Investigating the Potential Causes of the Decline of the Wood Warbler *Phylloscopus sibilatrix*, a Long-distance Migrant Woodland Specialist**

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Amongst UK woodland bird species, those that have shown the most severe population declines have been long-distance migrant habitat specialists. Revisiting a study carried out in the same woods in the 1980s, we assess whether 1) habitat degradation, 2) increased rates of nest predation, 3) reduction in invertebrate food and 4) climate-induced resource asynchrony has played a role in the decline of the Wood Warbler *Phylloscopus sibilatrix* in Western Atlantic Oakwoods in mid Wales. Although certain habitat features were associated with abundance and population trends, there is little evidence to suggest that a reduction in habitat quality has driven the declines. Predation rates were typical for a ground-nesting species, and had not increased since the 1980s. There was no significant difference in the abundance of caterpillars between the two time periods, and this variation was not related to breeding success. Peak caterpillar abundance has advanced since the 1980s; however, Wood Warbler nesting activity also varied annually leading to some degree of synchrony. Although the mid Wales population has declined by 24% since the 1980s, this is small compared to other UK regions, and our future work aims to compare our Welsh results with those from a more severely declining population.

#### **O40.1.5**

##### **Spatial Heterogeneity in the Relative Importance of Climatic Drivers in the High-Arctic, Wild Svalbard Reindeer**

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Climate change is more pronounced in the terrestrial Arctic than in any other biome. For arctic herbivores, the recent and anticipated future rise in temperatures may have important implications through direct as well as indirect effects on food plant availability. In particular, whether improved plant growth due to longer and warmer summers may override potentially negative effects of changes in snow-conditions and food accessibility during winter is essential for our predictive understanding of the viability of populations and species. We analysed the long-term dynamics of three populations of high-arctic wild Svalbard reindeer, our northernmost ungulate. A rapid shift in climate during the mid 1990's generated an increase in plant productivity, yet, at the same time, an increase in the frequency of rainy and icy winters. We show that these climatic drivers, although operating similarly among populations, may generate highly contrasting population trajectories owing to variation in their relative strength. Thus, whereas the coastal population has shown a recent dramatic decline, the two more inland populations have increased in size. This suggests spatial heterogeneity in the relative importance of changes in summer and winter conditions, which may act as a buffer against climate change and thereby improve species viability.

## O40.1.6

### **It's Time to Help Barn Swallows! A Regional Population Assessment of Distribution and Abundance of Barn Swallows *Hirundo rustica* in Northern Italy**

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Barn Swallows are dramatically declining in Northern Italy, having more than halved their population consistency in the last 20 years. In 2011 the project "It's time to help Barn Swallows" started with the aim of assessing the distribution and abundance of Barn Swallow populations in the whole Lombardy, a wide (about 25.000 km<sup>2</sup>) region in Northern Italy. Thanks to the collaboration of professional and volunteer ornithologists, 408 potential nesting sites (usually farms) in 10 study areas were surveyed according to a standardized protocol. Structure of rural buildings, presence of livestock farming, and land use around potential nest sites were also recorded during surveys. Barn Swallows were more abundant in the intensively cultivated low Po plain (up to  $8.45 \pm 1.54$  SE breeding pairs per squared km), and less in the highly urbanized morainic lowlands (as few as  $0.98 \pm 0.38$ ). Presence of breeding pairs was strictly linked to the presence of livestock at a farm, in good accordance with the results of previous studies. These data were used to produce maps of the distribution of barn swallows at regional scale, which may form the basis for planning conservation strategies for this species.

## O40.1.7

### **Population Dynamics of Eastern Imperial Eagles in Hungary: Effects of Illegal Poisoning and Anti-poisoning Campaign**

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The Hungarian population of the globally threatened eastern imperial eagles consists of ca. 150 pairs, which represents >60% of the total EU population. This small population is slowly but continuously increasing since the 1980's, but it is still vulnerable and far from saturation. Poisoning of imperial eagles was not noticed in Hungary till 2005, but during the last six years up to 50 specimens were found poisoned, therefore it became absolutely the first mortality factor for the species. BirdLife Hungary and National Park Directorates started an intensive anti-poisoning campaign in 2008 by involving the most important stakeholders, such as hunters, police and veterinarians. The causes behind the incidents were identified and an action plan was initiated.

In the recent study we show that the sudden increase of poisoning incidents decreased the annual growth of the population (from +10% in average between 2003-2006 to +4% by 2007-2008), although it did not revise the trend in short-time, which could be expected from the huge number of affected specimens. After the anti-poisoning campaign started the number of poisoning incidents decreased dramatically for the next year and the annual growth of the population increased significantly (up to +18% in average between 2009-2011).

### O40.1.8

#### Transplanting Epiphytic Lichens for Conservation Measures: Improving Population Stability and Mating-type Balance

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Forest management and catastrophic forest stand disturbance frequently reduce small populations of rare and endangered tree colonizing lichen species below the size of viable populations. During the past twenty years we have developed methods to transplant fragments of lichen thalli to increase the number of colonized trees in forest landscapes. We will show results of long-term experiments with the critically endangered lichen species *Erioderma pedicellatum* (Newfoundland) and *Bunodophoron melanocarpus* (Switzerland) and discuss flanking measures that can facilitate the success of population augmentations. Recently we have developed mating-type specific markers to determine imbalanced mating type frequencies in small populations of the threatened old-growth forest lichen *Lobaria pulmonaria*. Transplanting thalli with complementary mat-idiomorphs will be discussed as an instrument to increase the frequency of sexual reproduction in this mostly asexually reproducing lichen species.

### O40.2.1

#### Niche Models Tell Half the Story: Spatial Context and Life History Traits Influence Species Responses to Global Change

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While niche models are typically used to assess species vulnerability to climate change, they have been criticized for their limited assessment of threats other than climate change. We attempt to evaluate this limitation by combining niche models with life history models to investigate the relative influence of climate change and a range of fire regimes on the viability of *Leucopogon setiger*.

Altered fire regime, in particular more frequent fires relative to the historic regime, was predicted to be the main threat to this species, which may reflect a vulnerability of obligate seeders in general. Range shifts induced by climate change were a secondary threat when habitat reductions were predicted. Incorporating life history traits into habitat suitability models by linking species distribution models with population models allowed for the population-level evaluation of multiple stressors that affect population dynamics and habitat, ultimately providing a greater understanding of global change impacts than would be gained by niche models alone. Further investigations of this type could elucidate how particular bioecological factors can affect certain types of species under global change, and help inform conservation efforts.

## O40.2.2

### Factors Affecting Road Mortality of the Grassland Butterflies

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Roads have important consequences for population dynamics of animals through the habitat fragmentation and mortality of individuals. Most of studies on road mortality were done on vertebrates. Impact of roads on mortality of insects is barely known. It is a gap because road verges are regarded as important tool for insect conservation. In this study we investigated which factors affect number of roadkills in grassland butterflies. We established 60, 200 m long transects along roads differing in traffic volume in Polish farmland. Number of butterflies killed on roads was positively dependent on number of butterflies living on road verges, and moderately correlated with a traffic volume. Also, number of roadkills was negatively correlated with share of grassland in a landscape. Ordination methods showed that species composition of the butterflies killed on roads was explained mostly by the species composition of butterflies living on road verges. Environmental factors explained little variation in species composition. There was a statistically significant tendency for small species to be overrepresented in a sample of roadkills than it was expected from species composition at road verges. Our results indicate that the use of road verges for insect conservation is a serious conservation dilemma.

## O40.2.3

### Conservation Genetics of a Wetland Grasshopper Species *Stethophyma grossum*

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The large marsh grasshopper *Stethophyma grossum* is strictly bound to wetlands and categorized as vulnerable in Switzerland. Conservation efforts should focus on facilitating migration and gene flow between existing and new populations. Therefore, we need to increase our understanding of the effect of different landscape elements on gene flow between grasshopper populations. We established a genetic dataset of all 37 populations found in an intensive agricultural area in Switzerland where three parallel river basins create ideal habitats for this species. With a landscape genetic analysis we determined that a strong influence of the landscape on migration rates was only apparent between population pairs that were within a 3 km radius from one another. Population network topology showed that all populations were connected to at least two other populations at a maximum migration distance of 3264 m, which may explain the reduced landscape effect for larger migration distances. Three major clusters were detected by spatial genetic clustering. These clusters coincided with the three river basins, but also with the three well-connected groups of populations in the population network. We conclude that conservation efforts should not only take the landscape between populations into account, but also the overall population network topology.

#### O40.2.4

##### **Broad-scale Upland Land Use Influences Nesting Success and Population Trends of a Breeding Wader: The Eurasian Curlew *Numenius arquata***

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A suite of upland breeding waders have shown large population declines in the UK and elsewhere in Europe. These birds are exposed to broad-scale land uses that may exert significant ecosystem change; in the UK the dominant upland land uses are sheep grazing, commercial forestry and sport shooting of red grouse, the latter incorporating vegetation burning and predator control. Here we use the Eurasian Curlew *Numenius arquata* as a focal species of high conservation concern (Globally Near Threatened), to examine how upland land use influences nesting success and population change. Population changes over an 8 - 10 year period were positively related to the density of gamekeepers (an index of predator control), and negatively related to grazing intensity. Nest hatching success was positively related to the density of gamekeepers and the intensity of vegetation burning, and negatively to sheep abundance, proximity to forestry and a gradient from grass to heather dominated plots. This study provides strong evidence for both positive and negative effects of the dominant upland land uses (sheep grazing, forestry and grouse moor management) on nesting success and population change of a breeding bird of conservation concern, requiring broad-scale implementation of conservation measures.

#### O40.2.5

##### **Long-term Status of a Small Cetacean Population in a Protected Area**

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EU legislation requires regular assessments of trends in protected populations to inform management and conservation. We present the first robust evidence of long-term trends and use of an EU Special Area of Conservation by a small cetacean population. The abundance of bottlenose dolphins within the Moray Firth SAC was estimated from 1990-2010 with a refined mark-recapture method, accounting for sampling heterogeneity. A Bayesian capture-recapture model was used to estimate the trends in abundance for the entire east coast of Scotland bottlenose dolphin population (1990-2010). These suggest that the number of dolphins using the SAC has remained stable and there is a 99% probability that the total east coast population is stable or increasing. However, the proportion of the population using the SAC decreased over this time period, while usage of the SAC remained high. In the summers of 2006-2010, acoustic loggers detected dolphins for a median of 5 hours per day and the average probability of encountering dolphins in a core area from 2002-2010 was 69%. This evidence suggests that the decreasing trend in the proportion of the population using the SAC is driven by an increase in the overall population size, rather than fewer individual dolphins using the SAC.

## O40.2.6

### **Abundance of Rare and Elusive Species: Empirical Investigation of Closed vs. Spatially Explicit Capture-recapture Models with Lynx as a Case Study**

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Effective conservation and management require reliable monitoring methods and estimates of abundance to prioritize human and financial investments. Camera trapping is a non-invasive sampling method enabling the use of capture-recapture (CR) model to estimate abundance while accounting for the difficulty of detecting individuals in the wild. Here, we investigated the relative performance of classical closed CR models and spatially explicit CR models (SECR) that incorporate spatial information in the data. Using simulations, we considered four scenarios comparing low vs. high detection probability and small vs. large populations and confronted abundance estimates obtained from both approaches. The SECR model was closer to true abundance and more precise than classical CR models and associated confidence intervals provided better coverage than their non-spatial counterpart. SECR models exhibit better statistical performance than standard closed CR models and allow producing sound management strategies through maps of activity centers density. To illustrate the comparison, we considered the Eurasian lynx (*Lynx lynx*) as a case study and provided the first abundance estimates of local populations in France.

## O40.3.1

### **The Long-term Risks of Exposure to Anthropogenic Habitat: Altered Ageing Rates and Reduced Lifetime Reproductive Success in a Threatened Forest Specialist**

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The natal environment is known to have a long-term effect on the fitness trajectories of individuals. For a habitat specialist, exposure to anthropogenic habitat in early life may have a lasting, detrimental impact on fitness, but there is currently a lack of empirical evidence for such an effect. We address this issue using 15 years of complete longitudinal data for the reintroduced Mauritius kestrel (*Falco punctatus*), a tropical forest specialist occupying a fragmented forest/agriculture landscape. We examined whether agricultural habitat within the natal territory is linked to variation in individuals' lifespans and age-specific fledgling production. We controlled for the potentially confounding effects of adult habitat experience and cohort-level environmental variation. We then investigated the consequences of these altered schedules for lifetime reproductive success (LRS). Kestrels from natal territories containing agriculture had shorter lifespans, and an earlier and greater peak reproductive output, followed by earlier, and more rapid reproductive senescence. The net result was that the LRS of kestrels from agricultural territories was lower than their non-agricultural counterparts. Thus, anthropogenic habitat in early life has a long-term impact on individual fitness, and highlights the need to investigate -and prepare for- potentially delayed impacts of habitat change on populations.

### O40.3.2

#### A Population Health Check for Birds: Towards an Early Warning System for Conservation, Based on Insights from Population Modelling

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Red lists are a powerful communication tool to inform the general public and policy makers that species are under threat. However, red list criteria are usually not informative concerning the underlying causes of decline that leads to a Red List status, nor do they help us to formulate management options. To overcome these limitations, we are exploring the utility of population demographical data as key elements for science based conservation. We have started to collect and integrate monitoring and population demographical data for as many bird species occurring in The Netherlands as possible. We are currently developing a generic toolbox to integrate the data. Integral projection models are employed to determine the relative contributions of the demographic vital rates to population growth rates, and more importantly to population fluctuations. This information should allow us to understand the causes of these fluctuations and to make inferences about future Red List status. Based on this information we will construct an information system as a 'cockpit' with gauges that indicate the health of the population. These analyses will form the basis for an Early Warning System of bird populations and a scientific basis for conservation plans, focused on Red Listed species.

### O40.3.3

#### Getting Started: The Initiation of an *Ex situ* Collection of the European Endemic *Gentianella bohemica* (Gentianaceae) - Population Genetic and Reproductive Insights

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*Gentianella bohemica* is endemic to extensively used grasslands in the Bohemian Massif and protected by the EU Habitats Directive. Besides the conservation issue, it is of evolutionary interest due to its seasonal differentiation with two phenologically non-overlapping cohorts. Early-flowering populations are currently known only from our study area, the Lower Austrian Waldviertel. We investigated breeding system, pollination, and AFLP constitution to elucidate the origin, taxonomic and conservation status of the seasonal cohorts. Our observations indicated longer flowering and higher pollinator activity in late-flowering populations. Bagging experiments (80 June, 135 September flowers) showed differential reproductive fitness including differences between varying cross-pollination treatments. The AFLP data of 290 individuals representing 15 populations showed the four early-flowering populations forming a discrete, but genetically depleted lineage. However, the degree of differentiation between the early- and late-flowering populations from the same region was similar to that among other regional groups of late-flowering populations, indicating strong isolation. Combining the results of cross-pollinations with AFLP-defined groupings demonstrated possible outbreeding depression. Therefore, our results stress the independent conservation significance of the early-flowering lineage and of three regional late-flowering groups in Lower Austria, which should all be represented in the *ex situ* collection of *G. bohemica*.

#### O40.3.4

##### Behavioural Correlates of Extinction Risk for Primate Populations in Timber Extraction Systems

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Understanding species extinction patterns has been a central approach in conservation science. Behavioural traits such as sexual selection and sociality have been shown to increase species vulnerability to disturbance. Here, we explore the importance of behavioural traits (social structure and reproductive behaviour) in local population declines following habitat disturbance (logging), while controlling for alternative intrinsic and extrinsic drivers. To achieve these goals, we analyse an unusually detailed global dataset for primate responses to logging, using generalised linear mixed models. We show that primate populations are more likely to decline following logging when the species is characterised by slow reproduction, small body size, and female are the dispersing sex. In contrast, social units based on pairs are associated with a lower vulnerability to logging. These variables do not, however, explain IUCN status of the species here examined. Our results support the existence of an Allee effect in many Primate species that can be triggered by a disturbance such as logging. They also highlight that traits associated to species vulnerability to a specific threat at a local level may differ from those identified at a global level.

#### O40.3.5

##### Linking Theories of Biological Control to Biological Conservation of Saproxyllic Insects

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In classical biological control, the way in which an enemy responds to changes in prey density is important for evaluation. Responses may be numerical (reproductive or migratory) or functional. Depending on the nature of these responses an evaluation of the efficacy of a biological control agent can be assessed. The natural enemy may have no effect, a limiting effect or in best cases a regulating effect on the prey population. A positive density dependent response is considered a requisite for population regulation and efficient biological control, i.e. the rate in population increase (numerical) or food intake (functional) increases with prey density. Such a reasoning may also be useful for evaluation of conservation actions. The nature of the response of a "predator" (e.g. a wood beetle) to changes in "prey" (wood) density may be used to evaluate the efficacy of creating or retaining dead wood. Also the nature of such responses may somewhat explain why certain species are sensitive and others not to decreasing wood amounts in the forest. Examples are given from threatened and non-threatened boreal forest insects.

#### O40.3.6

##### Overlapping Generations Can Mitigate the Fluctuations in the Activity Patterns of an Endangered Ground Beetle Species: Long-term Monitoring of the *Carabus hungaricus* Fabricius, 1792 in Hungary

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The population ecology of a highly endangered ground beetle species *Carabus hungaricus* was investigated in a sandy grassland, Hungary between 2006 and 2010. Proportion of the surviving beetles from the preceding year was found to contribute considerably (c.a. 20%) to the population size in the first three years of the study. Female survival rate was higher than male, but there were slight differences in the capture rate between sexes. Population size was around 2000 individuals, but the number of females was consistently higher than that of males. Population size decreased between 2006 and 2007, whilst the abundance of the beetles was the highest in 2008 and after that decreased monotonously toward 2010. The expected mean of the captures ( $79.11 \pm 59.18$ ) for the next year suggested by the ARIMA model suited well with the observed mean of captures ( $78.93 \pm 12.82$ ). Insect populations might be exposed to strong fluctuations especially in open habitats such as tall-grass steppe; such fluctuations increase their extinction risk. Despite the studied population showed considerable fluctuations in the activity pattern during the five years, its size seemed to be relatively stable. This promotes the importance of overlapping generations for survival of isolated populations.

### O40.3.7

#### Genetic Diversity and Structure of *Lobaria pulmonaria* in Fragments of Northern Hemisphere Rainforest

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A high diversity of epiphytic lichens is found in the boreal rainforest of central Norway, but only small patches of boreal rainforest remains due to clear cutting. We hypothesized that old forest associated lichens in the remaining *Picea abies* patches has suffered a depletion of genetic diversity. In order to test this hypothesis we assessed genetic diversity and structure in populations of the vulnerable epiphytic lichen *Lobaria pulmonaria* using eight SSR loci. We sampled thalli from *Picea abies* branches and propagules deposited in snow at three localities. All samples were mapped in a coordinate system to be used in spatial genetic analyses. Contrary to expectations, we found high genetic diversity in lichen and snow samples, and surprisingly high effective population sizes. Limited genetic differentiation between populations (mean  $F_{ST} = 0.07$ ),  $>1$  migrant per generation based on coalescent approach, and a high proportion of first generation immigrants indicated high connectivity across distances  $< 27$  km. Almost all genetic variation was due to variation within sites and spatial genetic structure within populations was absent or appeared on very small scales. The high genetic diversity in the remaining old forests shows that even relict forests might be suitable for conservation of genetic diversity.

### O40.3.8

#### The Combined Effects of Climate Change and Habitat Fragmentation on the Decline of a Flightless Wetland Grasshopper

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Deterioration and fragmentation of wetlands is of major concern for nature conservation. Many biota are strongly dependent on wetlands, including a large number of invertebrates. We studied population trends, mobility and population genetics of an endangered grasshopper, *Chorthippus montanus*. Our results suggest that this species is strongly threatened by climate change as it has lost all populations  $< 400$  m in Rhineland-Palatinate during the last 30 years. Furthermore, we found a very low mobility of this species on five study sites. However, mobility correlated positively with habitat size and negatively with vegetation density. We also performed mark-release experiments, which showed that mobility increased dramatically in unsuitable habitat (forest). In hybridization and mate choice experiments, we found out that *Ch. montanus* may hybridize rapidly with *Ch. parallelus*, particularly when heterospecific abundance is much higher than conspecific abundance. This might explain the records of intermediate morphotypes at localities where the *Ch. montanus* occurred before. Altogether, our results suggest that *Ch. montanus* is strongly threatened by climate change. Due to the strong fragmentation of the populations and its low dispersal abilities, it is not able to rapidly colonize suitable habitat. After periods of drought, it might be displaced by hybridization with *Ch. parallelus*.

#### O40.4.1

##### Lack of Conservation Efforts Leads Rapidly to Increased Great Ape Extinction Risk

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A network of resource management areas (RMAs) has been established across Africa in order to protect natural resources. Nevertheless, many of these areas are partially managed and scarcely protected. In this study, we evaluate how the lack of conservation efforts influences the extinction risk of a tropical forest umbrella species, the African great apes. We compiled information on the presence and absence of four different conservation efforts (law enforcement guards, tourism, research and local or international non-governmental conservation organizations (NGOs)). These were collected over a period of 20 years for 109 RMAs across tropical Africa. Furthermore, we collected anthropogenic and environmental variables and recent records on chimpanzee, bonobo and gorilla presence and absence. Results revealed that long-term presence of conservation efforts decrease great ape extinction risk. More in particular, lack of law enforcement guards is the most influential conservation effort on ape disappearance, as expected, rather than absence of research or tourism. Long-term presence of NGO has as well a positive influence on great ape persistence. This study calls for more evidence-based approach in conservation as an important tool for the quantification of the success of different conservation actions.

#### O40.4.2

##### Issues Currently Affecting Vulture Populations in Assam, India

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The populations of three species of Gyps vultures have been declined catastrophically in south Asia in recent years as a result of contamination of livestock carcasses with diclofenac and possibly to a lesser extent other NSAIDs (non-steroidal anti-inflammatory drug) with similar properties. To know the status and to initiate a long term conservation process for two Critically Endangered vultures (*G. tenuirostris* and *G. bengalensis*), a survey was initiated in 2003 and thereafter surveying and monitoring regularly to know about the factors which are currently affecting their survival. These include destruction of nests and cutting and thinning of nesting trees; egg collection for medicinal purposes, hunting chicks and adult birds for meat; being killed accidentally by vehicles and trains while feeding on carcasses on roads and railway tracks and poisoning of carcasses with insecticides to kill carnivores. The result suggests a decline of 50% of nestings of both species. In order to ensure the long-term conservation of vultures in wild in Assam, we propose: awareness campaigns among local communities to protect nests, nestlings and nesting trees; to use safer drugs in veterinary medicine instead of diclofenac and not to poison vultures' food sources.

### O40.4.3

#### Diversifying the Study of Functional Genetic Diversity: Wildlife Immunogenetics Using Toll-like Receptors

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Functional genetic markers are of key interest in conservation genetics for assessing how genetic diversity relates to adaptive potential of populations. In recent years, the dominant tool has been genes of the major histocompatibility complex (MHC), but evidence from model organisms suggests that at least half of the inter-individual variability in genetic immune responses may be a consequence of non-MHC genes. The growing body of immunogenetic data from model organism studies reveals additional potential targets of natural selection, diversifying the conservation genetics toolkit. One promising example is Toll-like receptors (TLRs): an ancient family of genes encoding transmembrane proteins that bind pathogen-associated molecular patterns of microorganisms and initiate both innate and adaptive aspects of the immune response. We optimised TLRs for a reintroduced population of New Zealand robins (*Petroica australis*) and found that five of the six TLRs we examined were polymorphic (each with two to four alleles) in the 12 founding individuals. All alleles exhibited non-synonymous (and therefore potentially functional) diversity in the binding region. Alongside MHC and microsatellites, these TLRs will be combined with survival and reproductive data to compare the effects of natural selection and genetic drift on genetic diversity in this intensely-studied population.

### O40.4.4

#### Evolutionary History of Four Species of Baltic Seals: Understanding Processes Underlying Population Extinction or Survival

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We studied the dynamics of population genetic changes in four species of seals that have inhabited the Baltic Sea during the Holocene: the extant ringed seal, harbour seal, and grey seal, and the harp seal that went extinct about 2,800 years ago. Comparison between modern (from years 1975-2005) and historical samples (1843-1970) of each extant species showed a decline in the number of mtDNA haplotypes and haplotype diversity without a decline in nucleotide diversity, consistent with a recent population bottleneck in the 1970's. Panmixia in historical populations of harbour and grey seals contrasted with contemporary genetic structure, which likely results from recent population declines and fragmentation. Subfossil samples (9,500-2,800 yBP) had higher haplotype and nucleotide diversity than historical samples of each extant species, suggesting that seal populations have been losing genetic variability throughout the Holocene, and not only as a result of recent population declines. Nucleotide diversity in ancient harp seals was comparable with harbour seals (known to have low population numbers throughout the Holocene) and lower than grey and ringed seals. Further analyses will be carried out to assess whether the low diversity was a cause or a result of a process leading to the harp seal extinction.

#### O40.4.5

##### A Success Story from a Swiss Lapwing Recovery Program

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Throughout Europe northern lapwings (*Vanellus vanellus*) have undergone substantial population decline in the past years and also in Switzerland the breeding population of lapwings has declined from over 1000 breeding pairs in the 1980ies to less than 100 in 2005. Main threats in modern agricultural landscape are the lack of suitable nesting habitat, nest destruction and high chick mortality due to agricultural activities and predation. In 2005 the Swiss Ornithological Institute started a recovery program for lapwings in a model population in the plain of Wauwil (CH). Successively several protection and recovery measures were implemented such as marking and protection of nests from destruction by land machines, electric fences to protect nests and chicks from ground predators and the application of lapwing fallow plots where undisturbed nesting was possible for first broods. All nestlings were individually marked to assess fledging success and local return rates. Nest and chick protection was effective in enhancing fledging success to levels that would allow stable population development. However, with the additional application of fallow plots that allow undisturbed breeding, breeding pairs raised more than 1 young annually, resulting in substantial population growth from initially 17 to 53 breeding pairs in 2011.

#### O40.4.6

##### Sex-biased Hunting as a Likely Source of Population Decline

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Trophy hunting is a common recreational activity, usually focused on breeding males. Because most of the species hunted in this way are polygynous, the idea that trophy hunting has no effect on demography is widespread. However, there is some evidence that sex-biased hunting can have important effects on population viability. We have analysed the demography of a highly endangered bird species, the Cantabrian capercaillie, which suffered from intensive male-biased hunting during the 20<sup>th</sup> century. We analysed the changes in genetic variation over the last 80 years, under the hypothesis that early population decline matched hunting intensity and that this decline was mainly due to a decrease in the number of breeding males. We combined maternal (mtDNA) and bi-parentally inherited genetic markers (microsatellites) to assess changes in the effective population size of females alone and for both sexes together. We found evidence of an early decrease in the effective population size for the microsatellites but not for the mtDNA, suggesting that it was due to a reduction in the number of breeding males. Because this decrease matched the time when male hunting was more intense, it points to this as a likely cause of population decline.

#### O40.4.7

##### From Rapid Surveys to Population Estimates of Inconspicuous Organisms: Estimating Survey Bias for Forest Lichens

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Estimates of population size and local species richness are essential tools for conservation planning. However, at the most relevant spatial scales, such data on inconspicuous species-rich taxon groups are usually scarce and of varied quality. We assessed various types of bias in stand-scale surveys of forest lichens in Estonia. In 2-ha plots, experienced observers detected approximately half of all species, but generally 1-10% of individuals, in 4 hours. Every doubling of effort roughly increased species-richness estimates by 20% in a given site, while gaining experience during subsequent surveys was a minor factor. Both total species richness and species abundances recorded varied more among experts than the number of species of conservation concern found; thus site ranking appears more robust when based on the latter. We conclude that rapid surveys (while being a useful conservation assessment method for diverse inconspicuous organisms) are very sensitive to variation in study effort. Also, surprisingly rich assemblages in exhaustively studied plots suggested that viable lichen populations may depend on many more individuals and better connectivity than rapid surveys might initially suggest. Hence, reserve planning for lichens might be most efficient when based on a combination of rapid standardized surveys and general habitat assessment.

#### **O40.4.8**

##### **Population Genetic Structure of Mussels (*Mytilus galloprovincialis*) in Central-Eastern Mediterranean Inferred by Microsatellite Markers**

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The Mediterranean mussel (*Mytilus galloprovincialis* Lamarck, 1819) is the indigenous species of mussel on the coasts of Central-Eastern Mediterranean. Despite its great commercial and economic importance for aquaculture purposes, restricted information is available concerning its population genetic structure in this area. The present study was designed to evaluate the genetic differentiation and variability of thirteen Central-Eastern Mediterranean mussel populations (9 Greek, 1 Turkish, 1 Croatian and 2 Italian) using microsatellites. Two of the populations studied were cultured while the rest were wild. Totally 22 microsatellite loci were screened, 10 of which were selected for further analysis. Statistical analyses indicated the presence of null alleles in 9 out of 10 loci. In addition extensive heterozygote deficiency occurred, even after null alleles correction, phenomenon very common in marine bivalves. On the other hand, no significant genetic differentiation and high levels of gene flow were revealed among the populations studied. Therefore, the panmictic model intuitively expected could not be rejected. Species' large larval dispersal, sea streams, shipping but mainly anthropogenic transports for farming explain briefly the latter observation. Thus, the genetic pattern of wild populations of *M. galloprovincialis* from Eastern Mediterranean has probably been largely influenced by the applied aquaculture practices.

### **PROTECTED AREA PLANNING AND DESIGN, NATURA 2000 & MPAs**

#### **O41.1.1**

##### **The Natural Habitats Monitoring System in Poland - Toward the Common EU Methodology**

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Article 11 of the Habitats Directive requires EU member states to monitor natural habitats of Community interest. Aiming to develop national monitoring system in Poland we carried out field and analytical research on 4295 study plots for 60 habitat types in 2006-2012. The huge database, containing e.g. phytosociological relevés, information on threats, and the most important - 45804 records with the indicators values and grades, was analyzed. The key features of the methodology are: (1) common structure of assessment for all habitats and species, (2) implementation of the biogeographic level way of grading (FV/U1/U2) on site level, plot level and in each of indicator grade, (3) flexible set of indicators for each of habitat type, (4) cheap and quick data acquisition method. The results enable appointment of 955 plots (21 %) with the state U2 (unfavourable - bad), where conservation measures should be urgently undertaken. Most of them were located in lowlands and were dependent on extensive agricultural use, suitable water conditions or were fragile to mechanical damage. One of the most important factor in forest habitats was the amount of deadwood and diverse structure of stands. The developed system can be easily adapted and implemented in other EU countries.

### **O41.1.2**

#### **Exploring the Impacts of Marine Spatial Zoning for Fisheries and Conservation Using an Ecosystem Model**

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Marine and coastal ecosystems are under increasing pressure from a diverse range of threats, and many governments have responded to these threats by developing marine protected area (MPA) networks. However, to date most of the theory behind marine spatial planning has paid little attention to how these MPA networks should be managed, whereas current practice focuses on producing MPA networks with varying levels of protection, ranging from no-take zones that prohibit all extractive activities to those where specific activities are restricted. To allow conservation practitioners and policymakers to consider the impact of these alternate management options, we used Marxan and Ecopath with Ecosim software packages to investigate the impact of applying different MPA management options in the Eastern English Channel on ecosystem function and fisheries stocks by: (i) comparing a network consisting solely of no-take MPAs with one containing multiple zones with different fishing restrictions; and (ii) exploring the predicted range of ecosystem responses that would arise through the associated redistribution of fishing effort. We demonstrate that these tools provide invaluable information to facilitate the evaluation of the impact of proposed MPA networks, especially by helping predict the potential impact associated with different zoning strategies and their management actions.

### **O41.1.3**

#### **Investigating the Impact of Size and Spacing Constraints on Marine Protected Area Network Design**

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Developing ecologically coherent Marine Protected Area (MPA) networks generally involves applying criteria for minimum MPA size and spacing, so several governments and researchers have recommended parameters for these spatial constraints. However, the effects of using them in conservation planning are poorly understood, despite this having potentially large impacts on network extent and comprehensiveness. Here we include these constraints in a systematic conservation planning assessment using data from England and measure their impact on the resultant MPA networks. This involved (i) using Marxan to identify networks of MPAs that met conservation targets, whilst minimising impacts on areas most used by the fishing industry, and (ii) using MinPatch to modify these networks, based on a range of minimum MPA size and spacing parameters. We found applying the minimum size constraints reduced the number and mean size of each MPA but had little impact on total MPA extent and configuration, whereas applying the minimum MPA size and spacing constraints produced larger impacts on the total MPA extent and MPA locations, although this was more influential when minimum spacing was low. These results highlight the importance of testing the impact of applying such constraints before making recommendations about their adoption in MPA network design.

#### **O41.1.4**

##### **The Use of Long-term Data on Seabird Foraging Distributions to Inform Designation of MPAs**

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The marine environment has changed dramatically in recent decades due to human activities and climate warming. Numbers of many seabird species have declined over the same period. A primary tool for safeguarding seabird populations is the designation of important habitats as Marine Protected Areas (MPAs). However, the identification of MPAs is complex, as population distributions may vary across seasons or years depending on environmental conditions, density dependence and within-individual effects. It is therefore crucial to quantify the extrinsic and intrinsic determinants of foraging distribution and designate marine areas that are important over a broad range of conditions. However, this is rarely possible because of the shortage of long-term data. We studied foraging distributions of European shags breeding on the Isle of May, NE Scotland over a 23-year period. 290 birds were deployed with locational loggers in 16 breeding seasons (1987 - 2010). Over this period, the population experienced significant environmental change, a ten-fold range in population size and five-fold range in annual breeding success. Despite this, the foraging distributions were strikingly consistent, enabling us to identify areas important in a range of conditions. These results have profound implications for the designation of MPAs that remain effective in the long term.

#### **O41.1.5**

##### **Biotelemetry Results in Greatly Increased Foraging Range Estimates for Three European Seabirds, and Consequences for Site-based at-Sea Protection Measures**

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UK seabirds have fared poorly in recent years, with low breeding success a recurring theme at a number of formerly productive colonies, apparently driven by oceanographic change. Meanwhile, human use of the marine environment is increasing, with unknown cumulative ecological consequences. Although necessary domestic and EU legislative tools are now largely in place, Marine Protected Area (MPA) designation continues to lag behind terrestrial conservation, particularly for seabirds, and a lack of data or accepted ways to use data are frequently cited reasons for this. FAME (Future of the Atlantic Marine Environment) is an international project tracking multiple seabird species at multiple sites to better understand seabird foraging requirements. Using high resolution GPS dataloggers, we have measured foraging distances that are between two and three times greater than previously assumed for Common guillemot (*Uria aalge*), Razorbill (*Alca torda*) and Kittiwake (*Rissa tridactyla*). This has important implications for using a foraging radius approach to designating MPAs, since a doubling in radius represents a quadrupling of area, which renders the approach a blunt tool for MPA designation. High resolution GPS tracking presents an opportunity in MPA designation by identifying foraging hotspots and connections between foraging behaviour and underlying habitat characteristics.

## O41.1.6

### Characteristics and Characteristic Drivers of Marine Protected Areas in the Mediterranean Sea

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MPAs are critical to the well-being of threatened ecosystems. Humans benefit greatly when MPAs are appropriately designated and well designed. Our research documents MPAs offshore of 21 countries on the Mediterranean Sea and analyzes their spatial distribution according to represented bio-geographic regions and levels of human activity. First we gathered information on a total of 225 MPAs from professional reports, on-line data bases and academic literature. Then we classified the MPAs into 3 categories based on characteristics of management status, allowed uses and corresponding levels of protection; we create a typology using data such as date established, international (IUCN) designation, marine vs. terrestrial area, distance from shore, maximal depth, type of responsible administrative authority, and prohibited and regulated activities. Finally, we apply these categories in a spatial analysis using the work of Spalding et al. (2007), Halpern et al. (2008) and Sanderson et al. (2002). The former is a bioregional classification system and the latter two are human impacts and influence models. This study informs about gaps in protection, identifies drivers of MPA designation in sub-regions and addresses to what extent levels of protection suit existing conditions for improving the network of protected areas in the Mediterranean Sea.

## O41.1.7

### How Do Targets Affect Conservation Value? A Comparison of Common Reserve Selection Methods

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Most commonly used class of reserve selection problems aims at achieving conservation targets with minimal cost. Another common class of problems aims at maximizing conservation value under limited resources. In this talk a theoretical comparison of these frameworks is presented in terms of conservation performance measures, such as return on investment. It is shown in particular that target-based planning may lead to a reduced performance. The underlying reason for this is that the resources which are spent on possibly expensive targets are away from resources that could be used for achieving higher conservation value in more cost-efficient parts of the reserve network. The quantity of this phenomenon is demonstrated by numerical examples. To balance out the performance loss, a novel planning framework is proposed where targets are combined with a general value-maximizing model in a manner that benefits from the advantages of both frameworks.

## O41.2.1

### Natura 2000 & Emerald - How Europe's Networks of Protected Areas Interact

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The Natura 2000 network is one of the most important measures to protect biodiversity in the European Union under the 1992 Habitats Directive which was largely conceived as an EU implementation of the 1979 Berne Convention. Initially the Convention, which applies to a much larger area than the EU, did not have an associated network of protected areas. However, in 1989 the Convention adopted a resolution creating the Emerald network that includes Natura 2000 as the EU contribution. The two networks have developed together, each influencing the other and share several features, including the same biogeographical approach and recently Emerald has started to hold seminars to assess the network based on the Natura 2000 biogeographical seminars. The lists of species and habitats to be protected by the 2 networks were initially coherent but due to EU enlargement the lists diverged. Following work by the ETC/BD, the list of species for Emerald was amended at the end of 2011 to make them coherent again. Work is underway to align the lists of protected habitats but this is more complicated, partly due to the use of different habitat classifications.

## O41.2.2

### Legal Designation as Preservation Tool for Natural Areas

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Protected areas all over the world are the most widespread way of preserving nature. However they exclude a large amount of natural and are expensive. In France, in the 1980s, the areas of high fauna and floristic interest (ZNIEFF) were identified throughout the territory. ZNIEFF are not protection tools *per se* but must be taken into account in urban planning by municipalities. We aimed to test if this simple legal designation could be a tool for nature protection and in which urbanization and environmental contexts. We worked during the 1982-1999 period in Seine-et-Marne administrative region (Paris great region). Controlling for hydrological and slope conditions, we observed that ZNIEFF preservation/urbanization was strongly dependent to municipality demography, urbanization changes between 1982 and 1999, ZNIEFF proportion and farmlands proportion in 1982 ( $r^2=0,59$ ). We showed that ZNIEFF preservation was possible only in municipalities with whether low ZNIEFF proportions and high farmlands proportion or whether high ZNIEFF proportions and low farmlands proportion. On the contrary, ZNIEFF urbanization occurred in municipalities with low demography and urbanization pressure. Legal designation as preservation tool appeared to be effective in dynamical demography and urbanization contexts, provided that designated natural areas do not exceed an acceptable proportion for municipalities.

## O41.2.3

### Robustifying Model-based Reserve Selection: on Summarizing Model Ensembles in Conservation Prioritization

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Conservation planning exercises increasingly rely on predicted species distributions and, recently, multiple predictions per species (ensemble forecasting). Best practices to use ensemble predictions in conservation planning should aim at maximising both optimality and robustness of the reserve network. But alternative techniques to summarize ensemble predictions differ in both optimality and robustness of the resulting reserve network. We identify benefits and problems of alternative techniques and give recommendations to make model-based conservation more robust to modelling uncertainties.

First, we assess reserve networks selected with ensembles of modelled distributions of European birds that were summarized either prior or after identifying conservation priorities. Additionally, we reviewed literature to discover how modelled species distributions are used in conservation: do applications follow the rapid methodological advancements in distribution modelling? We show that when ensemble modelling is used to predict species distributions, the predictions should be summarized after reserve selection process rather than before. Identifying matches and mismatches between methodological research and applications will help accounting for model-related uncertainties in model-based conservation planning. Guidelines for using ensembles in conservation are expected to be particularly useful when species distributions are projected into the future, to conserve biodiversity in a changing climate.

#### **O41.2.4**

##### **Assessing the Natura 2000 Network with Common Breeding Birds Survey**

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Despite the importance of common biodiversity in ecosystem functioning, there is no protection measure dedicated to common species. In this study, we investigated if the European protection network, Natura 2000 (N2000) may contribute to common breeding bird species protection. We focused on the effect of the network on abundances and specialization of species. We also investigated the influence of N2000 on the temporal trends of bird specialist groups. We used 102 species on 1915 squares monitored by the French Breeding Bird Survey between 2001 and 2010. We found that 48 species had a positive response to the N2000 proportion in the square, these species being predominantly habitat specialists. Communities were more specialized and functional (exhibiting a higher trophic index) inside N2000. We found no differences in the trends of farmland and woodland birds between plots inside and outside the N2000 networks, whereas the increase in generalist species was insignificant inside the network. We concluded that the designation process of N2000 areas allowed to protect areas with a higher common bird abundance and a better ecosystem functioning and dynamics than non-N2000 areas. The French BBS, a citizen science program, have proved to be an efficient tool to assess protection networks

#### **O41.2.5**

##### **Connectivity Conservation in Europe: Applying the EU Birds and Habitats Directives in a Fragmented Landscape and a Changing Climate**

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In Europe, the combined forces of habitat fragmentation and climate change make the need for ecological connectivity greater than ever. The EU Birds and Habitats Directives have often been criticized in this regard. Specifically, it has hitherto generally been assumed that providing for connectivity outside of designated Natura 2000 sites is not a legal obligation under the directives, but constitutes voluntary action to be freely decided upon by EU member states. Large parts of Natura 2000 indeed do not actually constitute a network but rather a collection of isolated sites. This legal study takes a fresh look at the Birds and Habitats Directives from a connectivity conservation perspective. It employs standard international law methodology, including the identification and analysis of relevant provisions, case law of the EU Court of Justice, and guidance by the European Commission. Member states' obligations are interpreted in light of (i) the directives' overarching objectives, (ii) scientific literature regarding fragmentation, climate adaptation and connectivity, and (iii) EU Court jurisprudence, including recent case law concerning connectivity of bear and capercaillie populations in Natura 2000 sites. Results indicate that - contrary to previous assumptions - ensuring adequate connectivity, including outside Natura 2000 sites, is not voluntary but obligatory.

## **RESTORATION ECOLOGY AND RECOVERY OF ENDANGERED SPECIES**

#### **O42.1.1**

##### **Higher Establishment Success in More Diverse Founder Groups of Pygmy Grasshoppers, *Tetrix subulata***

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For successful establishment of re-introduced, locally extinct populations it has been shown that large founder groups and habitat match are important factors. However, when number of individuals and source populations available for re-locations are restricted, the composition of individuals in founder groups becomes more crucial. Here, experimental introductions of colour polymorphic *Tetrix subulata* pygmy grasshoppers into outdoor enclosures were used to test if higher phenotypic and genetic diversity enhances establishment success. We show that the number of individuals present one year after introduction increases with higher colour morph diversity in founder groups. The morphs in *T. subulata* represent integrated phenotypes where the colours co-vary with a range of other functionally important traits, such as body size, reproductive life-history, diet, predator avoidance, and temperature preference. Our results indicate that more variable founder groups are more likely to include pre-adapted morphs suitable for new environmental conditions and that this increases the chance of successful establishment.

### **O42.1.2**

#### **The Rate of Population Decline of Vultures in South Asia Has Slowed**

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During the past two decades, three Gyps and two other vulture species in South Asia have undergone unprecedented declines. Most hard-hit was the oriental white-rumped vulture *Gyps bengalensis*: having declined by 99.9%. Now four species are critically endangered and the fifth is endangered. Diclofenac, a non-steroid anti-inflammatory drug administered to ailing cattle and shown to be highly toxic to Gyps vultures, was identified as the main cause of Gyps vulture declines. Strong advocacy and awareness raising of the vulture-diclofenac problem led to a ban on diclofenac in 2006 and the promotion of the vulture-safe alternative non-steroid anti-inflammatory drug, meloxicam. Recent pharmacy surveys show a reduction in diclofenac availability; while cattle carcass surveys show a reduction in diclofenac prevalence. Here, with the most recent road transect data on vulture sightings in India and Nepal, we show that populations of all five species remain at very low levels, but that the declines for all have slowed and may have even reversed in *Gyps bengalensis*. The rarity of these species means that estimates are necessarily imprecise; hence, declines may continue at slow rate. Therefore, conservation efforts and monitoring must continue to assure South Asia's vultures recover.

### **O42.1.3**

#### **Radio Tagging Can Restrain the Success of Recovery Programs: An Example of a Grey Partridge *Perdix perdix* Project in Switzerland**

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The breeding population of grey partridge (*Perdix perdix*) in Switzerland has declined steeply in the last decades from over 10'000 to less than 20 individuals. To prevent complete disappearance of this species the partridge recovery project started in 1991 in two agricultural areas. Its scope was to strengthen remnant populations through habitat improvements and regular release of small numbers (< 100) of grey partridges. Until 2008 the measures resulted in recovery of several red-listed bird species but grey partridge population stayed small. To test whether higher local population density would improve survival and breeding success, 500-1000 grey partridges were released annually from 2008-2011 in the Geneva region. Artificially-reared chicks, fostered to captive pairs in aviaries, were released as family groups in autumn. All birds were colour ringed and some were equipped with radio tags to monitor movements and locate nests for protection in spring. The project resulted in a considerable increase of the breeding population. Survival of release partridges was low but birds that adapted to the local habitat (+1 year post release) showed a high survival. Unfortunately radio tagged birds had reduced survival compared to untagged birds. This suggests that radio tagging should be reconsidered in recovery programs.

### **O42.1.4**

#### **The Effects of Ground Vegetation in Vineyards on the Occurrence Probability of the Woodlark (*Lullula arborea*)**

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Vineyards in Switzerland are among the most intensively cultivated cultures. 95% of the vineyards in the upper Rhône valley do not have any vegetation cover. However, there has been a considerable reduction in the application of herbicides over the past decades, leading to more and diverse vegetation on the ground. The Woodlark (*Lullula arborea*) is an endangered ground-nesting bird that is likely to benefit from a mosaic of ground vegetation and bare ground. Here we demonstrate the positive effects of the ground vegetation on the Woodlark: on a large scale, the occurrence probability increased with ground vegetation cover while on a small scale, the optimal feeding habitat has a ground vegetation cover of around 50%. In a next step we used the combination of field surveys and satellite images to analyse the quantity and quality of the ground vegetation cover in order to predict Woodlark occurrence on a large scale, i.e. over the whole upper Rhône Valley. Using these findings our project aims to designate core zones with a high occurrence probability of the Woodlark where species-specific conservation measures can be promoted.

### O42.1.5

#### Resilience of Orthoptera Assemblages after Ecological Restoration of a Mediterranean Dry Grassland (La Crau, Provence, France)

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In the last century, human activities have contributed to the fragmentation and the loss of 80% of the original surface of the unique European pseudo-steppic area in south-eastern France. In 2006, an industrial orchard of 357 ha created on the steppe vegetation since 1987 have been abandoned and restored in 2009. To restore the dry grassland vegetation and its associated entomofauna, three treatments have been experimented (soil inoculation; nurse species seeding and hay transfer). In the overall context of the restoration of the former orchard, we studied here the natural resilience and impacts of ecological restoration treatments on Orthoptera assemblages as their composition and distribution have been previously positively correlated with herbaceous vegetation structure. A three years study (2008-2010) highlighted that resilience has been effective in terms of species richness but not for population abundance. Nevertheless, restoration treatments have not promoted a significant increase of species richness or abundances of the different populations identified. This rapid resilience could be linked more to the abandonment of pesticide applications than the restoration of the herbaceous ecosystem.

### O42.1.6

#### Action and Management Plans for Endangered Species in the Czech Republic

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Action and management plans are aimed at activities focused on reduction of biodiversity decline and conservation of species. Nature Conservation Agency prepares plans according to the IUCN standards and implements them for the most endangered species of plants and animals in the Czech Republic. The plans include detailed analysis of biology of a given species, individual threats, objectives and exact measures that are implemented. All measures are classified into 6 categories: habitat management, species management, monitoring, research, education, and other measures. Action plans represent a complex of active measures to protect species *in situ* and *ex situ* (breeding or cultivation) (e.g. AP for *Margaritifera margaritifera*, *Gentianella praecox* ssp. *bohemica*). Management plans are focused on species endangered to a lower degree requiring a complex coordination approach due to their socio-economic impact (e.g. MP for *Lutra lutra*). More details are available at [www.zachraneprogramy.cz](http://www.zachraneprogramy.cz). Within this topic three main problems are discussed: *Where is the boarder between restoration of the nature and creating of the nature? How make the process of choosing priority species for APs more objective? How consider suitability of the species for APs in case that the populations in the country are on the edge of the area?*

### **O42.1.7**

#### **Combining Amphibian Conservation and Flood Protection: Simulation Models as Tools for Improving Amphibian Habitats in Restored Floodplains**

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In Europe, about 40 percent of amphibians are considered as “Threatened” or “Near Threatened” (IUCN 2009). Hence, the protection or revitalisation of habitats for these species is an important task in nature conservation. Especially in Central Europe, river floodplains are important habitats for amphibians. Regrettably, river regulations have degenerated these formerly dynamic landscapes. Thus, renaturalisation of floodplains in the context of precautionary flood protection is a great chance for amphibian conservation.

We will present general recommendations and demonstrate a model, which is implemented in an open and easy to learn software platform (NetLogo) and can be adjusted to specific floodplains.

Population development of four anuran species (firebellied toad, moorfrog, common spadefoot, European tree frog) can be simulated. The model is based on habitat analyses of data collected in a nearly natural floodplain in eastern Germany in 2010 and 2011.

Renaturalisation of single floodplain sections does not restore the natural hydrological dynamics of rivers, including regular floods and sediment shifts. Therefore, it is necessary to restore essential structures and dynamics in floodplains to optimise the habitat for amphibians. Systematic variation of parameters of restored structures and processes allow optimising floodplains for amphibians.

### **O42.1.8**

#### **Optimal Restoration in a Fragmented Landscape: Trading Off the Benefits and Risks of Connectivity Restoration**

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Increasing connectivity in fragmented habitats by re-vegetating cleared areas is expected to make positive contributions to species persistence under climate change. However, increasing connectivity may also negatively affect species persistence through changes in other threatening processes such as the frequency or severity of fires and the spread of invasive predators and disease. We modelled these trade-offs for a suite of bird species in the Wheatbelt region of south west Western Australia. We find that the optimal landscape restoration plan for our study area is dependent on species life history and habitat requirements, and the trade-off with other threatening processes. We conclude that restoring connectivity will benefit species in the face of global change, but that there are trade-offs with both cost and the risks posed by alternate threats. Examining these trade-offs provides information to managers to allow strategic decisions to be made at the landscape scale.

### **O42.2.1**

#### **Long-term Trends in Restored Moorland Vegetation Assemblages**

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We investigated whether restored heather moorland vegetation increasingly resembles long-established moorland vegetation over time. At seven moorland restoration projects in the UK, vegetation was sampled once at 6-13 years after the onset of restoration and again seven years later. Three of the sites were restored solely by grazing control and four by a suite of more intensive techniques. In each sampling year, vegetation sampling was carried out in degraded, restored and long-established reference areas at each site.

Restored vegetation closely resembled reference assemblages. However samples were dominated by species targeted for management; *Molinia caerulea* and *Nardus stricta* in degraded samples and *Calluna vulgaris* in reference samples. Discounting these species and concentrating on the remainder of the vegetation assemblage, areas restored by grazing control more closely resembled reference assemblages whilst those managed more intensively were more intermediate between degraded and reference assemblages.

There was no systematic pattern of change in restored areas between the sampling dates. Two sites advanced towards reference conditions. Others either showed little change or moved back towards a degraded assemblage. We conclude that whilst moorland restoration can succeed in re-establishing *C. vulgaris*, this frequently does not equate to plant assemblages similar to those of long-established moors.

### **O42.2.2**

#### **An Overview of Changes in Abundance and Distribution of Selected Wildlife Species in Europe for the Period 1960-2010**

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Monitoring the resurgence of some species in Europe can provide an important foundation for conservation across the European continent, particularly if we develop a broader understanding of the reasons behind these positive trends. We collected range and population time series data to provide an overview of the changes in abundance and distribution of selected species of mammals and birds in Europe over the past 50 years, and compared to historical times. Our results confirmed the recovery of many species within Europe, including the Grey wolf (*Canis lupus*), White stork (*Ciconia ciconia*) and Alpine ibex (*Capra ibex*), as well as the beneficial effects of legal protection and management intervention, and the absence of threats. We believe that our findings can support future conservation by contributing to the enlargement of natural areas, setting the science base for the rewilding of many areas in Europe, and providing an evidence base from which successful conservation action can be derived.

### **O42.2.3**

#### **Behavioural Traits and their Consequences for Survival in the Re-introduced Grey Partridge**

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Behavioural traits are often correlated and are referred to as behavioural syndromes; i. e. an animal keen to explore a novel environment also tends to be less shy across different contexts. Whereas a strong selection for a reduced behavioural plasticity can be beneficial in a constant environment, such as captivity, it might negatively influence fitness in a changing environment such as the natural habitat of a species. Within a long-term re-introduction project of the grey partridge in Switzerland we conducted well-established behavioural tests to characterise behavioural traits of 177 birds in 16 cohorts in captivity and measured survival of these birds after release. We found evidence that exploration behaviour positively correlated with survival after release. Fearfulness also tended to increase survival. However, the two behavioural measurements did not correlate and an individual's cohort-affiliation contributed largely to the overall variance of behavioural tests and survival. Our findings highlight important behavioural traits correlated with survival of released grey partridges. Considering the high post-release mortality in grey partridge re-introductions due to predation and potential behavioural maladaptation to the captive environment, our findings are of importance to re-introduction projects that became an important tool for conservationists in recent years.

#### **O42.2.4**

##### **Contrasting Effects of the Release Period on Short- and Long-term Survival Rates in a Reinforced Long Lived Bird Population: The Houbara Bustard**

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Assessing the success of translocations designed to establish viable populations requires long-term and costly monitoring. Conservationists mostly rely on survival rates of released individuals to evaluate and optimise their release strategy. However, short-term survival of a released population might not always reflect its ability to persist on the long term. In Morocco, the Emirates Center for Wildlife Propagation released about 54 000 captive-bred Houbara Bustards in the last 15 years. Based on a 9-year individual monitoring we tested the effects of individual characteristics (N=957), meteorological conditions and release season on short- (3 months) and long-term survival. Short-term survival was highly variable across years (0.16-0.94) and highly correlated with meteorological conditions for releases occurring in autumn, while short-term survival was constant (0.85) over years for releases occurring in spring. However, long-term survival remained quite stable over time (0.78-0.95) for both release seasons. This underlines the importance of long-term monitoring, as short-term survival does not provide accurate insight of adult survival, a key parameter in the dynamics of long-lived species.

#### **O42.2.5**

##### **Inbreeding Depression in Re-introduced Brown Bear Populations**

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Brown bears have been extirpated in large areas of the European continent. The further development in land use and agricultural techniques led to a decrease of problems and into a change in attitude of the general public in favour of bears. Re-introduction projects were launched in Trentino/Italy, the Pyrenees/France and Central Austria. Founder population size differed between four (Austria) and ten bears (Trentino). Intensive monitoring, genetically and in the field, resulted in detailed data on life history of each individual and a complete pedigree for each population. Due to the small founder populations breeding between close relatives happened in each population. We used generalized linear mixed models and techniques of model averaging and multimodel inference to study the effect of inbreeding on litter size and survival of the cubs of the year (COYs). Both, litter size and survival of COYs were affected by inbreeding depression in Austria, but not in Trentino. The case of the Pyrenees remained uncertain. We conclude that a founder population of ten bears, including at least three males, can be enough to avoid inbreeding depression, but smaller founder populations seem to be at a higher risk.

## O42.2.6

### The Spatial-temporal Distribution of Haplotypes of the Reintroduced Wild Ass (*Equus hemionus*) in Israel

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Understanding the role of landscape features in shaping populations' genetic structure, can provide valuable insights into the process of range expansion, gene flow, movement patterns and social behavior of reintroduced populations. Our study focuses on the effect of landscape features on the spatial-temporal distribution of genotypes of the critically endangered reintroduced Asiatic wild ass (*Equus hemionus*) in the Negev desert, Israel. 37 individuals were released into the Negev during 1983-1992, DNA samples of some of them (founders) were preserved since then. The current wild population (ca. 200 individuals) is distributed throughout the region. 269 fecal samples were collected in 65 sites within this range. Three mtDNA haplotypes were identified in the founders and wild population. Clustering analyses indicated that nearest-neighbor samples tend to have the same haplotypes ( $Chi-Square=7.9$ ,  $df=1$ ,  $p< 0.01$ ) which may indicate that relatives tend to travel together. While all haplotypes were found around permanent water sources, clusters of haplotypes were identified at the edge of the population's distribution, suggesting potential founder effects. Hence, behavior patterns, associated with the process of range expansion, affect the population genetic structure at the edge of the range. This 'edge effect' might have direct implications for the long term population's genetic diversity.

## O42.2.7

### How to Protect the Critically Endangered European Eel (*Anguilla anguilla*) from Being Chopped Up in Pumping Stations

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The applicability and efficiency of fish-repelling from and fish-guiding along pumping stations in the Netherlands was investigated, with as primary goal protection and conservation of the critically endangered European Eel. In the Netherlands circa 4000 pumping stations of different types form a barrier for migrating fish, especially as many become chopped up. Effects of repelling as well as guiding systems were tested at 7 locations. Repelling mechanisms included deterring with a 10 mm holes-screen, using infrasonic sound or using stroboscope or LED-light, while guiding systems included FishTrack or used induced flow towards a bypass. At each location one repelling or guiding system was installed whereby the type depended on local conditions. Effects were compared between systems switched on and switched off. Bream and Roach were encountered most; a few Eel were also found. No Eel was found on the location of the LED-light so light effects could not be inferred for that species although a positive effect may be expected due to its nightly behaviour. Light did not affect most Ciprinidae. The infrasound system barely affects behaviour of Eels and is very susceptible to interference. FishTrack and induced flow worked best and are little susceptible for interference or malfunction.

## RISK ASSESSMENT AND UNCERTAINTY

### O43.1.1

#### Ecological Impact Assessment of Alien Species: Generic and Quantitative Classification Criteria

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Risk communication about and management of alien species could be greatly improved by a generic set of ecological "Black List" criteria, analogous to the criteria used in classifying threatened species in Red Lists. We present a set of criteria that meets this requirement. It is generic in the sense of being applicable to all taxonomic groups and all habitats. In contrast to most previous classification schemes of alien species, it is quantitative and, therefore, transparent, testable, and easily adjustable to new knowledge or changing environmental conditions. The classification system is two-dimensional: it assesses the ecological impact of species along two independent axes, one measuring invasion potential, and the other ecological effects. Invasion potential is determined based on the estimated spread velocity; on the expected population lifetime; and on the proportion of different habitat types that are projected to be occupied. Ecological effect is inferred from interactions with native species; from state changes brought about in landscapes; and from the probability of transmission of genetic material and/or parasites to native species. Effects on threatened native species, and state changes in rare landscape elements, receive greater weight. The set of criteria is currently applied to all known alien species of Norway.

### O43.1.2

#### Effects of Variable Selection on Species' Range - Predictions under Climate Change

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Correlative species distribution models are frequently used to predict species' range shifts under climate change. However, climate variables often show a strong colinearity and most statistical approaches require the selection of one out of strongly correlated variables. While this only marginally affects the prediction of current distributions, future distributions may vary considerably when variables change differently. We used four correlated climate variables together with a set of landscape variables to predict current (2010) and future (2050) distributions of four conservation-relevant mountain forest birds in Central Europe. Using a machine learning approach (Maxent) we calculated models including each of the climate variables alone, a model containing all variables simultaneously and an ensemble-forecast, comparing predictive power and predicted area. In addition, for one species, we performed back-projections to 1920 using historical data. Future range predictions varied considerably depending on the variables selected, with ensemble forecasts and models including all four variables predicting intermediate scenarios. The latter models tended to have the highest accuracy and performed best in back-projections. When mechanisms of species-climate associations are unknown, caution has to be taken when using correlative models and variable selection for predicting range shifts, and a combination of climate variables may provide more stable results.

### O43.1.3

#### **Predicting the Conservation Status of Data Deficient Mammals on the IUCN Red List: A Comparison of Machine Learning Tools**

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Of the 5489 species of mammals assessed using the IUCN criteria to date, 836 are assessed as Data Deficient (DD). This represents a significant gap in our knowledge of mammalian diversity, as we have no appreciation of the likely level of extinction risk those species face. Determining the true status of DD species is therefore essential to both developing a more accurate picture of biodiversity and enabling the protection of potentially threatened DD species. We compared the ability of six machine-learning tools (k-nearest neighbours, classification trees, random forests, boosted trees, support vector machines and artificial neural networks) to determine the threat status of non-DD species using taxonomic, life-history, geographical and anthropogenic threat information. Modelling performance varied considerably across methods and taxonomic orders, with random forests and artificial neural networks typically performing best in terms of overall classification accuracy and correct identification of threatened species. The best classifiers were used to determine the likelihood of the predicted threat status of DD species under various scenarios of threat prevalence. We evaluated how the expected value of sample information for each DD species based on their predicted threat status and Evolutionary Diversity score could be used to prioritize DD species for conservation action.

### O43.1.4

#### **Can Variability in Life-history and Ecological Traits Act as a Buffer Against Extinction?**

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Anthropogenic degradation of the world's ecosystems has led to a widespread and accelerating loss of biodiversity. However, not all species respond equally to existing threats, so, what makes a species more vulnerable to extinction? Here we explore how variation among individuals in ecological, morphological and behavioral traits may explain differences in vulnerability across species. We propose that trait variation may act as a buffer against extinction as different individuals within a species may respond differently to occurring threats. Supporting this prediction our results reveal that mammalian species with more variable adult body mass, litter size, sexual maturity age, and those living at more variable population densities are generally less vulnerable to extinction. Trait variation appears to result from both local variability (variation among populations) and individual flexibility (variation among individuals within populations). These results provide a new insight into what makes some species less vulnerable to existing threats; and importantly, reveal the roles of local variability and individual flexibility as potential buffering mechanisms against extinction.

### O43.1.5

#### **Developing Disease Risk Analysis Methodology for Re-introduction Projects**

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Re-introduction projects have facilitated population recovery of endangered species across Europe in recent years, and continue to be utilised with varying degrees of success. Re-introduction projects may present risks of disease in both re-introduced and resident wild animal populations, with potential implications for the health of wildlife, domestic animals and humans. We have used disease risk analysis to inform health screening and disease surveillance for re-introductions of eight extinct or highly endangered species in England, for example, the Eurasian crane (*Grus grus*), sand lizard (*Lacerta agilis*), pool frog (*Rana lessonae*) and short-haired bumblebee (*Bombus subterraneus*). Our disease risk analysis methodology has comprised: 'Hazard Identification', 'Risk Assessment', 'Risk Management' and 'Risk Communication'. Through Risk Assessment high-risk pathogens and other 'hazards' have been graded qualitatively according to the risk that they will trigger disease during the course of the re-introduction in question, and/or threaten other populations. Disease risk analysis has both identified hazards and also areas of uncertainty; uncertainty regarding the number, identity and pathogenicity of parasites in wild animals reduces the reliability of disease risk analysis. Management actions undertaken based on risk assessment results include modification of therapeutic regimes and elimination of suspected non-native parasites.

## **O43.1.6**

### **The Likelihood of Entanglement When Bats Meet Breathable Roofing Membranes**

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Since the introduction of breathable roofing membranes (BRMs) into UK roof construction around 15 years ago, the production of non-woven materials for such purposes has more than trebled. Bitumen felt has for the past century, been considered a safe option for use within bat roosts, with only rare reports of problems. However, most modern BRMs are thought unsuitable for use within bat roosts, following a number of reports and anecdotal evidence of death through entanglement in fibres which have been pulled loose. Through the study of bat claws and modification of industry standard testing methods, we have investigated the likely outcome of bat interactions with these membranes. The results presented show that whilst industry tests consider standard stresses within a roof, they do not give an accurate interpretation of what happens when bats come into contact with such membranes. The likelihood of entanglement in a number of roosting scenarios is then discussed and the data disseminated to aid the production of clear mitigation guidelines, for use by those working towards bat conservation and those in the roofing industry wanting to meet increasing energy efficiency targets.

## **SPATIAL ECOLOGY AND CONSERVATION**

### **O46.1.1**

#### **Conservation Priorities under Climate Change: Identifying Threats and Opportunities for the Iberian Reserves Networks**

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Conservation policies are often implemented without consideration of the impacts of climate change on biodiversity. We identified conservation priorities based on both present and projected future distributions of 168 Iberian bird species. We then assessed threats and opportunities for conservation within the identified priorities by evaluating a) their current coverage by Protected Areas and Natura 2000 networks and b) their main present and projected future land use threats. Results showed that 23% of the areas identified as priorities under climate change are covered by Protected Areas and 40% by Natura 2000. However, if we separate the importance of areas for present or future distributions, both reserve networks have a higher overlap with present priorities. Croplands are the most extensive pressure on currently unprotected priorities but their extent is expected to decrease in the future. Land use pressures are also predicted to decrease in both reserve networks but this will be foiled by climate change driven distribution shifts which will increase the mismatch between the locations of reserves and the identified priorities. Although Iberian reserve networks are clearly beneficial for conserving biodiversity, we identify several conflict locations where further efforts are needed to preserve biodiversity also in the future.

## O46.1.2

### Assessment of the Functional Connectivity of Populations in a Dispersal-limited Forest Species, the Fire Salamander *Salamandra salamandra*, by Means of Gene Flow Analysis

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**Aims:** The maintenance of functional connectivity in fragmented landscapes is essential for populations' survival. Ecological corridors for dispersal are usually identified by using expert-based approaches or habitat suitability models, but their effectiveness is seldom assessed. Molecular markers allow to measure connections between populations better than traditional approaches (e.g. capture-recapture, radio-tracking), because they represent reproductive events. We assessed connection among populations and neighbourhood sizes in the Fire Salamander.

**Methods:** Presence-absence data were collected in 565 sites, and ten microsatellites were used to genotype 160 individuals from seven forest areas (Lombardy, Northern Italy) suffering different degrees of fragmentation. We assessed neighbourhood size by combining population genetics with species distribution models. We then evaluated population structure.

**Results:** Species distribution data showed significant spatial autocorrelation at fine geographical scale (500 m). Genotypes were autocorrelated over the same spatial scale, suggesting that most of dispersal occurs within this distance, which may represent the species neighbourhood size. At regional scale, the genetic structure across areas was weak in the mountain areas, but strong in the foothills.

**Conclusions:** The functional connectivity among Fire Salamander populations is well preserved in mountain regions, while isolation prevails in hills and morainic lowlands, where habitat fragmentation is extremely high.

## O46.1.3

### How Do Plant Functional Traits Influence Response to Variation in the Spatial and Historic Distribution of Forest Patches?

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The loss and subsequent fragmentation of habitat area within landscapes is thought to impact on species in a number of ways, often causing declines in local biodiversity. Knowledge of how aspects of the spatial configuration of habitat interact to influence species occurrence is central to directing effective conservation measures. This study examines how variation in plant functional traits influences the way species respond to spatial and temporal characteristics of forest patches. Two unique, national scale databases were combined; relating large scale forest cover information to detailed local vegetation samples from over 1000 plots across Britain, sampled as part of the Countryside Survey of Great Britain. Historic maps (circa 1880) were also used to distinguish secondary woods from longer established patches. Results suggest a relationship between establishment and regenerative traits of species and the way their distribution is limited by variation in the area and connectivity of their habitat patches. Response to variation in these spatial characteristics also differs in primary woods compared to secondary woods. Furthermore, results also suggest that spatial species compositional differences are more strongly correlated with historical rather than present-day variation in forest extent.

#### O46.1.4

##### **Species Distribution Models May Report Population Dynamics: The Case of the Environmental Favourability and the Local Abundance in an Endangered Eagle**

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How species use the available geographic space is a key issue in conservation biogeography, and the differential spatial use may be inferred from the known distribution of the species by applying spatial modelling techniques. Spatial heterogeneity determines gradients of habitat quality, which vary depending of the species considered and may have profound effects on its abundance. To infer the factors that influence Bonelli's Eagle presence in Andalusia, the main stronghold for the species in Europe, we used variables related to climate, topography, spatial situation, vegetation and human activity. We used a favourability function and a variation partitioning procedure to estimate how much of the variation of the model was explained by each factor and by the simultaneous effect of two or more factors. Finally, the relationship between the predicted favourability values and the number of breeding pairs in each square was explored using quantile regression. The estimated favourability accounted for the upper limit of species density within Andalusia. We conclude that favourability, modelled from presence-absence data, provides useful information on spatial patterns of abundance, and discuss implications of this in conservation biology.

#### O46.1.5

##### **Population Viability in a Changing Landscape for Epiphytes with Slow Colonization-extinction Dynamics**

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After habitat loss, species occurrence patterns are not in equilibrium with the landscape structure, and the time-lag until a new equilibrium is reached depends on species colonization-extinction rates. Population viability analyses of species with slow dynamics are scarce, and our general understanding of their persistence in changing landscapes is therefore poor. A key problem is that data on colonization-extinction dynamics is time- or resource demanding to collect. We overcame this problem by fitting a Bayesian incidence function model extended for dynamic landscapes to snapshot data on five lichen species with different traits among 2083 mapped oaks. We used the fitted models to project future colonization-extinction dynamics, and assessed species viability in scenarios of low oak densities or periods of low tree regeneration, which are two major conservational challenges. The results show considerable time-lags (>200 years) in species occupancy after habitat loss. Low oak density and age gaps in the tree age distribution decreased occupancy of all species. The long-term extinction risk was highest for species having narrow niches (few suitable trees) with low colonization rates. Conservation efforts should focus on protecting and restoring stands which currently have rich epiphyte floras, and promoting regeneration of trees in their near vicinity.

## O46.1.6

### Habitat Networks for the Grey-sided Vole (*Myodes rufocanus*): Importance of Ground Structure Characteristics

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We built habitat networks for a specialist species in fragmented boreal forests using the declining grey-sided vole (*Myodes rufocanus*) as a model species. Previous studies suggest that grey-sided voles are dependent on large old forest patches. We trapped voles in 20 large (>80 ha) and 20 small (< 25 ha) forest patches (>60 yrs old with ≥15% pine forest >100 yrs) with high and low connectivity, respectively. Unexpectedly, large forest patch size or high connectivity of patches did not show any correlation with grey-sided vole occurrence. To facilitate the interpretation of the results, a local habitat structure inventory was later carried out on the same sampling plots. Cobbles and large holes (>5cm diameter) in the ground layer had a positive correlation with grey-sided vole occurrence at the local habitat scale. Also, we found that the preferred food plant, bilberry, had sparser coverage on sampling plots with than without voles, indicating that shelter rather than food is the main habitat prerequisite. To conclude, sampling plots must contain suitable local habitats with good shelter to make it possible to compare and analyze dependence of grey-sided vole occurrence on patch size and connectivity in habitat networks at the landscape scale.

## O46.1.7

### Understanding the Past, Today, to Predict the Future: The Impact of Land-use Changes on North American Breeding Bird Populations

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The land-use changes caused by human societies over the last centuries have caused habitat loss and fragmentation for some species while creating new habitats for others. Though those land-use changes impacted both the distribution and abundance of species, today, there is no clear assessment on the historical impact of land-use change on biodiversity. The understanding of past patterns is nowadays essential, especially given the growing interest in predicting biodiversity responses to scenarios of global change. We used the North American breeding bird atlas data to assess the change in bird species distribution between 1970 and 2010. Such differences were obtained by overlaying the distribution maps of bird species and by identifying areas of contraction or expansion of the range of the species. In parallel, the IMAGE model was used to back-cast land-use maps of North America over the same time period. The overlaying of land-use change maps with the maps of species range change allowed to model the response of bird populations to 40 years of land-use change in North America. The modelled bird response, combined with predictions of land-use change in North America for the next decades, can also serve to forecast the future distribution of breeding birds.

### **O46.1.8**

#### **Species Distribution Models and Seagrass Habitat Characteristics in Coastal Lagoons: Implication for Conservation**

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The loss of seagrass meadows is among the priorities of the environmental policy of the EU, since most of seagrass species are of conservation interest and constitute an important ecological habitat for many species. We focused on habitat characteristics of the three species occurring in the Venice lagoon, namely *Zostera marina*, *Nanozostera noltii* and *Cymodocea nodosa*. We developed Species Distribution Models, by using a Random Forest algorithm to relate presence-absence of each species to the main physical, chemical and hydrological variables of the Venice lagoon, using distribution data available for the period 2002-2004. After the validation on an independent data set, the application of fitted models allowed the prediction of the year-specific spatial distribution for the three species for the 2000s decade. The analysis of the change of the spatial distribution of the seagrass species over time provided several information relevant for the management of the habitat, such as: identification of the environmental variables whose changes seagrass species are most sensitive to; identification of areas with high probability of presence and low temporal variability; and identification of critical areas (e. g., presence in unfavourable conditions). We show how these information can be combined to prioritize conservation areas for seagrass viability.

### **O46.2.1**

#### **Compensatory and Dispensatory Processes and their Importance in the Eradication of the Invasive American Mink**

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Invasive species are a major, global threat to biodiversity. Invasive eradication programmes face considerable logistic and financial challenges. A particular issue for efficient eradication of well-established, widely-spread invasives, is overcoming compensation through dispersal from adjacent uncontrolled areas, and understanding dispensatory effects. The development of feasible and effective eradication strategies can be greatly enhanced by incorporating information about demography, and dispersal rates, distances and dynamics. Here we use genetic, age and reproductive data to construct pedigree relationships between American mink removed during a large scale (>10000 km<sup>2</sup>) eradication project in the Cairngorms National Park, NE Scotland. These data are used to demonstrate: 1) large scale connectedness through dispersal between geographically distinct management units (river catchments); 2) differential rates of reinvasion from areas with different intensities of control; 3) 'hotspots' that contribute disproportionately high levels of emigrants and represent particularly significant management targets; 4) the provenance and demography of individuals captured in reduced density areas. These findings have been used to define the appropriate spatial scale of control and allocation of resources required to achieve specific goals for the conservation of native biodiversity, and have also been instrumental in securing extended funding to expand the range of the mink-free area in Scotland.

## O46.2.2

### Unravelling the Effects of Translocation History Versus Population Decline on a Widespread Migrant: The Case of the European White Stork

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European white stork (*Ciconia ciconia*) are long considered to diverge to eastern and western migration pools. In relatively recent times, the western and northern distribution has been subject to dramatic population decline. In response, a number of independent reintroduction programmes were started in the mid 1950's to bring storks back to historical ranges. Founder individuals were sourced from the eastern and western European distributions and Algeria. Here we used mitochondrial and microsatellite data to evaluate the impact of translocated individuals on the phylogeographic and demographic history of this species. Contrary to expectation, storks appear effectively panmictic. Regional populations displayed much higher levels of diversity than expected in an apparently bottlenecked species. Distinct genetic lineages in the mitochondrial data suggest geographic structure in the evolutionary past which long precedes dates associated with reintroduction activities. Apparent refugial populations, in combination with repeated expansion signatures in both mitochondrial and nuclear markers, indicate processes operating at both evolutionary and ecological scales that are maintaining current genetic patterns. There is also strong evidence to suggest a southern-crossroads link through the Mediterranean basin that could have facilitated gene flow between east and west migration pools during glacial periods contributing significantly to the current finding of panmixia.

## O46.2.3

### New Methods to Define Spatially Discrete Mammal Populations

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Species occurrence information are of great importance in conservation biology and are widely used to build models that allow the identification of priority areas. Geographic ranges are likely to lead to an overestimation of real species occurrence, therefore habitat suitability models are often preferred assuming presence in suitable areas. However, suitable habitat does not provide any information on the spatial structures of metapopulations. Here we present a new methodological approach to define population boundaries based on species-specific traits. Dispersal abilities of terrestrial mammal species are predicted based on specific ecological traits and integrated in spatial habitat suitability models to identify isolated population and dispersion areas. We develop multiple scenarios representing different dispersal models and assumptions about matrix permeability, each applicable to specific conservation issue.

Current gap analyses and conservation planning studies completely neglect species' spatial organization assuming one single panmictic population. This can lead to gross overestimate of species persistence both within existing and proposed conservation areas.

Our new approach allows to conduct population based spatial analysis useful to set population target levels for monitoring and conservation, conservation priorities among different (meta)populations, and to identify key areas for their persistence.

## O46.2.4

### Avoidance of Negative Ecological Impacts of Land Use Via Inverse Spatial Conservation Prioritization

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In the world of limited recourses, increasing demands for energy, and decreasing biodiversity values it has become evident that high end methods are needed to find the balance between contrasting needs and targets set by the society. As resource extraction and pristine ecosystem functions both need area, their continued and balanced co-existence demands functional land use prioritization. Here we demonstrate a novel conservation prioritization perspective called inverse spatial conservation prioritization. Instead of seeking a small proportion of areas with highest ecological values and excluding these areas from land use planning we search for the areas that have lowest ecological values to be directed at economical (industrial) use. Concentrating on the lower end of the prioritization makes it possible to conduct zoning of the actual land use areas by effectively combining economical and ecological features of the areas. We demonstrate this with a case study of land use allocation for partially degraded peatland areas in Finland using Zonation algorithm. We show that inverse spatial conservation prioritization, i.e. prioritizing sites with lowest ecological value for resource extraction, has a significant positive local area effect to what biodiversity will remain after extraction. An economical component, peat mining potential, is included in the analysis.

## O46.2.5

### Landscape Structure as Indicator of Species Diversity: A Global Meta-analysis

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The relation between landscape structure and species diversity is a major research topic in landscape ecology, population ecology, biogeography and conservation biology. However, the understanding of this relation remains elusive, and the results from different studies are often contradictory. For this reason, we conducted a meta-analysis encompassing different aspects of landscape structure and all groups of organisms. Around 900 ISI papers spanning four decades of research were scrutinized. This resulted in >4000 relevant cases, for which the strength of such relation was examined.

Landscape heterogeneity, patch area, proportion of habitat in the surrounding landscape, and patch shape complexity were positively related with species diversity, while isolation showed an ambiguous relation. The strength of these relations differed among taxa, as plants were strongly related to landscape heterogeneity (preliminary results: mean  $R^2 = 0.46$ ), whereas animals were most sensitive to patch area (0.63). There was often an impact of the covariate naturalness of these relations, whereas latitude was rarely of importance. The conclusions derived from this meta-analysis contribute to the theoretical framework of the main ecological drivers of biodiversity. They have direct conservation relevance as they support the choice of landscape indicators of species richness.

## O46.2.6

### Restoring Ecosystem Processes - An Ecological Argument for Fencing the Wild

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Here we explore the distinction between reintroduction for species conservation (classical reintroduction), and reintroduction to restore ecosystem function (rewilding), using the example of the reintroducing wolves to a protected area. Protected areas are often small and unfenced and so population dynamics of large mammals within are typically affected by human-wildlife conflict outside, especially where increased mortality rates create population sinks. Using computational modelling we primarily examined the extent to which boundary permeability to dispersal affects wolf population viability, and the re-establishment of top-down forcing. Increasing boundary permeability to dispersers decreased maximum wolf densities, reduced the strength of strong top-down forcing and increased population viability until the loss of dispersers was too great to support successful establishment. Our model indicated that threshold wolf densities are required to exert strong top down forcing and that this ecological process was lost at lower rates of disperser loss than were needed to threaten population viability. Where high, threshold population densities are required to exert functional relationships relatively light direct or indirect negative human interactions may prevent the reintroduction of function but still allow species conservation. Fencing out detrimental anthropogenic interactions may be important to restore functional processes within protected areas.

## O46.2.7

### Spatial Patterns of Geographic Range Change

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With habitat loss implicated in the decline of over 85% of the world's threatened mammals, birds and amphibians, habitat conversion must surely influence spatial patterns of local extinction. Is it possible to find predictive signals of local extinction additional to habitat conversion or do anthropogenic processes mask any underlying ecological patterns?

Using the avian order Galliformes as a case study, we investigate spatial patterns of geographic range change across Europe and Asia over the last 150 years, looking at predictors such as habitat conversion, directional range loss and relative position to range centre. We find a strong signal of local extinction at southern and western range margins for several species groups implicating respectively climate change and urbanization as drivers of range change. Surprisingly, habitat conversion is not correlated with recent range loss in threatened species, perhaps due to the coarse scale of the analysis. Indeed, we find no predictors of spatial patterns of local extinction for threatened species. We therefore conclude that whilst there are patterns of decline common to many species, it is additional opportunistic (and hence largely unpredictable) anthropogenic processes that have pushed species on to the red list.

## O46.2.8

### A Spatial Prioritization Framework to Optimize Species Persistence under Climate Change

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With climate change, spatial conservation planning needs to account for the movement of species in space and time. The dynamic nature of this task requires explicit integration of uncertainties. In this study we present an optimized corridor selection strategy that goes in this direction. The framework uses probabilistic outputs from species distribution models and the ability of species to disperse to identify the best-valued linkages that promote species persistence. Different budgetary constraints, reflecting distinct levels of commitment regarding conservation, and the possibility of a controversial acquisition/release scheme of areas are tested and their impact evaluated in terms of expected persistence for each species. We illustrate the framework using a suite of nine species occurring in Iberia Peninsula for which future ranges (2020, 2050, 2080) are obtained using ensembles of distribution models for two climate change scenarios. Enabling area-release produced patterns of linkages highly dissimilar from the one obtained with an acquisition-only strategy. In general, species persistence was not significantly affected when switching climate scenarios, but larger budgets produced better results. Nevertheless, our framework identified species that, despite high budgetary efforts, present a limited ability to disperse to climatically suitable areas. Connectivity enhancement and assisted colonization merits attention for such cases.

## URBAN ECOLOGY AND CONSERVATION

### O47.1.1

#### Potential Benefits of Urban Habitats for Bee Diversity

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Dry meadow habitats have been in decline in Finland throughout the 20<sup>th</sup> century, as in many other parts of Europe. Many vascular plants and insect taxa associated with dry meadows have become threatened as a result, giving rise to concerns over the provision of the ecosystem service of pollination. Urban regions contain a variety of natural and semi-natural habitats with nectar-bearing vascular plants. Also ruderal habitats provide resources for some pollinating insects, though most of the threatened species are dependent on managed and natural meadows. In this study, we survey the bee fauna of a variety of dry meadow habitats in the capital region of Helsinki and address the questions of 1) do urban meadow habitats support declining species of managed meadows, 2) do ruderal habitats support a different set of species from natural and managed meadows and 3) do urban meadows offer potential for maintaining bee species diversity. In this study we detected 411 individuals of 36 species. We report that the urban dry meadow network supports a diverse bee fauna, though no declining species were observed. The only red databook species recorded was *Andrena minutula* (VU), which is not declining but rather expanding into this region and associated with ruderal habitats.

## O47.1.2

### Cost-effective Large Scale Monitoring of Insects with Sound Detection

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Although insects are a very rich species group, they have been largely neglected in conservation studies and policies. Sound detection, which method is non destructive thus well accepted, could be an interesting solution within a citizen science framework.

We evaluated the effectiveness of a citizen science program based on acoustic road sampling to monitor Orthoptera. Using Bayesian Model Averaging we tested if we could detect widely known patterns such as the negative effects of urbanization or intensive agriculture on populations and communities. We estimated the biases on species detection in order to evaluate and to improve the protocol. We also evaluated the cost-effectiveness of this program.

Similarly to the literature results on vertebrates, carabids or butterflies, we found negative relationships between urbanization or intensive agricultural landscapes and species richness, diversity and abundance. The average mass and dispersal ability of communities decreased with increasing urban land cover. We identified some bias linked to the protocol such as car speed or temperature that is mandatory to take into account in analyses on this kind of datasets.

Acoustic monitoring of Orthoptera from road sampling seems to be a cost-effective opportunity to assess biodiversity states at large spatial scales.

## O47.1.3

### Could Business Sites Contribute to Enhance Urban Biodiversity?

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Business sites gardens cover large surfaces in French cities. However their biodiversity is poorly known and they may have a role to play to enhance urban biodiversity. Our objectives are:

(1) To improve knowledge of biodiversity of these sites (2) To compare two kinds of factors that influence biodiversity:

- Factors linked to urbanization and ecological connectivities
- Factors linked to the aims the managers expect from their gardens

For that purpose, we realize a typology of green spaces of business sites in Parisian region and inventory them for tree taxonomic groups (plants, butterflies and birds). We first study their ecological functions in the network of other green spaces. Then, by observation and interviews, we define the social uses of these gardens (place to relax, to see "nature", to meet colleagues...) and also the motivations of the green spaces managers. These motivations will determine management plans (use of phytosanitary products or not, ecological infrastructures...).

We hope to define the key points that could influence the ecological quality of these particular gardens and find management tools that conciliate respect of biodiversity and companies expectations.

#### **O47.1.4**

##### **The Effects of Habitat Edges and Trampling Intensity on Understorey Vegetation, Beetles and People in Urban Forests**

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Urban remnant forests are characteristically highly fragmented and are heavily used for recreation. This results in abrupt forest edges and severe trampling on the forest floor. We studied both edge and footpath effects on the spatial distribution of understorey vegetation and carabid beetles in urban forests in Helsinki, Finland. In both spruce and pine dominated forests, the edge effect penetrated up to 50 m into these forests (based on the responses of forest understorey vegetation), while the effects of paths were observed up to 10 m off the paths into the seemingly untrampled vegetation. Carabid beetles show little response to either edge or footpath effects, possibly due to the fact that forest specialist species have already disappeared from the city environment. People also appear to respond to forest edges. Through questionnaires, we showed that perceived restorativeness (an indicator of restoration and thus human health) increased into forest patches when visibility to the urban matrix was restricted. Our studies showed that both nature and humans respond surprisingly similarly to edge effects. One recommendation for the management of urban forests is to allow edges to grow thick, which will restrict the edge effect, benefiting both nature and city dwellers.

#### **O47.1.6**

##### **The Effect of Landscape Composition on Butterfly Richness in Belgian Gardens**

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Butterflies are among the best-known invertebrates by the general public. In Belgium, 19 easily recognisable and common butterfly species are counted monthly by volunteer citizen-scientists since 2007. In total, 1140 gardens were counted in a range of different landscape matrices. We analyzed both the effect of the garden characteristics and landscape composition and heterogeneity on butterfly species richness in gardens at 5 different spatial scales (radius 500-2500m). Species richness was highest in large gardens with a butterfly bush (*Buddleia davidii*) that were located in a heterogeneous landscape. Different biotope types exerted an effect on the butterfly richness at varying distances from the gardens. Natural areas and residential urban areas had a positive, while dense urban areas had a negative effect in the immediate vicinity of the gardens (250m). Woodlands, hedges and grasslands had positive effects at intermediate distances (750m) and agricultural land had the largest effect in the wider surroundings of the garden (2500m). The presence of individual species was strongly influenced by both the composition of the landscape and by the distance to the different biotopes surrounding the gardens.

### **O47.1.7**

#### **Do Urban Birds Adapt to a Weekly Cycle and 'Work' Harder during the Weekends?**

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Urban environments are increasingly valued for their contribution to conservation, since cities can harbour a rich biodiversity. However, this urban biodiversity is subject to changing conditions (e.g., quiet weekends vs. busy weekdays) that may alter species behaviour and contribute to biotic homogenization. Here, we aimed to explore whether communities of urban birds adapted their activity to peoples' weekly cycle. We analysed three independent inventories of birds, in Paris (2009-10), Paris metropolis (2001-3) and across France (STOC, 2001-9), to find that both the overall richness and the abundance of urban adaptors were significantly higher during weekends in cities but not in other more natural habitats, such as forests. We used bank-holidays that fell within the week as a natural experiment to test whether these results were driven by improved delectability on weekends rather than behavioural change. We found that richness and abundance of urban birds during holidays were significantly lower than in weekends, and more similar to weekdays. This indicates that several bird species may adapt their behaviour to exploit better conditions during quiet weekends. This behavioural change may bias community sampling and more importantly may lead to differentiation of urban birds from more natural populations in the long term.

### **O47.1.8**

#### **Effects of Supplementary Feeding on Reproductive Success and Colony Size in Suburban House Sparrows *Passer domesticus***

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Knowledge of factors limiting animal abundance and demography provides a direct means of developing effective conservation interventions, but are poorly understood in urban landscapes. We describe a replicated supplementary feeding experiment to test whether food limits the abundance of suburban house sparrows. Supplementary invertebrate prey was provided during four successive breeding seasons at 33 house sparrow colonies spread across Greater London, where house sparrow abundance fell by 60% over the preceding decade. A further 33 colonies served as unfed controls. The quantity of invertebrates provided was probably sufficient to satisfy a high proportion of chick nutritional requirements at most fed colonies. Impacts of feeding were large and positive at small colonies, intermediate and positive at medium-sized colonies and absent at large colonies, demonstrating that availability of invertebrate prey is one factor limiting suburban house sparrow abundance. The enhancement of invertebrate availability in urban-suburban landscapes therefore constitutes a potential conservation measure. Further work is needed to assess potential negative impacts of sparrowhawks on fledgling abundance and of pigeons on adult abundance.

## CONSERVATION MODELLING

### O77.1.1

#### Modelling of Lekking Area Location in the Great Bustard (*Otis tarda*): Implications for Conservation

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In lekking species, males concentrate yearly on specific geographic areas where they perform displays to attract females. Being able to predict the location of these lekking areas is crucial for conservation. During three consecutive years (2002-2004), the display sites of a threatened bird, the great bustard (*Otis tarda*), were mapped for the most important population of this species in southern Portugal. The importance of habitat, disturbance, topography and the presence of conspecifics in determining the location of lekking areas was modelled. Both topography, habitat, disturbance and the presence of conspecifics influenced the selection of display areas by male great bustards. The presence of conspecifics was the more important driver of lekking area occurrence. Additionally, leks were preferentially located in areas with flat topography, surrounded by larger amounts of steppe habitat, located at more than 1 to 2 km from the nearest road and urban area, and mostly oriented towards East. This information should be taken into account when defining conservation priorities, particularly for evaluating the negative impact of new urban structures and roads in existing leks, or when defining priority areas for re-introduction attempts.

### O77.1.2

#### Modelling the Risk of Collision with Power Lines in Little Bustard (*Tetrax tetrax*): Implication for Impact Minimization

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The Little Bustard (*Tetrax tetrax*) is a threatened grassland bird, considered to be one of the most susceptible species to suffer collisions with overhead distribution power lines. We modelled the risk of Little Bustard collision with power lines in Southern Portugal for three different seasons (breeding, post-breeding and wintering) as a function of population densities, distance travelled during flights, flight height and density of migratory movements. Our methodology was based on the satellite tracking of radio-tagged Little Bustard's and focal field observations. We tracked 27 birds for a period of time ranging from 1 month to 2.5 years, collecting over 75,000 locations. Collision risk was found to be highest during winter and lowest during the breeding season. Migratory movements were mostly short-distanced, made during the night, and without the use of specific migratory corridors, but nonetheless concentrated in areas nearby the breeding sites. Collision risk maps were generated and can be used to aid the planning of new power lines. They can also identify existing lines that coincide with areas of greater collision risk, to help prioritize mitigation efforts, e.g. through means of conductor and earth wire marking.

### **O77.1.3**

#### **Linking Biodiversity Conservation and Ecosystem Services: New Insights in Tradeoffs and Synergies between Biodiversity, Ecosystem Functioning and Ecosystem Service Values for Improved Integrated Biodiversity Policy**

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Biodiversity policy is increasingly influenced by evidence about the role of biodiversity in the provision of ecosystem services. A new approach to investigate the relationship between biodiversity, ecosystem service provision and socio-economic values in European landscapes is presented as resulting from the CONNECT BiodivERsA project. A decision support framework for embedding the scientific research findings in the existing biodiversity and ecosystem services policy community and public debate is designed. Results from case studies at different scales indicate that the relations between biodiversity, ecosystem service provision and economic value are scale and context-dependent. The specific landscape characteristics and differences in demand for ecosystem services are important determinants in addition to the dynamics of land use. It is concluded that in conservation considerations both biodiversity priorities, ecosystem service provision and its social and monetary values should be considered.

### **O77.1.4**

#### **Using Predictive Models to Improve the Detection and Monitoring of Alien Invasive Species in Heterogeneous Landscapes**

*Vicente J.<sup>1,2</sup>, Lomba A.<sup>1,3,4</sup>, Roxo A.<sup>2</sup>, Fernandes R.<sup>2</sup>, Silva A.R.<sup>1,2</sup>, Vaz A.S.<sup>1</sup>, Randin C.<sup>5</sup>, Honrado J.<sup>1,2</sup>, Guisan A.<sup>4</sup>*

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Alien invasion, along with climate change and land-use dynamics, is among the main drivers of biodiversity loss worldwide. Preserving biodiversity from effects of alien invasions requires tools to anticipate them, in order to protect species and habitats presumed to be at risk, and to monitor invasion patterns. Ecological modelling tools such as BIOMOD (R package) are predictive, ensemble and forecasting tools that allow the detection of current and future areas of invasion, under climate and land-use change scenarios, as well as predicting conflicts between alien species and focal areas or species (e.g. those of higher conservation value). Here we present results from the application of new modelling techniques to accurately predict how ecological suitability/probability of alien species occurrence is spatially distributed today, which factors most determine that spatial distribution, and also why there are differences between model predictions and effective invasion. The resulting knowledge of trends and dynamics of invasion have practical applications in conservation and management programs, especially those aimed at mitigating impacts of invasive plants, land-use and climate changes in sensitive regions. Furthermore, our modelling approaches allow the early detection of changes in alien species distributions, which provide essential information for optimising eradication programs and monitoring networks.

### **O77.1.5**

#### **Modelling the Distribution and Dynamics of Species and Habitats of Higher Conservation Value to Support the Mapping and Monitoring of High Nature Value Farmland Areas**

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The High Nature Value (HNV) farmland concept acknowledges the importance of many rural landscapes and agro-ecosystems for the conservation of biodiversity and the provision of valuable ecosystem services in the wider European countryside. However, the operational relevance of this concept depends on the development of a robust theoretical and analytical framework to model the distribution and dynamics of species and habitats of higher conservation value, in order to support the mapping, monitoring and management of such HNV farmland. Here, we address the conceptual and theoretical constraints behind the use of the HNV concept across several types of European rural landscapes, as a step towards an innovative analytical framework for a more operational use of the HNV concept and for forecasting the impacts of changes in land use patterns on plant diversity in HNV landscapes. Results from recent research on the application of ecological models to predict the distribution of rare species and priority habitat types will be presented. Such a model-based approach is advocated as a robust framework to support forecasts of HNV farmland dynamics under future scenarios of climate and/or land use change.

### **O77.1.6**

#### **Reasons of the Occurrence of Boreo-Montane Species on the Edge of their Area**

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High geomorphological diversity of the sandstone landscapes causes high heterogeneity of habitats which leads to higher species diversity. The sandstone landscapes consist of sites with very dry and hot environmental conditions (top plateaus), steep slopes with weak thin layer of the soil (sandstone rock slope) or sites with high moisture, low temperature and low level of the sun radiation (bottom of gorges). Our project is aimed to precisely measure microclimatic conditions in the system of 6 different deep gorges (in total 400 sensors) and find the relationship between environment and composition of the vegetation. Main target of the project is to create microclimate-vegetation model of the National park Bohemian Switzerland (Czech Republic) based on exact digital elevation model and our measurements. We study selected boreo-montane species growing on the bottom of the inverse gorges to find its demands on environmental conditions and the reason why they could grow in the low elevation and latitude than the rest of the area. In the future we want to use this model to predict potential sites of these selected species in the whole area on the national park.

# ECCB2012 Posters

## ADAPTIVE MANAGEMENT

### P1.1

#### **A Novel Approach to Estimating Badgercrime Prevalence Rates in the UK through Triangulation of Three Indirect Measures**

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Obtaining accurate estimates of sensitive behaviours such as the illegal killing of badgers has proven problematic. Respondents are frequently reticent to respond to questionnaire techniques relating to illegal behaviour due to the risk of self-implication. Two methods were employed to estimate the prevalence of illegal badger killing (Randomised Response Technique and the False Consensus Effect) and a third investigated farmers' predisposition to kill badgers (Brief Implicit Association Test). Data was collected from 472 farmers attending agricultural shows and livestock markets across Wales during 2011. Approximately 11% of farmers reported killing badgers in the last 12 months. The probability of badger killing was related to farmers' implicit attitudes towards badgers, indicating that the stronger the farmer's attitude towards killing, the greater the probability of admitting to killing badgers. Localised culls (particularly at the individual farm level) are likely to aggravate the burden on farmers to control the disease. Consequently, the 11% of farmers who admitted to culling badgers may in fact be contributing to the spread of Bovine TB in the region. Combining the study techniques appears to offer renewed opportunity to the scientific community to develop a more profound understanding of the prevalence of such sensitive behaviours.

### P1.2

#### **Evaluation of Management Effectiveness as Adaptive Management Tool: Case Study - Evaluation of Wolf Management Effectiveness in Croatia**

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Nature protection is often challenged with inefficient management. Evaluation of management effectiveness is a tool used to understand adequacy of existing management practices and indicate possible improvements. Many efforts have been invested to ensure wolf's existence in Croatia. Are they sufficient? The protected areas management effectiveness evaluation methodologies were adjusted to evaluate wolf management in Croatia. Six elements of management cycle were analyzed: context, management planning, inputs, management processes, outputs and outcomes. Major threats to wolf are construction of roads and illegal kill, causing habitat degradation and reduction of population. Existing management supports maintenance of viable wolf population at biologically and socially acceptable levels. This is mostly a result of high motivation of nature conservationists and scientists, good level of stakeholders' participation in planning, inflow of substantial EU funds in the past and fair allocation of state finances. Several issues should be improved, including certain human capacities, financial possibilities, responsibility for coordination of overall plans' implementation, participation of particular stakeholders and awareness about development of large carnivores' based tourism. Applied methodology and evaluations' results could be useful to wolf conservationists. This methodology can also serve as a starting point and guidance for evaluation of other species management effectiveness.

### **P1.3**

#### **Placing Lochs in their Landscapes: Linking Landscape Ecology, Ecohydrology and Conservation Interest to Develop Adaptation Strategies for a Changing Climate**

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Scotland is a country with outstanding freshwater systems providing multiple social, economic and cultural functions as well as ecological services of international importance. Scotland's lakes (locally termed lochs) contain more than 90% of Great Britain's total freshwater resource. With over 25,000 lochs (surface area greater than 0.1 hectares) standing freshwaters are an iconic part of Scotland's landscape and they come in a myriad of forms and sizes contributing outstanding geodiversity as well as habitats of international importance for numerous species of conservation interest. There is undoubtedly a need to protect the conservation interests of designated sites in the face of changing loch and catchment pressures - which include diffuse pollutants, morphological modification, recreation and invasive species. Climate change presents new challenges with potential impacts across the entire standing water resource base and predicting how these systems might respond to these changes greatly amplifies uncertainties implicit in their environmental management. The aim of this paper is to discuss the potential impacts of climate change to the ecohydrology and conservation interest of lochs in Scotland. We use landscape ecology to frame changes in the ecohydrology of standing freshwaters within the challenging context of the physical and human landscapes in which they sit.

### **P1.4**

#### **Conservation Strategies for the Last Remaining Population of the Pale-headed Brushfinch (*Atlapetes pallidiceps*) in Ecuador**

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The Pale-headed Brushfinch was believed to be extinct for more than twenty years, when in 1998 less than 20 pairs were discovered in the upper Yunguilla Valley, Ecuador. The local NGO Fundacion Jocotoco established a 150 ha reserve, which encompasses 94% of all known territories, but the population failed to recover. First studies investigating breeding success found that parasitism of the shiny cowbird lead to juvenile mortality rates up to 66%. Consequent shooting of cowbirds lead to a five-fold population increase, so the short term survival of the species seemed to be secured. We here present first results of potential inbreeding effects in this species by analysing genetic diversity. Additionally, population viability analysis allowed us to identify the most beneficial management strategies which enabled us to target our conservation plans more precisely. In the case of the Pale-headed Brushfinch, extinction probability will be lowest in the case of translocating birds to a second site to ensure the population will not go extinct during a single demographic or environmental collapse. We also describe criteria for identifying suitable new sites for the species and make specific management recommendations to maintain habitat quality in the long term.

## ALIEN AND INVASIVE SPECIES

### P2.1

#### Establishment of Non-native Plant Species Distributions in Relation to Climate and Land Use in Britain

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Climate change and invasive non-native species are two of the greatest threats to biodiversity and ecosystem services. Evidence is growing on how climate change is compounding the negative effects of invasive species, increasing the number and distribution of non-native plant species. Previous studies have shown that distributions of non-native species in Britain are influenced by both climate and land use. The main aims of this project are to determine how climate and land use are affecting the distributions of non-native plants with different levels of establishment and with different plant functional types (PFTs) in Britain. Future distributions of non-native plant species will be predicted using climate projection data. Species were classified into PFTs and an establishment index was calculated. Environmental variables including temperature, rainfall and main land cover and habitat types were used to predict species richness. Distributions of established species are predicted best by climate variables, while casual and recently introduced species are associated with land use. Different PFTs are assuming different distributions related to climate. Using projected climate data to indicate possible future distributions of groups of species will help to identify areas where non-native species will potentially have a greater negative impact.

### P2.2

#### The Added-value of Fine-scale Data and Models to Support the Management of Biological Invasions in the Landscape Context

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Biological invasions are nowadays considered a major threat to biodiversity worldwide. Managing local invasions by alien plants (from anticipation to control and eradication) requires fine-scale data, usually not available. Species distribution models (SDMs) are statistical tools that allow the prediction and forecast of where and when invasion may be occurring or will take place in the future. However, the usefulness of SDMs may be constrained by the quality of available calibration data. In this study, fine-scale SMDs were developed for the Alto-Minho region (Portugal) based on patch level environmental information and occurrence data for *Acacia dealbata*, an Australian species invasive in Mediterranean countries of Europe. Models were spatially and temporally projected to provide data suitable for management, and to detect local trends not detectable at coarser scales. Finally, patch-level SDMs were compared against two probability allocation methodologies developed in previous studies based on predictions from coarse-scale SDMs. Patch-level models were used to validate the probability allocation techniques. However, whenever data are available, fine-scale models should be preferred since they provide more detailed information for management in the landscape context, even if they are cost and time-consuming due to the large amount of field data required.

## **P2.3**

### **Do Abundance and Proximity of the Alien *Impatiens glandulifera* Affect Pollination and Reproductive Success of Two Sympatric Co-flowering Native Species?**

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In invasion ecology, potential impacts of aliens on native flora are still under debate. Our aim was to determine the pollinator mediated effects of both proximity and abundance of an alien species on the reproductive success of natives. We chose the highly invasive *Impatiens glandulifera* and two native species: *Epilobium angustifolium* and *Aconitum napellus* subsp. *lusitanicum*. These species share characteristics allowing for pollination interactions: similar biotopes, overlapping flowering periods and same main pollinators.

The effects of abundance (5, 25 and 100 individuals) and proximity (0 and 15 m) of the alien on visitation rate, insect behavior, pollen deposition and reproductive success of both natives were investigated. We used centered visitation rates as they can be directly interpreted as a positive or negative effect of the invasive.

Abundance and proximity of the alien increased bumblebee visitation rates to both natives. The behavior of bumblebees changed as visitors left significantly more often the native plants for *I. glandulifera* when its abundance increased. As a consequence of this “inconstancy”, bees deposited considerable quantities of alien pollen on native stigmas. Nevertheless, this interspecific pollen transfer did not decrease seed set in natives.

## **P2.4**

### **Management of Invasive American Bullfrog *Lithobates catesbeianus* in Small and Shallow Water Bodies**

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The control of invasive alien species is essential for securing native biodiversity. As for the American bullfrog *Lithobates catesbeianus*, suspected to cause ecological damage to native amphibians around the globe, comprehensive management techniques are currently absent. We investigated two contrasting approaches to control the species in permanent, small and shallow water bodies. Small and isolated populations were actively managed through trapping with double fyke nets. The catchability of tadpoles averaged 6% of the population with the specified sampling gear, implying feasible perspectives for a full eradication of the species when maintained over multiple years in the infested water bodies. In large and connected populations, where active control is no option, we explored possibilities of passive management through habitat restoration. Using an experimental setup, we investigated effects of complete drawdown (with amphibian and fish removal) and predation (introduction of native northern pike *Esox lucius*) on bullfrogs. The presence of pike lead to a strong decline in tadpoles, while no effect of drawdown was present. Here, biomanipulation of permanent water bodies, leading to a change in food web interactions, may thus be regarded as a candidate for effective and sustainable control of invasive bullfrogs.

## P2.5

### Morphological and Reproductive Traits of the Invasive Herb *Argemone ochroleuca* in the Southwest of Saudi Arabia

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Understanding the strategies and mechanisms of invasive species could guide their control and management especially in the fragile arid regions. The current study compared morphological and reproductive attributes of the invasive *Argemone ochroleuca* in eight habitats (cultivated fields, abandoned fields, road sides, mountain gravelly plains, overgrazed sandy plains, wadi runnels, alluvial deposits and waste lands) along the southwestern region of Saudi Arabia. The results showed that morphological attributes such as plant height (91 cm), leaf area (116 cm<sup>2</sup>) and leaf dry mass (2077 mg) were highest in the wadi channels, whereas these attributes attained their lowest values in the overgrazed sandy plains. Maximum specific leaf area (132.2 cm g<sup>-1</sup> of leaves) and root dry matter content (609.3 mg g<sup>-1</sup>) were recorded in the abandoned fields. Similarly, reproductive attributes in terms of number of flowers and fruits (11 and 65 per plant, respectively) and fruit dry matter content (951.6 mg g<sup>-1</sup>) were highest in the abandoned fields. Our results suggested that *A. ochroleuca* has different invasive strategies depending on the invaded habitats.

## P2.6

### The Role of Ectozoochory in the Dispersal of the Alien Amphipod *Crangonyx pseudogracillis*

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Ecological experiments were performed in order to assess the ability of the alien freshwater amphipod *Crangonyx pseudogracillis* to spread through ectozoochory. We investigated if the amphipods attached both to mallard's legs and feathers. In our experiments a dead mallard was immersed or dragged under different conditions in water containing amphipods. We also tested the ability of *C. pseudogracillis* to be transported and to survive during duck flight. Flight was simulated by mounting a dead mallard on a pick-up truck moving with a constant speed of 70 km h<sup>-1</sup>. We obtained probabilities of clinging to the duck's leg, of respectively 0.2%, 1% and 2% for immersion periods of 1, 5 and 10 seconds at a density of 400 ind. m<sup>-2</sup>. In the experiment with a duck placed without any movement into containers with amphipods no ectozoochory was detected. Nevertheless, when the experiment was repeated with a moving duck we obtained a transport probability of 1.83%. A probit analysis unveiled that *C. pseudogracillis* can be transported alive on a flying duck over a distance of 11.7 km with a survival probability of 0.2%. We concluded that waterbirds may enhance the spread of *C. pseudogracillis*.

## **P2.7**

### **The Red Swamp Crayfish, *Procambarus clarkii*, Overland Dispersal: A Study of Environmental Variables Affecting Crayfish Motion Patterns and Orientation in Dry Land**

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The red swamp crayfish, *Procambarus clarkii*, is a successful worldwide freshwater invasive species and although thoroughly studied, its overland dispersal capabilities aren't yet well explained. The main goal of this study was therefore to identify environmental variables affecting crayfish motion patterns and orientation in dry land. Crayfish motion preferences related to relative humidity, temperature, luminosity and ground slope were tested under laboratory conditions. The crayfish were placed at the centre of a 2 meter long metal gutter and given a choice between two different values of each variable. Its movements were recorded using a webcam. For each variable we replicated the experiment 30 times, always using a different adult crayfish and analysed the results using Chi-square. There was no significant preference regarding high or low humidity or luminosity levels. Crayfish had a significant preference regarding temperature, showing a tendency to move towards cooler areas. Likewise, crayfish movement preferences were significantly affected by slope, since they preferred to move downhill. The awareness of such preferences may help to predict the invasiveness of the freshwater ecosystems and to identify the most effective management practices to prevent or contain its spread.

## **P2.8**

### **Feral Cat Diet and Impact on Canary Islands with a Focus on La Palma Island**

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Cat is one of the worst invasive species on islands directly responsible for the extinction of numerous species, including endemic species of mammals, birds and reptiles. The diet of feral cats in the main habitats of the Canary Islands, as generally occurred on oceanic islands, is mainly composed of introduced mammals, and native species of birds, reptiles and insects. We studied the spatial and seasonal variations of feral cat diet in relation to the prey availability in the main four habitats (coastal shrub, laurel forest, pine forest and high mountain shrub) present on La Palma Island, determining trophic interactions and magnitude of cat predation on prey species. The analyze of cat diet showed strong differences between habitats and seasons and seemed to confirm the opportunistic trophic behavior of feral cat due to the correlation found between prey availability and prey consumed. Studying cat diet in relation to prey availability has to be encouraged for future diet studies as such results lead to (i) calculate a "real impact" on prey populations and (ii) provide more precise results to perform eradication or control managements.

## **P2.9**

### **Finding Non-lethal Solutions to the Risk of Establishing the Zoonotic Parasite *Echinococcus multilocularis* in the UK from Feral European Beavers (*Castor fiber*)**

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*Echinococcus multilocularis* is a highly pathogenic zoonotic cestode parasite of human health importance that is currently not present in the UK. European beavers (*Castor fiber*) introduced in the Scottish beaver trial originate from Norway which is free of the disease, and have undergone extensive health screening. Feral beavers elsewhere in the UK, most notably the expanding population in Tayside, originate from European regions known to host the disease, and a feral beaver in the UK has already been diagnosed at post-mortem examination to have been infected with the parasite. There is a real risk of the parasite becoming established in the UK. There is currently no definitive validated ante-mortem diagnostic test, and there is notable public opposition to any suggestions of a cull of the feral beavers in Tayside. While the risk from new beaver imports can be limited, this does not address the risk from established first generation feral beavers. Initial examinations performed on 20 European beavers using polymerase chain reaction (PCR) blood testing, abdominal ultrasonography, and 3mm minimally invasive “keyhole” surgical examination of the viscera, appear in combination to hold the best chance of screening feral beavers in a non-lethal manner.

## **P2.10**

### **Monitoring and Evaluating the Distribution and Successes of Invasive Species in a Riparian Landscape within the Restoration of the River Traisen, Lower Austria**

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The regulated riverbed of the Traisen will be revitalized as part of the LIFE + project “TRAISEN”. The creation of a natural river course required the management of invasive species in the project area. The evaluation of the situation and the development of invasive species are done by means of a grid that is placed over the research area. This creates a network of 135 recording surfaces, each 200m<sup>2</sup>. In 2010 and 2011 seven invasive plant species were found. Further an analysis of seed banks in 2011 is used to detect the dynamics of the invasive species occurrence. In the following study years, the development of invasive species will be monitored during the construction. The aim of this work is to evaluate the quality and the development of plant diversity before and after the change of the course of the river Traisen. The polluter-affected-effect is to be analyzed. Furthermore, the interaction between the intervention and the spread of invasive species and endangered species and value imaging has to be analysed. Based on the evaluated data of the monitoring, the management of invasive species is going to be developed.

## **P2.11**

### **Factors Inducing Invasive Red-swamp-crayfish (*Procambarus clarkii*) Overland Dispersion**

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The ability for overland dispersion in some freshwater invertebrates can provide an important advantage over other species when colonizing new water bodies. In this study the factors involved in red-swamp-crayfish (*Procambarus clarkii*), an exotic invasive crayfish species in Europe, overland dispersion were investigated. The numbers of individual *P. clarkii* moving out of water were monitored during a 12 month period in a rice cultivation system in Portugal. One of the main factors inducing crayfish overland dispersal was the drainage of the study area and the number of crayfish dispersing overland was inversely correlated with the water level in the rice pads. Overland dispersion was only observed immediately after the drainage of the study area and occurred until the area was reflooded due to heavy rain events. Other variables significantly affecting the overland dispersal of crayfish were the temperature, relative humidity and the period of the day. These results can be of great use for controlling and managing invasive crayfish population, especially in recently invaded areas.

## **APPLIED ETHICS AND VALUES**

### **P3.1**

#### **Conservation and Public Opinion**

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Public perception about environmental problems and the situation of the threatened species has already been changing for a while. Since the opinion of the society plays an important role in conservation, we have carried out a survey in Spain in order to try to know this opinion. 79.7% of 232 people surveyed believed that all species have intrinsically the same value and only 76.3% supported the funding of conservation programs with public funds. However, 11.2% of respondents think that conservation projects should not be developed at all, allowing the species to recover on their own or become extinct. Even 1.7% says that they would live better if some species disappeared. By correlating these views with a certain number of sociocultural factors we have found that educational level is of vital importance, significantly associated with all of them. Thus, people who believe that the extinction of some species would improve our lives, none of the conservation actions should be undertaken and that not all species have the same value, have a lower academic profile. Other relevant factors have proved to be the professional background, age and interest on Nature.

## Biodiversity and conservation in non european countries

### P4.1

#### **Bridging the Gap between Theory and Management. A Case Study Demonstrating an Integrative Approach to Conservation of New Zealand's Rarest Kiwi, the Rowi (*Apteryx rowi*)**

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We applied a multi-disciplinary adaptive management approach to inform conservation of New Zealand's rarest kiwi, the rowi (*Apteryx rowi*). In doing so, we demonstrate bridging the gap between the theory of integrative approaches and management practice. This research investigates factors affecting reintroduction success and explores the value of expanding the current reintroduction programme into new areas. Experiments involve manipulations of release areas and reintroduction strategies, followed by extensive monitoring over 3 years to test key hypotheses. Kernel density estimations of location fixes within the rowi sanctuary show that reintroduced rowi establish significantly larger territories, 192.71Ha ( $\pm 65.27$ , n=10), compared to 84.09Ha ( $\pm 38.46$ , n=67) of wild rowi. This suggests reintroduced birds may be relegated to sub optimal habitat and hence require a larger area to meet their needs. Rowi released into an unoccupied trial area gained more weight per week post release, 0.0145Kg ( $\pm 0.00316$ , n=31), compared to those reintroduced into the sanctuary, 0.0049Kg ( $\pm 0.00308$ , n=25). These results suggest that the sanctuary is close to carrying capacity, and expansion of the management area may be necessary to maintain or improve the efficacy of rowi conservation.

### P4.2

#### **Impacts of Hunting and Logging on the Structure of Frugivore Communities in a Neotropical Rain Forest: Consequences for Seed Dispersal**

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The increasingly pervasive effects of hunting in tropical rain forests are often compounded by other forms of human disturbance, with dire consequences for animal populations. Among the numerous effects of this defaunation on ecosystem processes, the potential loss of frugivores can have critical impacts on seed dispersal and forest regeneration. We tried to assess the modifications in the frugivore communities induced by hunting, whether or not compounded by logging, at two forest sites in French Guiana. The human-impacted site, Montagne de Kaw, is located close to urban areas and sees hunting and, in some areas, logging. The remote control site, Nouragues Research Station, is virtually untouched. On both sites, the diversity and abundance of diurnal frugivorous mammals and birds was evaluated during day time distance sampling censuses conducted along 2000 m long line transects. Species abundances were analyzed as a function of each species' body mass, guild and hunting pressure. Many of the depleted species in Kaw were large-bodied, key seed dispersers that also are the favorite game species of local hunters. Such a depletion of the frugivore community has potentially serious impacts on the dispersal and recruitment of large-seeded tree species, which specifically depend on these large frugivores.

### **P4.3**

#### **Carnivore Conservation: Attitudes of Teenagers Towards the Maned Wolf in the Southeast of Brazil**

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The relationships between people and carnivores are a worldwide concern for the conservation of species as well as habitats. The maned wolf is an endangered, endemic canid inhabiting the southeast of Brazil - highly populated and rich in biodiversity and endemism. Strategies to conserve this key stone species may benefit the also declining Cerrado biome. The attitudes of teenagers towards wild carnivores are also of worldwide interest as future citizens and future decision makers. The present study investigates the attitudes of two age groups (12-13 and 16-17) towards the maned wolf. Questionnaires aimed to identify selected attitudes, beliefs and knowledge of students in relation to the maned wolf in urban areas of three locations in the São Paulo state. Responses were analysed according to age groups, gender, location and experiences concerning the maned wolf. Results suggest that positive attitudes declined with age; older teenage girls were more scared of the maned wolf than any other group; and the school and environmental education, as well as first hand experiences of seeing the maned wolf in nature influenced attitudes positively towards the species amongst the younger group. This study could be instrumental in the planning of environmental educational strategies.

### **P4.4**

#### **Conservation Genetics of Endangered Populations of Pampas Deer at the Southern Edge of its Distribution**

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*Ozotoceros bezoarticus* is one of the most endangered species of deer in Argentina. Although it was abundant in the past, its distribution has withdrawn more than 90% of the original area, due mainly to the anthropic disturbance of its habitat. Two subspecies have been described based on morphology, *O. b. leucogaster* and *O. b. celer*, constituting four isolated populations of low size. At present the species is categorized as Threatened in Argentina. We investigated genetic variability and structure in order to design conservation strategies. Using invasive and non invasive samples, we isolated ten microsatellite loci, designed specific primers to amplify the control region of the mtDNA and set up a protocol for molecular sexing. A preliminary analysis of the genotypes of both subspecies showed between 3 and 12 alleles per locus with observed heterozygosity ranging from 0.326 to 0.557. The combined analysis of the control region and cytochrome b sequences revealed no shared haplotypes between subspecies, lower genetic diversity in *O.b. celer* and significant differences among both groups, with no detectable gene flow between them. A phylogenetic analysis indicated a monophyletic clade only for *O.b. celer*. Accordingly, we postulate that both subspecies should be considered independent management units.

## **P4.5**

### **Prey Selection by *Panthera tigris tigris* of Chitwan National Park (CNP), Nepal**

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There has been a little study regarding the prey selectivity of tigers in Chitwan National Park, the scats (n=77) were collected (Jan-Mar,2010) for the analysis of food habit in terms of prey abundance. The selectivity of the Principle prey species was determined using the SCATMAN software.

*Axis axis* and *Cervus unicolor* constituted 82% of the tiger's diet. The average weight of the Principal prey species killed was 84 k.g. reflecting the preference to the larger prey. *Axis axis* was the most relatively killed (50%) and *Cervus unicolor* constituted the largest biomass (43%). *Cervus unicolor* (0.3017<sup>+</sup>), *Axis porcinus* (0.0042<sup>+</sup>) and *Sus scrofa* (0.0488<sup>+</sup>) were consumed more than their availability whereas *Axis axis* (0.0037<sup>-</sup>) and *Muntiacus muntjac* (0.5986<sup>-</sup>) were underestimated. The significant selectivity of *Cervus unicolor* suggests that the tiger selectively kills larger prey provided there are choices. Also, the diet analysis is a major factor to understand the ungulates situation, predation patterns and health of the forest, so must be done on the regular time frame. Besides, Chitwan National Park with high prey density and availability of larger prey made it a potential area for long term conservation of the tiger.

## **P4.6**

### **Plants That Need Protection in the Carpathian Area**

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Long-term economic activity has led to profound changes in vegetation cover in the Carpathian. In place of former forests have secondary and artificial groups of plants. These vegetation complexes in general, represent a wide range of qualifications of different origin and status, which are ecological niches of the existing species diversity populations against the background of natural and geographical differentiation of natural systems in the region. Only the persistence of these niches can be the key to the protection and restoration of authentic regional species diversity. Therefore, knowledge of the modern structure, origin and trends of the dynamic of plant communities is fundamental to the strategy of environmental management. Rarity of natural plant communities - a complex phenomenon associated with the dynamic process of vegetation, as well as the influence of economic activity. We found 555 species of vascular plants belonging to 313 genera, 95 families. Their number includes 39 rare species that grow in 34 groups of associations in the Carpathian part of the river Dniester.

#### **P4.7**

##### **Species Diversity on Protected and Non-protected Areas of Golestan National Park and Vicinity Areas**

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It is important to monitor the status of native rangeland vegetation because of their high value for wildlife and the maintenance of the existing grassland remnants. In the Steppe region, there has been concern that grazing of late-successional ecosystems may decrease plant species diversity on a local and regional scale and adversely affect rare, threatened, or endangered species. Management and conservation of rangelands are increasingly concerned with maintaining productivity, species composition, and diversity of native plant communities. We estimated canopy cover and diversity of rangelands across 115, 0.25×0.65 m<sup>2</sup> plots in protected areas and 80, 0.25×0.65 m<sup>2</sup> in non-protected areas of northeast of Iran. Canopy cover was estimated visually as cover classes based on Daubenmire Method. The Shannon diversity index (*H*) was used to characterize species diversity in the study area. Across the study sites 42 plant species were observed, approximately 39 and 17 plant species were occurred in both protected and non-protected areas. We found that the non-protected areas were lower than protected areas in diversity and evenness of species. Shannon diversity index was 3.5 with evenness in species abundance being 0.95 for the protected area and it was 1.64 with evenness 0.58 for non-protected area.

#### **P4.8**

##### **Foraging Habitat Preferences of Bats in Northern Zambia and their Role as a Wildlife Reservoir for Human African Trypanosoma Parasites**

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The foraging habitat use of tropical African bat species during the dry season of 2008 was examined in Kasanka National Park, and its surrounding Game Management Area, in northern Zambia. The investigation was considered in the context of bat conservation significance and their potential role as a reservoir for Trypanosoma protozoan parasites of human populations, particularly the subspecies Trypanosoma brucei rhodesiense and T. b. gambiense, which are major causes of human disease and economic loss in sub-Saharan Africa. Bats (n=127) from 19 species (both insectivorous and pteropid) were captured by mist-netting across three key habitat types: dry miombo woodland, riparian (riverine) forest and agricultural sites within areas of human habitation. Condition data was collected from the bats and blood samples were taken from 57 individuals for assessment of trypanosome infection. 50.9% of samples tested positive for Trypanosoma parasites with minor variation in incidence between habitat types. Infected individuals demonstrated reduced body condition and variation was also found in the capture rates, condition and species diversity across the different habitats considered. Bat diversity was highest in agricultural areas, and insectivorous species foraging in agricultural areas also had significantly higher condition scores.

## **P4.9**

### **Developing Macrophyte-based Techniques to Aid Monitoring and Conservation of Zambian Rivers**

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Surveys during 2010-2011 from 140 sites on Zambian rivers have provided new information on the occurrence of aquatic macrophyte and riparian plant species and are contributing to the Southern African River Assessment Scheme (SAFRASS). This will build biomonitoring protocols for Zambian rivers, utilising plant and other biotic data. Initial identification work has recorded over 200 plant species from 45 families. Cyperaceae is a ubiquitous family, with 24 species tentatively identified so far. In contrast, members of the Eriocaulaceae tend to be restricted to perennial headwater rivers in northern regions of the country with higher rainfall, but may be locally dominant in stream in these locations. In addition, the survey work has also produced new records of *Nymphaea divaricata*, which is classed as an IUCN red list species due to data deficiency. We investigate the countrywide variation in the floristic data at varying taxonomic levels and in relation to our knowledge of hydrological and natural chemical variability. The production of a trophic ranking index for Zambian macrophytes in unimpacted situations will aid future conservation of rivers in a country where potential pressures include increasing mineral exploitation and a projected human population increase of almost 1000 percent by the end of this century.

## **P4.10**

### **Benthic Macroinvertebrate Diversity of Zambian Rivers: Biological Monitoring and Conservation Implications**

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This study reports initial findings of the first comprehensive survey of tropical benthic macroinvertebrates in Zambian rivers. In total 232 samples were collected during 2010 - 2011 from 140 sites on 87 rivers throughout the country, as part of fieldwork for the new Southern African River Assessment Scheme (SAFRASS). This project aims to develop pilot biomonitoring protocols for water quality assessment of tropical African rivers. Given the lack of prior studies of the freshwater ecology of Zambian rivers a priori taxonomic knowledge of the occurrence and distribution of invertebrate species is vital for developing a functioning biomonitoring protocol. Over 340 macroinvertebrate taxa have been identified to date from this dataset (mostly to species or genus level), forming a diverse group with wide-ranging disturbance tolerances, which reflect variations in water quality and habitat integrity. The dataset includes many new records for Zambia, and previously undescribed species. In one family alone, the baetid mayflies, over 55 morphospecies representing at least 20 of the 31 southern African mainland genera have been putatively identified. Community assemblages from different catchments, river types and habitats show distinct signatures and contribute to the biogeographic and ecological knowledge needed to develop the river biomonitoring protocol.

#### **P4.11**

##### **River Diatom Biodiversity and Biointegrity Assessment in Zambia: A Conservation Perspective**

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Freshwater benthic diatoms are sensitive indicators of nutrient status, explaining their widespread use in Europe and elsewhere for assessing river water quality and biointegrity. The Southern African River Assessment Scheme (SAFRASS) is developing a biomonitoring programme for tropical rivers, based on cognate schemes developed in temperate countries, for initial application in Zambia, where currently no such programmes exist, and even basic knowledge of the identity and distribution of potential biomonitoring diatom species remains mostly unknown. The project's diatom component aims to i) develop standard procedures for diatom sampling, preparation and analysis for use in Zambian rivers, and implement these techniques via appropriate training; ii) build a robust metric using diatoms to measure water quality; iii) document diatom species found, and enhance understanding of their ecology; iv) produce an identification guide to the diatom flora of Zambia; and v) assess diatom species biodiversity. Initial analysis of samples derived from field surveys of c. 140 sites over 2010-11 shows evidence of species-rich diatom assemblages from Zambian rivers, with high local endemism, wide-ranging morphological variation, and taxa new to science. This information, integrated with other biotic and physico-chemical survey data, is contributing new knowledge vital to the conservation of river biodiversity in Zambia.

#### **P4.12**

##### **Response of the Small Rodent Community to Sheep Grazing in a Semi-arid Rangeland in Southern Uzbekistan**

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Semi-arid to arid rangelands constitute nearly 30% of earth's land surface. Grazing is one of the most important uses of these areas. However, there is a lack of scientific consensus regarding the ecological effects of grazing; the scale and nature of impacts vary among ecosystems, in different environmental contexts, and according to site-specific variables and management. Much of the research on rangeland management focuses on consequences for livestock carrying capacity and productivity. Nevertheless, changes in vegetation due to grazing trigger bottom-up effects on ecosystem structure and composition, particularly for other primary consumers such as rodents, which can have knock-on effects on predator communities and secondary prey species (including ground-nesting birds). In the southern Kyzyl-Kum Desert, Uzbekistan, the relative abundance and species composition of the rodent assemblage were estimated in sites under different levels of grazing pressure using scat and burrow counts. Density estimates were calibrated and species verified by live-trapping, and guild composition and relative abundance related to livestock density (measured by distance transects) across a range of vegetation types including sandy, clay, and stony desert. Results are used to test the hypothesis that rodent densities are reduced with higher livestock densities.

#### **P4.13**

##### **Fire Policy Optimization in Kruger National Park to Maximize Suitable Habitat for Rare Antelopes**

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Fire is a key ecosystem driver in Savannas and it can have large negative or positive impacts for species and habitat persistence. A re-examination of fire management in Kruger National Park is currently under review with the objective to maintain natural ecosystem dynamics and favour tourists' ability to observe animals. The aim of this study is to provide a decision support tool for assessing the impact of different fire management strategies on six rare antelope species in the park.

We used data on location, intensity and frequency of fires and census data on antelopes to estimate the relationship between fire occurrence and species occurrence and density. The census data were used to correlate antelopes' density with presence of burnt areas. These density models were used to evaluate different scenarios of fire management. We compared the spatial output of the density models with the use of expert-based habitat suitability maps for these species.

We identify the spatial trade-off between the conservation of species attracted by burnt areas and species that avoided burnt areas. We finally make recommendation for an optimal fire management strategy for the conservation of these rare antelopes.

#### **P4.14**

##### **The Search for the Isabela Oriole (*Oriolus isabellae*)**

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The Isabela Oriole (*Oriolus isabellae*) is a Philippine endemic bird classified by the IUCN as critically endangered. Very little is known regarding this species as only a few observations have been reported. Six records exist prior to 1961 (Collar 1999) with no reported sightings between 1961 and 2003; leading many biologists to believe that this species was close to extinction. During 2003 and 2004 this species was re-discovered and the first photographs of a live specimen were obtained along with the first recordings and description of its song. Since this re-discovery sightings have still been minimal with the latest occurring during 2009. The aim of this project was to establish locations where this species may still occur. Interviews and point counts were conducted at sites of historical observations in Isabela and Bataan Provinces. Point counts with playback stimuli were undertaken every 400 meters and lasted 15 minutes. No Isabela Orioles were found in Bataan but they were observed, photographed and songs recorded within the Northern Sierra Madre National Park in Isabela. These are one of many species that can now only be found within this national park highlighting its importance as a conservation area.

#### **P4.15**

##### **Green Book of Indigenous Breeds of Domestic Animals in the Republic of Croatia and its Value in Biodiversity Conservation**

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Indigenous breeds are an important part of natural and cultural heritage. Numerous rare and endemic species are associated with the habitats in which these indigenous breeds are raised; therefore conservation of indigenous breeds is one of the cornerstones of preserving the biodiversity and rural development, in Croatia and also in the region. In recognizing the great importance of conserving indigenous breeds, and with them the many associated natural habitats, landscapes and traditional agricultural practices, the State Institute for Nature Protection has made a substantial contribution to the modern understanding of conservation, which recognizes both wild and domesticated taxa. In the expert sense, Green book is on the same track as the IUCN Red Lists of endangered taxa, the most credible global indicator of endangered species on the planet. Each out of 26 breeds recognized in the Book (3 cattle, 4 horses, 2 pigs, 3 donkeys, 9 sheep's, 2 goats, 2 poultry, 1 bee) plus 7 breeds of dogs is described in detail (name of the breed in Croatian and English, known folk names, threat category according to FAO, origin, cultural heritage value, ecology, description, population trend and distribution, current value, causes of the endangerment, current regulatory protection, conservation measures).

#### **P4.16**

##### **Rise in Numbers of Hibernating Lesser Horseshoe Bat *Rhinolophus hipposideros* in a Cave Opened for Tourists as a Possible Consequence of Bat Friendly Management**

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In the Veternica Cave, near Zagreb, Nature Park Medvednica, 18 bat species have been recorded by now. The cave is important hibernation site for 8 bat species: *Myotis bythii*, *M. daubentonii*, *M. emarginatus*, *M. myotis*, *M. nattereri*, *Rhinolophus hipposideros*, *Rh. euryale* and *Rh. ferrumequinum*. The cave is open for tourists, but bat friendly management introduced restriction of tourist visits during bat hibernation since 2003, bat friendly gate were built in 2006 and annual monitoring started in 2007, all as a result of research conducted by Croatian Biospeleological Society. Annual winter monitoring included 2 counts in January and February. The number of lesser horseshoe bats increased from 6 in 1996 to 184 in 2011. Although there is a missing period the trend shows significant exponential growth. It is probably related both to restriction of touristic visits in the winter time and changes in cave gating from solid doors to horizontal bars. There are also reports from Czech Republic and Slovenia on growth in numbers of lesser horseshoe bats with similar trends in some caves. Therefore we suspect that this rise in bat numbers is a consequence of bat friendly cave management and possibly reflect the bat social learning.

#### **P4.17**

##### **Comparative Morphological and Molecular Study of the Seafan Family Gorgoniidae (Cnidaria, Octocorallia) in the Eastern Pacific (Ecuador), Preliminary Results**

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Perhaps nowhere else in the world have the gorgonian corals attained such a prominent place in the coral reef fauna as they have in tropical American waters. On almost any reef or rocky bottom from the Eastern Pacific, seafan communities are almost composed by species belonging to the families, Gorgoniidae and Plexauridae. Moreover, the continuous nature of many of the morphological characters in the taxonomy of the Octocorallia has been an important problem for the systematic study of the group. For this reason, some authors consider octocoral characters difficult to encode or to polarize. Thus, the combined use of molecular and morphological datasets seems the best way to study the Systematics of different octocoral groups. It is widely recognized that the time since breaking two DNA sequences is typically greater than the time since the species split from their common ancestor. Therefore, it would be necessary a combined analysis including morphological and molecular data sets, to reorganize the distribution of the homoplasies and redefine a more natural classification, with true monophyletic taxonomic units and addressing the necessity of additional studies in those paraphyletic groups detected. However, more combined studies are needed to clarify and establish better and stronger phylogenies.

#### **P4.18**

##### **Phylogeography and Population Structure of the Black Arowana (*Osteoglossum ferreirai*) in Brazil and Colombia: Implications for its Management**

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In regions with high biodiversity, where species are exploited as source of income, is essential to learn more about the biology and current state of the populations being exploited. The aim is to make the species a sustainable resource, where local people can continue to benefit economically yet also ensure its conservation. The Black arowana distributed only in Colombia and Brazil currently lacks information, both genetically and ecologically, and is categorized as endangered. This fish is removed from the environment during their breeding season leading to a possible critical decline in the population.

A genetic population study was conducted sequencing the mitochondrial genes *cytochrome b* and *ATPase 8*, and genotyping eight microsatellites. Mitochondrial gene results indicated the absence of variable sites, and the microsatellite results showed a significantly lower observed heterozygosity than expected. This indicates diminished genetic diversity for Colombian populations compared to Brazilian populations. It appears regulation on the number of specimens caught in Brazil has led to a positive effect on the genetic diversity of the species. Fishing seems to be the largest contributor to loss of diversity in this species since there is no evidence of recent bottlenecks in the population from the samples analyzed to date.

#### **P4.19**

##### **Assessment of Conservation Status of Vascular Flora by Linking its Abundance and Uses in the Western Himalayas**

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Proper identification and quantification of indicator, endemic and rare species in the Himalayas was felt essential in the scenario of changing climate and long term strategies. Vegetation abundance was linked with its usage to assess the risks to critical species. It was hypothesized that people use vegetation according to their indigenous knowledge and not to its abundance. Abundance and uses of each species were computed using phytosociological and questionnaires techniques in the western Himalayas. Regression and residual value analyses were used to integrate both the data sets ( $p < 0.05$ ). Results revealed that 93 out of 198 species having residual values greater than the standard deviation (0.997) were overused by the inhabitants. Species with highest residuals had multiple provisioning ecosystem services whilst lowest residual values were reported for most of the unpalatable species of invasive nature. Most of the indicator species (some of which are endemic to the Himalayas) were under continuous anthropogenic pressure that inform about the risks to such species of very narrow amplitude. It indicates the species once destroyed are extremely difficult to be re-grown due to number of climatic, edaphic and anthropogenic constraints and could be considered more critically both at species and habitats levels.

#### **P4.20**

##### **The White Stork "*Ciconia Ciconia*" in the North Eastern of Algeria**

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After a period of decline in the years 1970-80, the population of white stork (*Ciconia ciconia* L. 1758) increases again in Europe, this is partly due to poor overwintering conditions. In Algeria, the species has experienced a significant increase in its workforce compared to previous years, we have chosen the wetlands of Tarf, in the extreme north eastern Algeria recognized by the remarkable number of breeding pairs. Between 1996 and 2011, the number of breeding pairs has increased considerably, from 174 in 1996 to 475 in 2007 and 634 in 2011. It should be noted that in the distribution of breeding pairs between 1996 and 2011, there is a significant development since the density of nests increased from 25.22 in 1996 to 64.76 km<sup>2</sup> couple/100 in 2011. This fluctuation is related to the vast agricultural lands and the conditions which give the kind of high food resource, enhances survival and promotes a sedentary lifestyle to a few groups in the region. Currently, 99% of couples have produced young, unlike in 1996 didn't exceed 86%. Changes related to local climate may submit binding conditions for their development.

**Keywords:** white stork, *Ciconia ciconia*, wetland Tarf, northeast Algeria, climatic condition, density, sedentary lifestyle.

#### **P4.21**

##### **Species Limits in the Isabela Oriole (*Oriolus isabellae*) and the White-lored Oriole (*Oriolus albiloris*)**

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The Isabela oriole (*Oriolus isabellae*) and White-lored oriole (*Oriolus albiloris*) are sympatric members of the Philippine endemic avifauna. *O. isabellae* is classified as critically endangered, whereas *O. albiloris* is classified as a species of least concern. Very little is known regarding these species, but they differ morphologically and acoustically. Nevertheless, results from a recent genetic study suggest that both species should be considered a single taxonomic unit. Single taxonomic units that contain more than one nominal species will lead to an underestimated alpha diversity and conservation priorities will be improperly assigned with species of concern being overlooked. The aim of this project was to establish whether the vocalisations of these species differ sufficiently to act as a mating barrier. We therefore conducted sound recordings of both species which were analysed for structural and temporal differences. Recorded vocalisations were also used for controlled playback experiments with individuals of both species as subjects. There was a significant difference between song components and both species responded stronger to conspecific than hetero specific playback stimuli. Our results suggest that the vocalisations of the species differ sufficiently to maintain premating isolation barriers and therefore recommend that these species should be considered individual taxonomic units.

#### **P4.22**

##### **Deciphering of Cytochrome *b* Sequence from *Eristicophis macmahoni* of Pakistan**

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The present article comprises the molecular studies of one of the most medically important viper species of Pakistan i.e., *Eristicophis macmahoni*, commonly called as leaf-nosed viper. In Pakistan, no studies have so far been undertaken to collect molecular information by deciphering the cytochrome *b* gene (complete or partial) for the said species. Keeping in mind the significance and nuisance of this deadly and rare viper of Pakistan, a study was elaborated by successfully translating the cytochrome *b* gene sequence data for the said species of interest. Snakes for the studies were collected through extensive field surveys conducted in Chagai Desert of Pakistan during 2004 to 2006. A comprehensive resolution of phylogeny for all viper species of Pakistan has to be brought about for medical reasons, as these lethal vipers are significant sources of snakebite accidents in many urban and rural areas of Pakistan. The present study shall lead towards this phylogenetic resolution by comparing the new data with the already discovered information available on the cytochrome *b* genes among the snakes of family Viperidae.

#### **P4.23**

##### **Local and Regional Management for Conservation in Serranía del Darién, Eastern Flank of Takarkuna Hill and its Influence Area in Colombian Territory**

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Today, the mountains of Darien, the most representative biological site and ecological functionality of the ecoregional complex Chocó-Darién, is threatened by the transformation of the natural landscape caused by the dramatic progress of the cattle frontier.

We seek to initiate processes oriented to environmental and land arrangement, to avoid deforestation on original vegetation, to restore degraded areas in these sites and protecting the forests of the eastern foothills of cerro Takarkuna and its area of influence.

We performing analysis of vegetation cover on the eastern cerro Takarkuna and nearby lowlands. We also determined the biological significance using as indicator to the fauna. We diagnosed the importance of territories and management provide indigenous and African descendants communities. The classification showed 4 types of vegetation, loss of primary forest and increase in secondary forest. Also we found a very high biological singularity. Embera communities play a role in the conservation of the forest in Tólo and Tanelita rivers. The Kuna community is interested in promoting connectivity with ancestral territories.

In conclusion, we propose to focus conservation efforts within a mosaic strategy with different categories of protection and management, linking ethnic territories previous mentioned, and the area of approximately 33.000 hectares.

#### **P4.24**

##### **Deteriorating Man-Monkey Relationship in Himachal Pradesh (India)**

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In Himachal Pradesh man-monkey conflict is serious issue - overwhelming in its magnitude and complexity. Monkeys are considered problematic pests causing huge loss to farmers. It is very difficult if not possible to solve this serious problem of deteriorating man-monkey relationship. In order to analyze the severity of man-monkey conflict, abundance and distribution of monkeys in Himachal Pradesh, causes of man-monkey conflict, opinion of people towards monkeys, step taken by the Govt. and to suggest possible solution to minimize the man monkey conflict, present study was planned. Study was carried out in District Shimla in Himachal Pradesh. Study revealed that the situation in the study area is very alarming . There are more than 3, 17000 rhesus monkeys in Himachal Pradesh. Majority of the villages in the state are severely affected by monkey menace. Monkeys were found in diverse habitats such as forests, agricultural fields, towns, villages, temples, garbage dumping sites etc. Monkeys harm people in number of ways such as -threatening, snatching, stealing, biting, breaking, crop raiding and spreading diseases. Average group consisted of [29] individuals. In comparison to some earlier studies regarding opinions of the people towards monkeys, considerable change in the attitude was observed in the public opinion survey.

## **P4.25**

### **Habitat and Species Diversity Patterns at Avdat LTER, Negev Desert, Israel**

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We tested the habitat mapping methodology of EBONE (the European Biodiversity Observation Network, (<http://www.ebone.wur.nl/UK/>)) in a Negev Desert landscape at Avdat LTER site. Habitats in four square kilometers were mapped and classified. Samples of vegetation, reptile and arthropod assemblages were taken using stratified random sampling of the mapped polygons. Habitat type correlated with both species richness (alpha diversity) and assemblage composition change (beta diversity) across all taxonomic groups. However, we found change in assemblage composition more interpretable, matching a gradient in land surface coarseness from silt through sand, gravel, and stones to large boulders and rock outcrops.

## **P4.26**

### **Bugs, Bats and Council Business - Biodiversity in a Big City**

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Ku-ring-gai is a local government area (LGA) in the greater Sydney Metropolitan area with 11,000 hectares remnant natural bushland and hundreds of flora, fauna and fungi species. A place where the 'burbs meet biodiversity and where there is a complex interplay between people, nature, conservation and commercial activities. The area is a biological gem in the jewel of our biggest city where managing natural areas is a balancing trick between conflicting interests, such as conservation and development, and sometimes conflicting legislation. This poster will give a glimpse at Ku-ring-gai's biological diversity from flying foxes and fossorial frogs to glow-in-the-dark fungi and trifid-like plants as well as a brief outline of legislation and management tools we use or must consider.

# CLIMATE CHANGE AND TERRESTRIAL AND MARINE BIODIVERSITY

## P5.1

### Land Use and Climate Change: Effects on Biodiversity

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The impacts of Climate Change and land use dynamics on biodiversity are already visible in distribution and behaviour of a large number of species. In terms of climate change the global mean surface temperature is rising, regional precipitation patterns are being altered and droughts and storms occur more often. On the other hand fragmentation and habitat loss are the main causes of loss of biodiversity on the planet. Understanding landscape patterns and climate change and their effects on biodiversity distribution is needed to improve conservation. Predict locations with favourable conditions are important for protecting biodiversity because it can help to reduce the loss of species richness that an area supports.

We model the number of species (vertebrates, invertebrates and flora) within each cell of a regular lattice for Catalonia, Spain, in the period 2004-2010, by means of a log-Gaussian Cox process, including as a explanatory variables (land use, meteorological, topography and other variables such as distance to roads and urban centres).

Our research gives important recommendations into how, where and when future threats could affect species distribution and how planning processes are needed because protected natural areas would not continue to support all species they were designed to protect.

## P5.2

### Biodiversity of Amphipoda in a Contact Zone of the Karadag Nature Reserve (Crimea, Feodosia Region)

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#### 1. Biodiversity of a rock contact zone

Contact zones of firm substrata (0 m, air-water-firm surface border)

A total number of 18 species of amphipoda were registered in the contact zone of the Karadag area. On rocks the dominating species is *Hyale schmidtii* (averaging 686 specimens per sample) with *Hyale perieri* as subdominant (387 specimens per sample). In breakwater fouling *H. schmidtii* is also the dominating species (146 specimens per sample) with *Hyale prevostii* as subdominant (102 specimens per sample). The number of other specimens of Amphipoda is considerably below the dominating and subdominating species (from 0.1 to 14.7 specimens - for rocks and from 0.1 to 17.9 specimens - for breakwater).

#### 2. The Biodiversity of a pebble-sand beache zone.

Pebble-sand beache contact zones (0 m).

In an uprush zone of sand and pebble beaches of Karadag qualitative sample were selected for identification of Amphipoda. The number of amphipoda specimens reached several thousands per 1 kg of a ground. Of 13 species of Amphipoda the most numerous specimens are *Echinogammarus foxi* Schellenberg, 1928 (from 2 % to 48 % of all identified specimens) and *Ecinogammarus olivii* Milne Edwards, 1830 (from 9.5 % to 94 %).

### **P5.3**

#### **The Use of Diachronic Data to Address the Question of Climatic Change: The Case Study of Fungi in the French Mediterranean Region**

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The Mediterranean region is facing a climatic shift that will include a rainfall decline and an extended drought period. Fungi are key organisms in soils that associate with autotrophs and drive nutrient cycling through decomposition of the necromass. Because they are sensitive to climatic conditions, fruiting patterns of most species of macromycetes occur in either spring or fall, with two annual interruptions. For this reason they have been successfully used in Northern Europe as markers of the climatic change during the second part of the XX<sup>th</sup> century. Using herbaria records from the Botanical Institute of Montpellier, we addressed the question of the influence of the ongoing rainfall decline and extended summer drought on the phenology of fungal fruiting patterns in the French Mediterranean region. We compared data recorded during the early XIX<sup>th</sup> (1821-1852) and the XXI<sup>th</sup> (2001-2011) century concerning 73 ectomycorrhizal and 86 saprobic fungal species collected within a radius of 40 km of Montpellier. Our analysis revealed a differential response depending on the fungal trophic group, with saprobic species being more reactive than mutualists. These results highlight the importance of utilizing herbaria records to better understand the functioning of Mediterranean forests and the conservation challenges associated with fungal diversity.

### **P5.4**

#### **The Effects of Temperature Patterns on the Biodiversity of a Theoretical Ecosystem**

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Our objective was to examine the effects of different climate patterns on ecological equilibrium and biodiversity, using the Theoretical Ecosystem Growth Model (TEGM). Measuring diversity is one of the most important parameters in conversation biology. This paper examines the changes occurring in a theoretical ecosystem as a result of different temperature-climate patterns with constant averages. The composition of the theoretical ecosystem was examined through simulations. Simulation experiments were performed on temperature averages of 293 K, 294 K and 295 K, applying two reproduction velocity parameters ( $r = 1$  and  $0.1$ ). A fluctuation of  $\pm 1 \dots \pm 11$  K were added to the temperature averages, randomly.

Our results showed that there was a more significant change in diversity when applying the lower velocity parameter, than when applying the higher one. In our experiments the diversity of the ecosystem was strongly affected by the set temperature average and its random fluctuation. In case of the largest fluctuation the value of diversity increased significantly.

We can conclude that climate change has a great impact on the diversity structure of the communities of this type of ecosystem models.

Our results concerning the noise-like temperature fluctuations support the Intermediate Disturbance Hypothesis.

## COMMUNITY-DRIVEN CONSERVATION

### P6.1

#### No Need for Conflict: How to Involve Illegal Hunters in Conservation

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South West Georgia forms one of world's most important bottlenecks for raptor migration, with autumn totals of >800,000 individuals recorded annually. However, field surveys in 2011 confirmed illegal hunting to form a major threat: 238 casualties were found by a single observer during 26 days. In contrast to other migration bottlenecks where a similar situation exists, no obvious conflicts have arisen yet between hunters and conservationists. Batumi Raptor Count, the main conservation actor in the region, promotes gradual change through a combination of education, research and ecotourism. Although this project is still in its initial stage, some major successes have already been achieved, in developing a close cooperation with the Ministries of Tourism and Environment, and putting a complete stop to illegal hunting in one of the villages.

## CONSERVATION AT THE SCIENCE-POLICY INTERFACE

### P7.1

#### Plant Species Loss Following Nutrient Enrichment in European Grasslands - Is It Nitrogen or Is It Phosphorus?

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Although many studies support the prevailing paradigm of N driven biodiversity loss, some have argued that P enrichment is the main culprit. Considering predictions of further increases in N and P pollution, there is an urgent need to disentangle their relative contribution to biodiversity loss. We selected 132 grasslands of the *Violin caninae* alliance across 15 European regions along a fertility gradient based on atmospheric N deposition and nutrient input from adjacent agriculture. Then, soil N and P and the type of nutrient limitation were determined. Next, we investigated the relationship between both nutrients and species richness. We also determined how the occurrence of 61 grassland species was related to soil nutrients. Species richness showed a strong negative relationship with soil P but not with soil N. Furthermore, P-limited grasslands exhibited higher species numbers as opposed to N-limited. The occurrence of 18 species was negatively related to increased P, whereas only five to increased N. Our results suggest that, although some species experience negative effects of N enrichment, P enrichment is a more important driver of species loss from European grasslands. This provides novel evidence that environmental policies biased towards N pollution alone will prove to be inadequate.

## P7.2

### Analysis of the Current Protection of Orchid Species in France: Evidence of Biases and Proposal for Improvements by Articulating Priorities on Regional and National Scales

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Application of priority selection methods to real situations has become a key issue of conservation biology. We analyzed the protection of orchid species in France as they are sensitive to global changes and have a great flagship status. We highlighted biases in the current protection (ghost protection, no protection for recently discovered species, compensation of national protection by regional ones). We then proposed an objective method which uses quantified data from atlas on their distribution, abundance and decline to score orchid species for three criteria (national responsibility, rarity and decline) in order to list them at either the national or regional scale. Currently, 21 orchid taxa are listed for national protection, 78 for regional protection and 58 have no conservation status. Our proposed method produced a list of 57 taxa for the national list, 52 for regional protection and 42 unprotected taxa. The slight increase in the total number of listed taxa (from 99 to 109), involves a more than two-fold increase in national protection with a reduction of regional protection from 262 to 75 listings. We showed advantages of our methods in the policy of conservation and incite to its generalization for other plant families and in other countries.

## P7.3

### Offset Measures and Species Conservation under EU Birds and Habitats Directives

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**Aims:** Offset policy frameworks for protected species support the implementation of offset measures that provide similar species to those affected by infrastructure projects with the overall aim of guarantee that no detrimental effect is produced at species' population level. A key concept behind these policies is the ecological equivalence between impacted species and offset species (i.e. 'species equivalence'), although the workability and the success of this principle remain unknown in practice.

**Methods:** We addressed this gap by collecting and reviewing 85 French derogation files to the strict protection of species under EU Birds and Habitats Directives. Data from these files were analysed to provide comparisons of impacted species and communities with offset species and communities.

**Results:** Our results revealed that impacted sites' characteristics (type of impact, type of species, species richness) have strong influences on the achievement of species equivalence supposed by EU Directives.

**Conclusions:** We conclude that the species equivalence principle is much more difficult to implement in practice than suggested in offset policies such as EU Directives. Admitting the limits of species equivalence principle could considerably help offset practitioners and decision makers to balance the needs of development with those of biodiversity conservation.

## **P7.4**

### **Species in a Fragmented Landscape. How Policy Scenario's Change Species Distributions**

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In highly fragmented landscapes there is not much space for nature. Therefore it is crucial to understand how policy decisions can maintain/improve biodiversity. Our study aimed to get scientifically based insight in possible evolutions of biodiversity under different policy choices within a given socio-economic context. Models should be simple and easy to understand for non-specialist policymakers. In short, we modelled 6 land use scenario's. A combination of two environmental and three nature scenario's. The business as usual scenario's continue present policy into the future. The Europe scenario puts on more resources to achieve the European environmental targets. Under the segregation scenario, the use of open space is strictly divided between nature and other uses. The intertwine scenario strives to realise good nature quality everywhere. To model the effects of changes in land use we used the LARCH model (Landscape ecological Analysis and Rules for the Configuration of Habitat). LARCH is based on meta-population systems. It includes habitat requirement, carrying capacity and dispersal capacity of the target species to construct habitat networks. These habitats are tested whether they are viable. To generalise our findings, we used ecoprofiles. Ecoprofiles are fictive taxa that represent a series of species with comparable ecological requirements.

## **P7.5**

### **Translocation of Common Hamsters (*Cricetus cricetus*) as Compensation Measure for an Infrastructural Construction Project in Vienna, Austria**

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While the Common hamster is prone to extinction in parts of Western Europe, it locally exhibits conspicuously high population densities in Austria. In the Viennese south (16°23' E, 48°09' N), the area of occupancy is even extending into urban areas. A population fragment in this region persisted amidst a multi-lane roundabout constructed some 40 years ago, where an underground line and an associated station is projected for 2012. As short-term compensation was not feasible within the < 4ha roundabout, the population had to be translocated to a 15ha park extending from the other side of the lanes to the south. From August to October 2011, we live-trapped 48 hamsters on the roundabout that were subsequently released in the park into prepared burrows equipped with grain feed and hay. We were able to recapture three of the 48 transferred individuals between end of October and mid-November, a time frame too short to provide a sufficient sample for rational conclusions. However, a pilot project in spring 2010 indicated that the release method is adequate, as eight out of 10 transferred hamsters were recaptured, and local survival was up to 50%, with two individuals even establishing their home ranges around the release burrows.

## **P7.6**

### **What Is It That Parks Protect? Searching for Quantitative Baselines of Conservation Status**

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Scientists keep looking for better theory and practice to design and manage parks and preserves. Concurrently, it is often claimed that no pristine ecosystem remains. Especially if we accept the latter premise - also if we don't - baselines are needed to gauge what parks protect, and how pertinent management actions may be. We developed a framework to evaluate the conservation status of parks, a multifaceted goal at the science-policy-politics interface.

We propose three quantitative indexes, on a 0-1 scale: 1) an index based on actual v. potential vegetation cover (*IV*); 2) an index of cultural -or anthropogenic- energy invested in maintaining human activities (*IC*), and 3) an index of trophic integrity based on presence of native top predators, wolves (*IT*). As case study, we applied them to 7 mountain parks in NW Spain.

Vegetation index *IV*, perhaps the most objective, averaged 0.75; one possible interpretation, from a wilderness point of view, is that studied parks achieved 3/4 of their goal. *IC* averaged 0.19, which may be interpreted as a rather high influx of anthropogenic impact on those parks, hindering ecological succession. *IT* averaged 0.70, interpreted as most of the area retaining the ecological influence of top predators.

## **P7.7**

### **Reversing the Corncrake Decline in Scotland: Science, Policy, Government and Agricultural Communities Working in Concert**

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Autecological research on corncrakes *Crex crex* in Scotland elucidated the proximate causes of the species' long-term population decline and severe range contraction in the UK, and the requirements for its conservation. Trial management on nature reserves, and consultation with crofters and farmers, helped refine these findings and develop effective but agriculturally practical measures for its conservation in the crofting areas of North-west Scotland. Liaison with government and policy advocacy at various levels led to the incorporation of these measures into targeted agri-environment schemes. With the negotiation of appropriate payment rates, local agricultural advisory support and outreach work from nature reserves, significant levels of uptake of these schemes was secured, and thus so too the implementation of beneficial management in corncrake areas. Analyses indicate that this sequence of events has successfully reversed the national population decline in this species, and initiated a partial recovery and significant improvement in its conservation status.

## CONSERVATION GENETICS & MEDICINE

### P9.1

#### Inbreeding Depression versus Local Adaptation: Using Multiple Sources for the Reintroduction of a Locally Extinct Plant Species

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The choice of the founding individuals can have a major effect on the viability and long-term chances of success of a reintroduction attempt. From a genetic perspective, two main aspects, sometimes conflicting, come into consideration. Increasing genetic diversity can improve the viability of the new population through a reduction of inbreeding depression. At the same time, using distant individuals can increase the risk of hybrid depression.

In our study, we focus on the reintroduction of the large flowered sandwort (*Arenaria grandiflora*, Caryophyllaceae). While common in calcareous rocks in European mountains, only two lowland populations are known. To restore one of them, which disappeared after a rapid decline, a reintroduction experiment was conducted in 1999. Nine local individuals, before the population completely collapsed, as well as 11 individuals from the other lowland population were used after *in vitro* multiplication. Using ten microsatellites, we study the resulting population ten years after the reintroduction. As well as a general increase in genetic diversity, we show that the dilution of local genes by non-local ones seems to increase the fitness of the plants (i.e. elimination of inbreeding depression), before decreasing it when too much admixture is obtained (i.e. lack of local adaptation).

### P9.2

#### Population Structure and Gene Flow in the Landlocked Saimaa Ringed Seal

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The critically endangered Saimaa ringed seal (*Phoca hispida saimensis*) has remained isolated in freshwater Lake Saimaa, Southeastern Finland, since the last ice-age. The current population is estimated at less than 300 seals. Because of the low number of individuals and the naturally fragmented area of Lake Saimaa, it is expected that the population may have divided into smaller subpopulations with limited inter-regional gene flow, which would make it especially vulnerable to environmental changes. Ringed seal samples collected from different parts of Lake Saimaa spanning three decades were examined for mtDNA control-region (N = 215) and microsatellite variation (N = 114). MtDNA survey revealed high spatial and temporal differentiation among four regions and three decades, which indicates high breeding site fidelity of females and pronounced effect of genetic drift. Microsatellite analyses show no differentiation between decades, but demonstrate moderate level of differentiation between the four regions, suggesting that gene flow is limited within the lake. This knowledge can be used to evaluate the need for translocations of mature seals within the lake as an active conservation measure for preventing possible inbreeding depression and for repopulating previously used breeding sites.

### P9.3

#### Genetic Structure of an Endangered Species: Hermann's Tortoise (*Testudo hermanni hermanni*) in Western Europe Revealed by Microsatellites Markers and Implications for Conservation

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Hermann's tortoise (*Testudo hermanni hermanni*) shows a very scattered distribution in Western Europe and is considered as one of the most endangered species in Europe. Our study focused on the genetic structure and diversity of this species in five geographic regions. Two major genetic groups were evidenced based on 19 microsatellite loci that were specifically developed from a pyrosequencing library. The first group mainly included continental populations: Var, Albères and the northern part of Menorca Island. The second group comprised the turtles of Corsica, Ebro Delta and south of Menorca. The origin of the two lineages observed on Menorca was not elucidated and a sub-population structure was evidenced for Corsican and Var populations. Our study also revealed that introduced populations (Ebro Delta, Menorca) showed a reduced genetic variability as compared to autochthonous ones (Corsica, Var) and that the Albères displayed signs of decline. The analysis of the genetic structure of *T. h. hermanni* populations allowed 1/to better understand the structuring of Hermann's tortoise populations in the occidental Mediterranean basin; 2/to address some issues concerning the ongoing conservation management programs: how many original conservation units can be defined? What are the implications for reintroduction projects, especially in France and Spain?

### P9.4

#### Habitat Fragmentation and Population Genetic Structure in the Endangered Cantabrian Capercaillie

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The Cantabrian capercaillie (*Tetrao urogallus cantabricus*) inhabits northern Spain, and is considered as an Evolutionary Significant Unit at high extinction risk due to a rapid demographic decline over the past 30 years. This decline takes place in a fragmented landscape that may contribute to isolation between groups, which in turn might increase their local extinction risk. Using DNA from faeces collected in 2009 from five areas at the Western margin of its distribution, we characterized genetic variability using microsatellites and evaluated the existence of population structure. A mantel test showed no correlation between genetic and geographic distances, while a Bayesian analysis indicated the presence of 4 groups not strictly related to geography. However, one of these groups only included individuals from one particular area, a wildlife reserve, which would suggest that birds living at high quality habitat do not disperse as much as others. Despite the fact that the remaining three groups were constituted by birds from all sampling localities, only a minority of individuals showed mixed ancestry. These results suggest that capercaillies are able to move throughout the sampling area, although reproduction might take place preferentially among a few local individuals, with migrants having low reproductive success.

## P9.5

### The Effect of Anthropogenic Hunting Practices on Population Structure in Guinea Baboons (*Papio hamadryas papio*) in Guinea Bissau

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In Guinea Bissau, Guinea baboons are heavily hunted for meat consumption and are thought to be undergoing a significant range contraction. In this work, we assessed if the mortality caused by hunting practices constitutes a barrier to dispersal. We used two different genetic markers (fourteen microsatellite loci and a fragment of the mitochondrial control region) and a non-invasive sampling strategy. After evaluating genetic diversity and population structure, we determined if genetic discontinuities in the data were concordant with the location of human pressure by using a landscape genetics approach. We found that, despite high hunting-driven mortality, the genetic diversity was not significantly reduced. Evidence of historically female-biased dispersal and more recent contact between localities was found, along with admixture between sampling regions. Evidence was found of a contact zone where gene flow seems to be unidirectional and where admixed individuals are in higher proportion. These genetic discontinuities are not related with natural or anthropogenic barriers to gene flow but are concordant for both genetic markers. Our results suggest that hunting pressure has caused recent contact between genetically differentiated individuals, which now co-exist in the same social unit.

**Keywords:** Hunting Pressure, Population Structure, Genetic Diversity, Guinea Baboons, Landscape genetics.

## P9.6

### Genetic Guidelines for the Conservation of the Endangered Polyploid *Centaurea borjae* (Asteraceae)

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Most members of the genus *Centaurea*, one of the most abundant among the *Asteraceae*, are common and widespread. A few, however, are endemics with narrow distribution. An interesting example is *Centaurea borjae*, an entomophilous outcrosser that also produces asexual rhizomes. This relict paleopolyploid is restricted to a few enclaves scattered along < 40km of sea cliffs in NW Iberian Peninsula. As small population size, asexual propagation, and restricted range can diminish genetic variation, appropriate management of *C. borjae* requires designing strategies that include genetic information. Using AFLPs and cpDNA sequences, we found no evidence of genetic impoverishment; genetic diversity was comparable to that of other plants with similar life history. Clone abundance was likewise low although clonal propagation seemed more common in populations from serpentine soils, suggesting a role for soil type on the magnitude of asexual reproduction. Our results also indicate that dispersal and gene flow between enclaves must be low. From a conservation perspective, we propose that most enclaves should be delimited as independent management units given their unique genetic composition. Also, the detection of fine-scale spatial genetic structure recommends that collection of germplasm for *ex-situ* conservation should focus on individuals separated >45m to maximize genetic variation.

## **P9.7**

### **Living on the Edge: Conservation Genetics of the Grey Long-eared Bat across Spatial Scales**

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Edge populations, characterised by higher vulnerability to extinction, pose a problem for conservation decision-making. While the global conservation value of edge populations depends on their extent of genetic divergence from core populations, their long-term survival and viability may depend on gene flow from adjacent populations. We used an integrated approach to study the conservation genetics of one of the rarest British mammals, the grey long-eared bat, *Plecotus austriacus*, across spatial scales. We combined population genetics analysis with ecological niche modelling to identify landscape barriers to gene flow and their effect on conservation status. Using 24 microsatellites we identified distinct genetic structure across the range and a unique population restricted to the British Isles with little recent gene flow from European populations. Genetically distinct populations were separated spatially by unsuitable environmental conditions or water bodies. Within Britain, colonies were divided into two main sub-populations. Although some colonies were isolated, overall genetic diversity was relatively high. The small size of the British grey long-eared bat population and its genetic isolation from European populations suggests that this edge population is of high conservation concern, especially as it contains unique genetic diversity absent from the rest of the species' range.

## **P9.8**

### **DNA Profiling of Leopard (*Panthera pardus*) in Himachal Pradesh, India and its Implication in Wildlife Forensic and Conservation Biology**

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Understanding genetics of free ranging of species is integral part of effective *in-situ* conservation in human dominated landscape and used to minimize poaching through population assignment tests. We describe DNA extraction, species and sex identification and assessment of genetic diversity of leopards (*Panthera pardus*) of Himachal Pradesh, India from semi-tanned skins (n=7) seized under a wildlife offence case. DNA obtained was ca. 1 kb (commercial kit) and suitable for genetic studies. We determine unique SNPs in 12s rRNA (384bp) and 16s rRNA (550bp) for species identification. Three haplotypes were observed only in 12S rRNA. Sex identification indicates that 3 skins were of male. Based on multilocus genotyping (17 loci), we observed 2 to 7 alleles with a mean of 4.41/locus and effective allele was 2.986/locus. Mean observed heterozygosity (HO) was 0.549. Estimated R values from ML relate software was 0.07 to 0.25 and two samples were half sibs. Genetic distance data reveals that these samples were at least from five different populations and two samples were half sibs probably belonging from same population. We suggest a need of developing mitochondrial and nuclear DNA data base for leopard in Himachal Pradesh for better conservation of species in this landscape.

## **P9.9**

### **Factors Affecting DNA Quality in Feathers Used for Non-invasive and Non-destructive Sampling**

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Previous studies demonstrated that shed feathers are good material for genetic analyses: they are relatively easy to collect and a single feather can provide sufficient amount of DNA. However it is proven that DNA quality extracted from the feather tips is affected by feather quality. As the superior umbilicus part of the feather shaft is an alternative DNA source, we examined whether parameters like physical condition, type, size and storage time of shed feathers of Eastern Imperial Eagles (*Aquila heliaca*) affect amplification success if DNA is extracted from this part of the feather. We also tested the effects of sunlight, temperature and humidity on DNA extracted from fresh Domestic Goose (*Anser anser domesticus*) feathers by modelling environmental conditions of the moulting season. To estimate the fragmentation of the DNA and to determine the most threatening factors we amplified fragments of various sizes. Good and moderate quality feathers provided sufficient DNA, however success was affected by feather type in moderate quality feathers. In order of importance humidity and direct sunlight were the most important factors that can make the feathers useless for genetic analyses within a short time in the field, which should be taken into consideration when scheduling field work.

## **P9.10**

### **Population Genetics: A Promising Future of Wildlife Conservation**

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The biological diversity of our planet is rapidly reducing due to direct or indirect effect of human interference. Most of the species have already become extinct while others are facing the risk of extinction. Still, we know less about the genetic and population status of these wild species. In view of advances taken place in DNA technologies, population genetics has become widely used to reveal future status and conservation of both abundant and endangered species. Population genetics focuses on the effects of present genetic structuring or sub-structuring on long-term survival of a species which facilitates wildlife managers protect biodiversity by identifying different conservation units viz. evolutionarily significant units, management significant units, etc. There are two major tools in population genetics, mitochondrial DNA markers and nuclear DNA (microsatellite DNA) markers. Mitochondrial DNA is regarded as an important tool in studying evolutionary relationships among various taxa. Microsatellites DNA have been widely used in studies with various organisms, due to their high degree of polymorphism and co-dominance and also have the potential to resolve genetic relationships at all levels of population structure. It is useful in describing the extent of gene flow, inbreeding depression, immigration, emigration, parentage analysis and genetic diversity.

## **P9.11**

### **Species Diversity vs. Genetic Diversity: A Conflict in Conserving Levels of Biodiversity?**

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Despite being crucial for long-term survival of populations, the conservation of genetic diversity has largely been neglected in the planning and implementation of conservation strategies. This is likely due to two reasons: 1) limited resources do not allow for consideration of genetic diversity separately from other more immediate goals of conservation, or 2) the hierarchical structure of biodiversity and similarities in the theories concerning different levels suggest all levels of biodiversity can be maximized simultaneously. As conservation often aims for maximizing species richness with minimal resources, the relationship between species richness and genetic diversity within populations should be of great interest for conservation biologists. A parallel effect of environmental variables on both, species richness and population sizes, has been observed. Thus, a positive correlation between species diversity and genetic diversity within species has been suggested. If species diversity and genetic diversity within species co-vary positively, they can be maximized simultaneously and one level can be used to make inferences of the other, providing possibilities of cost-effective conservation. However, a negative relationship is possible in communities where interspecific competition leads to reduced population sizes and genetic diversity due to increased genetic drift. This conflict between levels of diversity is problematic if the aim of conservation actions is to maximize species richness within a locality. In this article we review recent research related to the correlation between species diversity and genetic diversity. We believe that the potential for negative relationships should be reconsidered from a conservation viewpoint and conclude by making a point that making conservation decisions based solely on species richness might be suboptimal for the long-term survival of populations.

## **P9.12**

### **Genetic Structure of an Endangered Raptor at Individual and Population Level**

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The Finnish White-tailed Eagles have gone through two major demographic bottlenecks during the last two centuries. As a consequence of strong conservation measures the population has recovered, but despite the rapid growth during recent years the species is still classified endangered. We studied the population structure at both individual and population level to be able to recognize the processes shaping it. The research was done with 9 microsatellite loci and 473 bp fragment of the mitochondrial DNA (N= 489). We found clear isolation by distance pattern at fine scale which is most likely a result of species' philopatric behaviour. We did not find signs of the past demographic bottlenecks, which occurred during the last 200 years. Instead, we found evidence of an ancient bottleneck that has occurred most likely over 21 000 years ago. We conclude that the present population structure is mainly a consequence of species philopatric behaviour over a long time period instead of recent population bottlenecks. Based on our results, the Finnish population seems to have ongoing immigration from neighbour populations. Hence, even though the population recovered mainly through local growth, our results suggests that gene flow from genetically differentiated populations have had an impact too.

## CONSERVATION GIS

### P10.1

#### **The Satellites Data Use for Monitoring the Degradation Process of Natural Resources in Semi Arid Zones (Algeria)**

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The semi-arid region of the Aurès presents an undeniable diversity of flora and fauna, however weather conditions and actual adverse anthropogenic, caused degradation of the physical environment, which have the form of a regression in the natural forest cover.

The objective of this study is to determine the contribution of satellite images in detecting changes in land use and monitoring of the degradation processes in the southern part of the Aurès region.

As far as that goes, we used images: Landsat ETM + for 2007 and TM 1987. These last cover the southern region of the Aurès which presents a landscape exposed to the phenomena of degradation including forest Beni-Mloul, Dj.Mezbel and Dj khaddou Ahmar, characterized by endemic species. The adopted step is to treat multi-dates satellite imagery by the method of supervised classification of Maximum likelihood to see global changes of land use that have occurred in this area.

The results of treatment of satellite images show that the forest cover, rangelands and soil are being the object of advance degradation.

## CONSERVATION IN AGRICULTURAL LANDSCAPES

### P12.1

#### **Measuring the Success of Species-rich Semi-natural Grassland Restoration and Re-creation within English and Welsh Agri-environment Schemes**

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Restoration and re-creation of semi-natural grassland has been a component of UK agri-environment schemes for over 20 years but there is no standardised method of measuring success. During this study we developed techniques to monitor the progress of restoration and re-creation of five BAP priority habitat grassland types using field-scale data from sites across England and Wales.

127 sites were visited in the summers of 2010 and 2011. Botanical inventories, soil analyses and habitat assessment surveys were carried out for each site. Management histories were gathered from farmers.

We used expert opinion, gathered through a national consultation, to identify the habitat attributes deemed most important by grassland researchers and managers. Previously collected datasets from grassland restoration projects were used to identify attributes and plant species indicative of restoration success. We measured the level of the identified attributes and indicator species on our study sites.

Results indicated that grassland sites require active management, such as the spreading of additional seed, for substantial increases in quality to occur. The frequency of this management within agri-environment schemes varies widely depending on grassland type.

Clear restoration targets are needed to measure restoration success. The attributes associated with successful sites vary between BAP grassland types.

## **P12.2**

### **Vegetation of Environmental Fallows in Finland: their Value for Conservation in Agrolandscapes**

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A novel agri-environment scheme of Environmental Fallow was introduced in Finland in 2009 to replace a former CAP set-aside. The presentation evaluates the scheme's value for biodiversity based on data from the vegetation surveys in three regions across Finland. In 2010, over 7% of the agricultural utilized area was enrolled under the scheme with four fallows types: long-term grasslands, meadow fallows, and game and landscape fields. Species composition of fallow vegetation, except that of grasslands, considerably differed from that of other non-cropped biotopes in agrolandscapes such as margins and semi-natural grasslands. Species richness of vascular plants was the highest in meadow and lowest in game fields. In perennial meadow and grassland fallows, species richness related negatively with the height and density of the vegetation, positively with the height variability within fields and the longevity since establishment. Species richness also correlated negatively with the reported fertility levels. Landscape level variables of the forest cover within 1-km buffers or proximity of another fallow field did not relate to the total species numbers, reflecting importance of management over the placement. A long-term efficiency of the scheme can be compromised by its untargeted and unbinding nature, and agronomic challenges in "sowing for nature".

## **P12.3**

### **Landscape Effects on Plant Diversity in Species-rich Grasslands in Eastern Europe**

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Extensively used grasslands represent an increasingly rare but important source of biodiversity and ecosystem services in Europe. With the continuing intensification of agriculture, these habitats are often subject to fragmentation by a matrix of intensively managed agricultural land, however, the influence of the surrounding matrix on local grassland plant diversity remains unclear. Although recent studies have begun to address this question, these have mostly considered relatively intensified landscapes in Northern and Western Europe, and results have been conflicting or inconclusive. In this study, pastures in an extensive agricultural landscape in Eastern Europe (Central Romania) were surveyed for vascular plants to investigate the relative importance of local (plot scale) and landscape factors (up to 3km radius). Landscape habitat diversity and evenness was positively correlated with species richness, but negatively correlated with species turnover between plots. Clonal and generalist species were affected more by landscape factors than non-clonal and grassland specialist species. This suggests that biotic exchange with the surrounding landscape may play a secondary, but still significant, role in preserving biodiversity within species rich grasslands, and that a landscape scale approach to conservation is advisable.

## **P12.4**

### **How Do Small Landscape Fragments and the Management of These Affect Ecosystem Services?**

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In agricultural areas, small landscape fragments such as stone walls and field islets, can be very important in providing biodiversity and ecosystem services. In order to preserve these small cultural elements, agri-environmental support is paid to landowners who follow specified management regimes. The effects of this agri-environment scheme have not been properly evaluated, a study of species diversity and the abundance of key species was carried out in southern Sweden. Pollinating insects were collected in pan traps and counted along linear transects, in managed and unmanaged field borders and in landscapes of varying complexity. There were no significant difference in the number of bumble bee species between managed and unmanaged field borders but the abundance was higher in the unmanaged elements. Landscape complexity did not have an effect. The diversity of hover fly species was significantly higher in more complex landscapes but was not affected by management, whereas abundance was higher in unmanaged elements. The main result of the agri-environmental support is a decrease of bushes and trees covering small landscape fragments and our study shows that different insect groups respond differently to these actions. A balanced mix between managed and unmanaged small habitats is likely the best solution.

## **P12.5**

### **Effects of Agri-environmental Schemes on Foraging Behaviour and Reproductive Success of a Farmland Bird, the Skylark (*Alauda arvensis*)**

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To counteract biodiversity loss in agricultural areas, agri-environmental schemes such as field margins have been constructed in many European countries. We studied how effective arable field margins are in supporting a skylark population in the northeast of the Netherlands. In the research area, field margins had been established for over 12 years with a surface area of around 5%. Nevertheless, the skylark population decreased steadily with 34% between 2007 and 2011, from 9.1 to 6.0 breeding pairs per 100 ha. Observations showed that field margins were highly favoured as foraging habitat, but the presence of field margins did not increase reproductive success. The main cause of population decline was the inavailability of suitable nesting habitat later in the breeding season, when winter wheat became too tall. Many skylarks switched to grassland, where frequent mowing resulted in extremely low nestling survival. We suggest that current agri-environmental policies emphasizing on ecological focus area falsely separate conservation from production, and fall short in offering suitable and safe breeding habitat for birds nesting on farmland. Adding in-crop conservation options such as no-till or the growth of later-germinating crops may not only provide suitable breeding habitat later in the season, but also be more cost-effective.

## **P12.6**

### **Extensively Managed Grassland Field Margins as Meadow Bird Chick Habitat**

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In the Netherlands, meadow birds have declined on agricultural lands in the last 50 years. Despite the implementation of Agri-environmental schemes (AES) this decline is still ongoing. In this research, the potential of new types of AES benefiting meadow bird chicks are investigated. The aim of these schemes is to provide chick habitat in extensively managed grassland field margins on intensively managed pastures. The two factors influencing food availability for the self-foraging meadow bird chicks are vegetation density and the number of large insects, their staple diet. As vegetation density was lower in the field margins, food accessibility for meadow bird chicks was highest in field margins. Furthermore, more large insects were found in field margins compared to field centers. Field margins with different management regimes contained different amounts of large insects. Unfertilized field margins harbored more large insects than fertilized margins and mowing of the margin negatively influenced the number of large insects. These results suggest that unmowed and unfertilized field margins provide the best chick habitat. We will follow up with a foraging experiment with meadow bird chicks to investigate whether the field margins with the highest potential in food availability are indeed the best chick habitat.

## **P12.7**

### **Rising Ecological Awareness of Farmers with a Recovery Programme for Kestrel (*Falco tinunculus*) and Barn Owl (*Tyto alba*) in Switzerland**

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Kestrel and Barn Owl are widespread but uncommon breeding birds in Swiss agricultural landscapes. The breeding population of Barn Owls amounts to 1000-2000 pairs. The Kestrel population declined until 1989 and remained stable on a low level during the 1990ies. Today it probably exceeds 5000 breeding pairs again. We started a recovery programme in 2001 together with 28 groups of volunteers in study areas ranging across the lowland areas. We increased the number of nest boxes to now more than 1800. They were controlled yearly and most of the nestlings as well as some adults were banded. The breeding success in the nest boxes was very good (up to 80 % of broods successfully). Since the start of the programme, the number of breeding pairs of Kestrel increased steadily in many of the study areas. Barn Owl populations recovered as well, but showed the typical declines after cold and snow-rich winters. The intense collaboration of volunteers and local farmers increased ecological awareness of the farmers and opened the door to create further ecological compensation measures. Finally, public banding of young Kestrels and Barn Owls provided an ideal means to increase ecological awareness among the great public as well.

## P12.8

### Ground Beetles (Coleoptera: Carabidae) in the Simplified Agricultural Landscape - A Multivariate Study of Effects of Landscape Complexity and Seasonal Change on Species Assemblage within Winter Wheat Fields and in Grass Margins

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In simplified agricultural landscapes the negative impact on crop yield by pests can be partly explained by the absence of its natural enemies (e.g. ground beetles). How does land use intensity and season affect species assemblage of ground beetles? Sites with both wheat and grass plots were selected along a grassland gradient in simplified agricultural landscape, and pitfall trapping was carried out over the growing season. There was a significant interaction between crop and date (perMANOVA:  $F=2.48$ ,  $p=0.0004$ ). Indicator Species Analysis (BISA) showed that *Demetrias atricapillus* was a strong indicator during May and *Trechus quadristriatus* was a strong indicator during July in wheat. Seed feeding species were significant indicators of grass, overall larger species and autumn breeders were indicated later in the season in both wheat and grass. Spatially, there was significant correlation between *Pterostichus melanarius* and grassland within a 200m radius. The perMANOVA and BISA indicate a stronger seasonal shift in wheat, probably a result of higher temporal variability. A high amount of grass in the local landscape seems to favour *P. melanarius*. In conclusion, it could be wise to spread grasslands more evenly among crops and to consider temporal changes in natural enemy activity when planning management practises.

## P12.9

### Establishment of an Important Arable Plant Area Network in Germany

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The project „100 Fields for Biodiversity“ is developing new conservation measures for rare arable plant species. A nationwide network of so called "conservation fields" (Schutzäcker) is designed to counteract the ongoing loss of arable plants species. Nowadays, a growing number of arable plants can be found on the national Red Data Book of vascular plants. Examples of characteristic arable plant communities such as *Caucalido-Adonidetum*, *Teesdalia-Arnoseridetum* and *Papaveretum argemones* have been secured within different biogeographic regions in Germany based on these "conservation fields". On the fields, crop management is carried out without herbicide use and takes into consideration preferred growth conditions of target arable plant species. Basic conditions for sites to qualify as "conservation fields" include a botanically outstanding species inventory, assurances for long term preservation via contractual agreements, legal guarantees or ownership by conservation stakeholders (mostly NGOs), management plans assuring the conservation of target species and regular monitoring by local experts. The conservation fields are expected to act as future centres for a potential re-expansion of sites by currently rare and endangered arable plant species. To date, over 80 sites in Germany have been secured for long term interests of arable plant conservation.

## **P12.10**

### **Effects of Habitat Fragmentation and Management on Genetic Structure and Diversity of the Fen Specialist Moss *Scorpidium cossonii***

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Calcareous fens are nutrient-poor and wet habitats and they belong to the most species rich grasslands in Europe. In Switzerland, calcareous fens are either mown or extensively grazed. *S. cossonii* is a specialist species of these fens. So far, effects of habitat isolation and management on population genetics of this species have not been studied. Here, 30 populations of *S. cossonii* were collected in north-eastern Switzerland. Genetic differentiation and diversity were assessed using 14 microsatellites. The overall genetic differentiation between populations was very high ( $F_{ST} = 0.385$ ). Most populations were significantly different from each other. The number of alleles was significantly higher in mown populations than in grazed populations ( $P < 0.05$ ) even when corrected for effects of fen size and altitude. Gene diversity was marginally higher ( $P = 0.082$ ) in mown fens, but the number of haplotypes was not different. Our results indicated limited gene flow between populations due to habitat fragmentation. Effects of grazing on genetic diversity may be attributed to indirect effects such as trampling or deposition of urine and dung which may create a habitat less favourable for *S. cossonii*. For the conservation of genetic diversity of this specialist mowing seems to be more favourable than grazing.

## **P12.11**

### **Conservation Implications of Nesting Performance and Nest Habitat Selection of the Great Bustard *Otis tarda* in Southern Portugal**

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We present results on breeding performance and nest habitat selection of great bustards, based on 107 nests located over 3 years in southern Portugal. The estimated average onset of laying was April 22nd. The estimated total incubation period ranged from March 25th to June 15th. Nearly 95% of incubating females were detected between April 1st and May 31st. Mean clutch size was 2.12 (SD= 0.69, n= 86). Hatching occurred between April 21st and June 26th. Estimated hatching percentage was 87.5% in 2002, 64.0% in 2003 and 75.8% in 2004. Overall nesting success was 71%. The main causes of nesting failure were ploughing and harvesting, followed by corvid predation and female desertion. Nests were spatially aggregated up to 800-1500 m. Nesting females clearly preferred cereal fields, followed by young fallows, old fallows, ploughed fields and other habitats. Nests aggregated where both cereals and fallows occurred within the study area. This study provides a complete description of the nesting process in a Great Bustard population, as well as important cues to evaluate the Great Bustard conservation measures currently implemented in southern Portugal.

## **P12.12**

### **The Scottish Landrace Protection Scheme (SLPS)**

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The Scottish Landrace Protection Scheme was established by Science and Advice for Scottish Agriculture (SASA) in 2006. The scheme administers the seed quality assessment, storage and protection of individual stocks of donated landrace seed and thereby maintains genetic diversity. Information on seed quality is returned to the donors. Seed can also be made available for breeding, research and education and can be returned to donors if a harvest fails. Seed may be regenerated *ex-situ* although this is rare. Populations, particularly of Shetland cabbage/kail, have been characterised. SLPS-eligible crops have comprised Shetland cabbage/kail, bere barley, small bristle oat and Hebridean rye. These crops are still grown, despite declining areas and numbers of growers. They contribute to the rural economy and habitat conservation, particularly on environmentally sensitive, marginal agricultural land such as the Machair. This scheme aligns Scotland to the requirements of the Convention of Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA).

## **P12.13**

### **The Analysis of Ongoing and Future AES's in Finland - Focus on Biodiversity and Game Population Viability in Farmland Areas**

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The decline of biodiversity in farmland areas has widely acknowledged in several studies. In Finland, the Agri-Environmental Scheme (AES) plays an important role to halt this development. Wildlife management has been customarily done also outside of the schemes, and with wide spectrum of actors in rural areas (e.g. local hunting clubs). Hunters are motivated in managing wildlife habitats and, as they own almost 1/3 of land area in Finland, they have a fundamental role in biodiversity maintenance on private areas. Combining this knowledge and interest to ongoing preparation of AES 2014-2020, was important goal of this study. We describe best practices and bottlenecks of AES to enhance farmland biodiversity. Some new ideas are tested and measures of AES are evaluated by interviewing about 20 specialists, researchers, farmers and hunters. Results reveal that there are some multi-utility measures for biodiversity management in current AES. For example increase in plant cover and winter stubble has served cost-efficient method to increase wildlife populations, and farmland biodiversity as a whole. For landowners the wildlife management with AES's is a welcome component alongside to farming. In designing biodiversity management tools in AES it's crucial that methods are practical and easily adopted in everyday farming.

## **P12.14**

### **Climate Affected Land Use Changes Effects on European Farmland Birds**

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Farmland cultivation is influenced on a regional level by climate change having an effect on the composition of bird populations living in this area. In the present study we overview the concerning significant changes expected to occur in agricultural areas. Changed cultivation favors different species thus the pattern of areas also changes. Extended vegetation period has beneficial effect on arable land production in Northern Europe causing cultivation of new lands and intensification of agriculture in the future. In the Mediterranean areas the lack of rain in winter and spring leads to supplanting in intensive cultivation and abandoned agricultural areas, even traditional ways of cultivation in mountain grasslands are supplanted. Succession begins on abandoned areas and in a long term leads to the appearance of forest birds that replace birds of open areas. Aridity becomes more frequent in the interior of the mainland and it goes with decrease in production and increase of demographical factors mainly in case of populations that are located in the edge of their distribution. We came to the conclusion that planning instructions to reserve species needs environmental characteristics of the given region, expected transformation of vegetation and effects of fragmentation to be taken into account.

## **P12.15**

### **Influence of Landscape and Dry Pasture Characteristics on Two Lark Species in Krka National Park in Croatia**

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Definition of sustainable grassland uses in protected areas is one of the most delicate tasks for conservationists. Dry Mediterranean grasslands in the Krka National Park in Croatia are important bird areas supporting some of the Croatian rarest breeding birds. Calandra lark (*Melanocorypha calandra*) and Greater Short-toed Lark (*Calandrella brachydactyla*) are two of those species. Main goal of our research was to describe what types of dry grasslands those two species inhabits and which landscape and field variables affect their densities. Research has been done on 6 localities that represent typical pastures in different phases of succession as consequence of pasture abandonment. Habitat structure research was done on 82 points on which 2 grassland bird species breeding territories were mapped. Phase of succession was described as density of different scrub and trees species. Presence of stone-walls, scrub coverage and trees were taken as a measure of grasslands fragmentation. Calandra lark showed strong correlation with large, open and non-fragmented pastures, without trees and stone-walls. Greater Short-toed Lark showed the same preference for treeless habitats even though were less sensitive to habitat fragmentation. The amount of bare ground was correlated with absence of those two species on otherwise suitable habitats.

## **P12.16**

### **The Effect of Land Use on Distribution and Population Dynamics of *Knautia arvensis* in an Agricultural Landscape**

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The objectives of this study were to model the local distribution and effects of farmland abandonment and grazing on the population dynamics of *Knautia arvensis*. The population dynamics study extended over three years and included semi-natural grasslands with either grazing (high or low intensity) or abandonment. Population matrix models were constructed and LTRE analysis was used to analyse the effects of grazing intensity and abandonment. The results indicate that agricultural management has a large influence on both small-scale distribution and population dynamics of *K. arvensis*. The distribution of semi-natural pastures and terrain shape as described by the parameters slope and concavity explained approximately 50 % of the total variation explained by the model. Exposition was another important predictor as *K. arvensis* had higher probability of occurrence in south-facing slopes. The population growth rate was  $\geq 1$  for all grassland sites in the study and the highest growth rate was found in abandoned grasslands. Nevertheless, there were large differences between grazed and abandoned grasslands in reproductive strategy. In abandoned grasslands, nearly all regeneration was clonal whereas sexual reproduction was more common in grassland with high grazing intensity. The viability of these populations will be examined in further studies.

## **CONSERVATION MODELLING & POPULATION VIABILITY**

### **P13.1**

#### **Geographical Sampling Bias of Observations in Species Distribution Models - Assessing the Performance of Correction Methods in a Flagship Species with a Highly Biased Dataset, the Corncrake *Crex crex***

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Species distribution modelling (SDM) is now a common approach in ecology which has several applications for conservation biology. SDM techniques estimate the most suitable areas for a species and infer probability of presence in regions where no surveys are available, thus efficiently assisting in reserve planning. One recurrent cause of inaccuracy of distribution models is a geographically biased dataset of occurrences. Such datasets are often derived from opportunistic observations rather than from rigorous surveys. This may lead to bias model parameters towards values of regularly visited sites or densely inhabited areas. Unfortunately, there is no consensual method to solve this bias. We investigated here several methods to deal with geographical sampling bias in SDM, taking the Corncrake *Crex crex* as an example. Corncrake dataset exhibits a strong geographical sampling bias. Over 80% of occurrences lay in the European Union. The remaining data come from non EU countries including Russia that hosts the largest part both of the world population and the currently known range. We tested several methods of sampling bias correction and evaluated their relative performance. This work is expected to improve general knowledge about the species and bring insight about how sampling bias affect SDM outputs.

## **P13.2**

### **Population Structure Assessment and Viability Analysis of the Barbary Macaque, *Macaca sylvanus* L., 1758 (Primates: Cercopithecidae) from the High Ourika Valley, Morocco**

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The Barbary macaque, *Macaca sylvanus*, the unique non-human primate north of the Sahara desert, is an Endangered species (IUCN, 2011). A study was carried out in summer 2009 on the southernmost population of this species in the High Ourika valley. The population size and structure were estimated using the line-transect method. We also carried out a preliminary population viability analysis (PVA) simulating two different scenarios. The total population size was estimated to 122 individuals with a mean density of 27 ind./km<sup>2</sup>. The 435 detected and identified macaques were distributed in 24.8% adult males, 24.8% adult females, 48% subadults, 56% juveniles, 6.7% immature and 19.8% newborns. This revealed that nearly 50% of the population consists of young individuals as also indicated by the young/adult and young (subadults excluded)/adult ratios respectively of 1.1 and 0.8. The adult sex-ratio was 1:1. The apparent fertility rate was of 0.8 infant /adult female. According to an optimistic and pessimistic scenario, the PVA predicted that the Barbary macaque population of High Ourika valley would not be viable over the forthcoming 100 years with an extinction probability of 100% in both cases; the respective durations of total extinction of the population would be 89 and 22 years.

## **P13.3**

### **An Approach for a Capercaillie (*Tetrao urogallus*) Leks Distribution Model in Catalan Pyrenees**

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We have used some environmental variables that cannot be modified to create an initial model, we have separated first the 25% most suitable distribution area and secondly the remaining 75%. Then, we have divided each area into two using Thorntwaite humidity index. This division helps generate models that illustrate better suitability differences and variable influence. Environmental variables that can be modified have been added to each model. Diffuse and direct radiation, percent of forest and precipitation in February are the four common environmental variables in all the zones that explain the suitability better. Percent of open areas and mean temperature in April are variables selected for the high Thorntwaite index value zones. In low value zones we have selected percent of *Pinus uncinata* habitats with high NDVI values, percent of semi-natural dry grasslands and scrubland facies on calcareous substrates habitats and percent of *Pinus sylvestris* forests calcicolous and xerophilous (low and medium NDVI values). A three classes global model overlaying the four models has been created that detects the 95% of the leks, optimum areas use the 7,16% of the study area and detect the 56,64% of the active leks. These are the areas with more males per lek.

## DISTURBANCE ECOLOGY

### P14.1

#### The Effect of Grazing History on Fungal Diversity in Wood Pastures

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Traditional rural biotopes such as wood pastures are species rich habitats which have been created by extensive agriculture. In all European countries both quality and quantity of traditional rural biotopes have drastically decreased during the past century because of increasing farming intensity. This decline is causing threat to many species, but very little is known about the conservation ecology of fungi living in wood pastures. We investigated the effect of grazing history and current grazing intensity on fungal diversity in deciduous wood pastures in Central Finland. We studied 12 sites of which 6 were presently grazed by domestic animals and 6 were presently not, but had been grazed in the past. Our study group was “all stipitate macrofungi”, such as agarics, boletes and ramarioid fungi. Our results suggest that fungal diversity increases with grazing history duration. With presently grazed areas the relationship between grazing duration and fungal diversity is not so clear. We suggest that in presently grazed areas there are many additional factors (e.g. grazing intensity) that affect the fungal diversity.

### P14.2

#### Spontaneous Succession in a Limestone Quarry as a Tool of Dry Grassland Restoration

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Abandoned quarries represent important habitats for conservational biology: they have a potential as refuges of species diversity when left for natural development. The study site is a limestone quarry, abandoned in 2008 and left without directed management. The quarry is situated next to a protected dry grassland community with many rare species. We aim to evaluate seed transport from the grassland, observe vegetation and soil changes on the quarry surface in the course of succession and compare the grassland community with community on the quarry surface. We record species composition and percentage cover on permanent plots since 2010. Seed transport is monitored with the use of seed traps. Soil samples from both grassland and quarry surface are analyzed and compared. After three years of spontaneous succession the vegetation cover is increasing and the identity of main dominants is changing (from *Tussilago farfara* to *Mellilotus* sp.). 42% of species in the quarry are species present also on grassland. Soil conditions in quarry and grassland seem to be similar. We also record high intensity of seed rain in the quarry. According to these results we expect succession to head to similar community composition as the grassland community.

### **P14.3**

#### **The Use of Predatory Vocalisation Playbacks in the Displacement of a Problem Goose Species (*Anser anser*)**

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The rapid expansion of the European greylag goose population has led to increased grazing on agricultural lands. Such is the level of damage to land-owners' resources, effective solutions to the problem of over-grazing are being widely sought. This study examined the possibility of using avian predator vocalisation playbacks to manipulate greylag geese (*Anser anser*) on agricultural land. Geese were presented with the vocalisations of two raptor species; one sympatric, predatory species (peregrine falcon, *Falco peregrinus*) and a non-sympatric, unfamiliar species (bat hawk, *Macheiramphus alcinus*). The control vocalisation was that of a mallard (*Anas platyrhynchos*). Results indicate that greylag geese can discriminate between the acoustically similar calls of the bat hawk and peregrine falcon, exhibiting a reduction in foraging and an increase in vigilance during, and following, exposure to the vocalisations. However, all avian calls failed to displace geese reliably. This evidence suggests that the use of avian predatory vocalisations is not a viable tool for displacing problem populations of greylag geese.

### **P14.4**

#### **Reconstruction of Stand Dynamics in Old-growth Subalpine Spruce Forests of Babia Gora (Western Carpathians, Southern Poland)**

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The role of natural disturbances in spruce forests of Central Europe is widely recognized. The disturbances of large and moderate spatial extent, especially caused by wind and bark beetle outbreaks, are considered the main factors influencing the dynamics of these forests. I analyzed tree-ring series from subalpine spruce forests on northern and southern slopes of Babia Gora range to assess the frequency and severity of disturbances and their interactions with tree recruitment. 268 trees from northern slopes and 155 from southern part of Babia Gora were analyzed. Boundary line method was used to identify growth releases, resulting from disturbances (youngest trees had to be excluded from the analysis). In both forests relatively small number of trees showed the signs of major releases, which were regularly distributed over time. The age structure of forests indicated, that in the whole mountain range tree recruitment was the most abundant 150-200 years ago. However, on the southern slopes there was also numerous group of trees below 80 years, suggesting appearance of large scale disturbance with no survivors. The results suggest that different disturbance regimes could co-exist in relatively small areas of subalpine spruce forests.

## **P14.5**

### **How to Define the Ecological Resilience at the Community Scale?**

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Anthropogenic disturbances have various modes of action and consequences on ecological systems. Disturbance can be defined as temporary constraints faced by ecological systems; and their effects can be quantified using the resilience. The resilience can be estimated either by measuring the ability of a system (initially at equilibrium) to maintain its integrity or by measuring the time necessary to recover the initial equilibrium following a temporary disturbance. We developed a dynamic model that mimics the use of different resources by a community of competing generalist and specialist species and investigated the effects of various types of disturbances on the resilience of the community, computed with various biodiversity indicators (species richness, biomass or functional indicators). We show that the measure of resilience critically depends on the indicator used and the type of disturbance faced by the community. We further define an integrative measure of resilience, incorporating the resilience measured on several indicators, which introduces the original concept of meta-resilience.

## **P14.6**

### **New in Woodpigeon Biology in Ukraine**

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Woodpigeon was common breeding, migratory and wintering (on the South of Ukraine) hunting species not too long ago. The main biotopes for breeding were known only in woods. Now, its biology is changed. It was afraid to put nest near by the human settlements. They start to breed in towns and cities as it became known recently for Western Europe. The possible reason for these changes could be the disturbances by the people often visiting the forest for recreation and illegal hunters in our country.

## **ECOSYSTEM/CONSERVATION AREA MANAGEMENT**

## **P17.1**

### **Bird Conservation and Sustainable Fish Management in the Hortobágy Fishpond System**

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The Hortobágy is the first national park in Hungary established in 1973. The landscape is dominated by grasslands and marshes in the deeper areas with small forests where the soil parameters were better. The Hortobágy is an important breeding, migrating and wintering area of 342 bird species. After the river regulation works the area was dried out in the 19<sup>th</sup> century and the artificial fishpond system created in the middle of the 20<sup>th</sup> century. There are several endangered and rare bird species breeding in the fishponds, for example Spoonbill (*Platalea leucorodia*), Great White Egret (*Egretta alba*), Glossy Ibis (*Plegadis falcinellus*), Pygmy Cormorant (*Phalacrocorax pygmaeus*), Whiskered Tern (*Chlidonias hybrida*). The migrating species including the Lesser White-fronted Goose (*Anser erythropus*), Red-breasted Goose (*Branta ruficollis*) and the fishponds are the main resting place for Common Cranes (*Grus grus*) in autumn migration. The extensive ecological fish management by the Hortobágy Fish Farm Co. in cooperation with the Hortobágy National Park provides a favourable breeding condition for the breeding bird species and the habitat management programs aiming the conservation of endangered species.

## **P17.2**

### **Impact of Flooding on Earthworm Communities around Matsalu Bay and Kasari River**

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Matsalu Bay is one of the most important wetland bird areas in Europe, due to its prime position on the East Atlantic Flyway. Millions of migratory birds use Matsalu as a staging area. The continuum of Matsalu Bay and the Kasari River represents a complex mosaic of marine, coastal and inland wetlands (shallow sea waters, estuarine waters, coastal lagoons, inland delta, and flooded meadows). Earthworm communities were studied for a better knowledge of the ecology of conservation and restoration of wet semi-natural meadows, in five sites on the Southern shoreline of Bay and the banks of the Kasari River, at different distances from waterline. Most of Estonian earthworm species inhabits the flooded areas but the number of specimens is low. The brackish conditions of the Baltic Sea create special habitat conditions different from the habitats on river banks. The duration and character of flooding affect earthworm community composition. Sea water salinity (brackish or fresh) and closeness to waterline have strong negative impact on earthworm diversity and abundance. The duration of flooding seems to be the strongest factor having negative impact on the abundance of earthworm communities; this depends highly on species tolerance to high moisture content and low soil aeration.

## **P17.3**

### **Evaluation of Invertebrate Conservation in Latvia: Dragonflies (Odonata)**

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Until now, there are 59 dragonfly species known in Latvia. Although dragonflies represent a faunistically well studied group of invertebrates in Latvia, assessment the conservation status as well as real and potential threats for each species have never been performed. Threatened dragonfly species are mentioned in numerous management plans for protected nature territories almost always without assessment for real conservation status. Evaluation for each of Latvia's protected dragonfly species was performed by the author using 7-step scheme: distribution, occurrence, population, habitats, ecology, threats, conservation. 16 species of dragonflies from Latvian fauna are protected by national and European legislation or redlisted in Latvia: *Lestes virens*, *Ischnura pumilio*, *Pyrrhosoma nymphula*, *Nehalennia speciosa*, *Aeshna mixta*, *Aeshna isosceles*, *Aeshna viridis*, *Anax imperator*, *Gomphus flavipes*, *Ophiogomphus cecilia*, *Cordulegaster boltonii*, *Epitheca bimaculata*, *Libellula fulva*, *Leucorrhinia albifrons*, *Leucorrhinia caudalis*, *Leucorrhinia pectoralis*. As a result of evaluation, the following conservation measures are suggested for dragonflies in Latvia: establishing the unified locality information database for governmental institutions, an urgent need for improvement of all valid management plans for protected nature territories; estimation of population size and a long-term population monitoring at least for major Latvian populations for certain species; habitat management and site-based actions must be planned and performed.

## P17.4

### The Role of Bridge Species in the Transmission of Highly Pathogenic Avian Influenza (HPAI) and Newcastle Disease (ND) Viruses in Jos

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Avian Influenza (AI) and Newcastle Disease (ND) are the two most important diseases of poultry and other birds. This is not only because of its ability to cause serious threat to the welfare of wild bird populations, but also its effects on agriculture and human health. However, not much is understood of the route of recurrent outbreaks of these diseases. Wild resident birds (bridge species) have been implicated with harbouring these viruses and capable of transmitting it to poultry. To understand the role of these bridge species in the transmission of AI and ND, birds were trapped with mist nets around poultry farms and cloacal and tracheal samples collected. All samples tested negative for AI, but 53% showed positive result for ND. Fifty eight (58) bridge species were caught. Although no positive case of AI was seen, it was possible that infected birds died quickly after infection. The presence of ND viruses is a great threat to wild birds and poultry, and could lead to great economic loss. The study suggests that poultry farms should be located away from streams and open waters to minimize contact with wild birds, and if possible they should be reared in bird-proof concealments.

## P17.5

### The Nature Vegetation Diversity in the Alpine Belt of the Greater Caucasus and It Conservation

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The treeless alpine belt along the Greater Caucasus is situated above the absolute heights of 2500-2800 m. The alpine plant communities' physiognomic diversity is limited by four main types: alpine meadows or heaths on the steep, convex slopes; carpet-like alpine meadows or carpets on the gentle, concave slopes; plant communities on the screes and rocks. The diversity of alpine vegetation phytosociologic units is higher. According to the completed syntaxonomic classification there are 8 associations of the heaths, 6 associations of carpets, 6 associations on screes and 3 ones on rocks. These plant communities are characterized by exclusive species abundance and specificity. Among 807 vascular plant species of the Caucasian alpine flora belt there are 423 endemics and lot of rare and endangered species. For determining the zoologic status of the alpine communities the following criteria were used: locality, habitat's naturalness and diversity's parameters. According to these criteria the endangered plant communities were determined: heaths - ***Nardo-Geranium***, ***Alopecuro-Asteretum***, ***Hedysaro-Campanuletum***, ***Alchemillo-Caricetum***; carpets - ***Taraxaco-Geranium***, ***Minuartio-Agrostietum***, ***Gageo-Dichodontetum*** and all of screes and rocks syntaxa. All these communities are protected in the 6 reserves, 3 national parks and several sanctuaries which could be considered as the potential territories of the Emerald network.

## **P17.6**

### **A Multiyear Bark Beetle Population Outbreak in the National Park “Northern Velebit” and Surrounding Forests - Management Strategies and their Implications on Outbreak Dynamics**

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A multiyear monitoring programme has been established within the borders of “Northern Velebit National Park” focused on the outbreak of spruce bark beetles in the large areas of park itself and surrounding conifer forests managed by the standard forestry management practice. Monitoring itself was accomplished through pheromone trap catches of *Ips typographus* and *Pityogenes chalcographus*, two of the most important damaging bark beetles of common spruce. Differences in absolute numbers of trapped beetles in protected and non-protected areas, population trends in managed and unmanaged forests, and possible effects of taken measures in harvested forests are presented and discussed. Pronounced similarity is evident in the population trends in both the protected (unmanaged) and non-protected (harvested) spruce forests. Part of the reason for this we find in the fact that this recently established national park has inherited formerly managed forests, especially in its border area. Succession of spruce stands and future population dynamics of spruce bark beetles within the park area and surrounding forests is discussed, taking into account their role as natural disruption factor that shape naturally growing spruce forests in their composition and structure. Differences and confrontations between nature conservation and Croatian forestry practice are analyzed and visions of possible solutions via buffer zone establishment is recommended.

## **ECOSYSTEM SERVICES**

### **P18.1**

#### **Delivering Multiple Ecosystem Services in UK Agriculture - Can Agroforestry Do It All?**

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Agricultural production will need to double by 2050 to feed the predicted global population of 9 billion. A key challenge is therefore to increase productivity in a sustainable way so that environmental impacts are minimised. We investigated whether agroforestry, an intensive but sustainable system, could reconcile potentially conflicting demands for food production, biodiversity and provision of other ecosystem services in UK farmland. To quantify multiple ecosystem service provision and assess potential trade-offs between them we measured four services - productivity, biodiversity, pollination services and above- and below-ground carbon stocks - in six agroforestry systems paired with equivalent monoculture systems (controls) across southern UK. Responses differed both between agroforestry and control systems, and amongst agroforestry systems. Trade-offs were skewed in favour of productivity in control systems, but greater species diversity in agroforestry systems resulted in the potential for such systems to deliver more regulatory ecosystem services. Within agroforestry systems the trade-offs depended on system design, age and management practice. We conclude that agroforestry in the UK shows potential to enhance environmental quality through multiple ecosystem service provision without overall loss in productivity. Further work is ongoing to look at the economic implications of these findings.

## **P18.2**

### **Urban Ecological Innovation and Ecosystem Services**

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Community gardens, allotments and associated local food initiatives, as social-ecological systems, provide a number of ecosystem services. It is not clear, however which services are provided by such sites of social-ecological innovation, or the extent of that provision. A more intimate understanding of the nature of such innovation is needed to inform debate on urban development and green-space management.

A pilot study conducted across the districts of Salford and Manchester gauged the extent and distribution of these sites; the data were entered into a GIS. The study exposed several attributes of such innovation in the urban environment. Firstly, they are dynamic, ephemeral and often nebulous in their organisation and as such can be particularly hard to discover, assess and accurately map. Secondly, there is a wide-ranging degree of inter-project communication and less collaboration was observed than initially expected. Thirdly, as a socio-geographical phenomenon, such innovation does not occur in a uniform pattern but appears in “clumps” around a central hub of environmental information and education. Furthermore, such “hubs” and their associated “clumps” are not evenly distributed city-wide; neither do they correspond neatly to green space density and/or availability of such space, raising questions about discrepancies in urban environmental awareness.

## **EDUCATION AND OUTREACH**

### **P19.1**

#### **Teaching Biodiversity in Koranic Schools in Algeria. Algerian-German Cooperation Program**

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During 2010, the office of religious affairs and the office of German Technical Cooperation GIZ (GTZ ex) have established a cooperative program to train 20 teachers in Koranic schools of the city of Annaba. The first step was to design a learning booklet of biodiversity based on the text, image and religious verses from the Koran. The second step was to train imams on the contents of the book learning. The third step was to organize workshops and practical for trainers of Koranic schools. The fourth step was to organize an exhibition on the biodiversity of the work of Koranic schools. We will present the main stages of our cooperation and the results of the experience that benefited the city of Annaba

## **P19.2**

### **Application and Assessment of Group Work Learning in a University Course on Conservation Biology**

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Interdisciplinarity, teamwork, debating, reporting and assessment of scientific information, are essential skills in the field of Conservation Biology. The course "Workshops in Conservation Biology" at Helsinki University is intended to develop these skills in undergraduate students and prepare them for this field. The course itself comprises lectures, literature-based tasks and reporting, internet-based discussion, a small group conservation project and presentation of the group project to a panel of experts. A major challenge in the development of this course has been to devise an equitable assessment scheme for the group work. This has been addressed using the Zero-sum technique of Strachan and Wilcox, which requires students to assess their own contributions and those of their fellow group members, giving each a grade in the range -2 to +2, such that the group's overall grade sums to zero. Another major challenge has been to incorporate a balance of virtual and actual discussion, such that all students are able to participate and express their opinions. Electronic forms were used to survey participating students about this. Results confirm that many students relish the opportunity to express their views orally, though internet discussions facilitate broader participation.

## **ENVIRONMENTAL POLITICS AND POLICY**

### **P20.1**

#### **Small Wind Turbine Noise Propagation and Microchiroptera: A Field Trial Investigation**

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Fuel cost, fuel security and acceptance of environmental degradation through fossil fuel emission is prompting technical advancement of clean renewable energies. Consumer stimulation is a catalyst for wind turbine technological advancement. Concern has been raised over the impact to wildlife. Microchiroptera have shown susceptible to large wind turbines with several hypotheses proposed. The relatively recent market introduction of micro wind technology is responsible for bat collision mortality. This phenomenon is yet to be quantified and scientifically tested. A neglected hypothesis of acoustic attractant was tested in-situ on echolocating bats. Acoustic attraction was rejected. In direct contrast small wind turbine noise propagation deterred foraging bats. Although further research is required to reinforce these findings two considerations can be proposed. Firstly; acoustic deterrent results in avoidance of the area, in certain situations, and so may limit collision events. Secondly; a positive correlation between small turbine erection and habitat degradation should be expected. This research also propounds evidence that low frequency sound wave energy has a greater impact to echolocating bats than previously proposed.

## **P20.2**

### **Building Useful Synergies of Sustainable Tourism and Environmental Education for Wetlands' Biodiversity Conservation and Alleviation of Poverty in Ukraine**

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The paper is focused on providing the characteristics of wetland conservation regime, its interrelationship with poverty and potential applicability of sustainable tourism and environmental education for creating a new environmental regime, which would integrate poverty reduction and protection of wetlands biodiversity. The analysis of the success of conservation policy implementation in Ukraine is provided along with major obstacles outlined, as well as the jurisdictional, implementation and information gaps of the existing conservation policy regime at the international and national levels analyzed.

Highlighting the effectiveness of sustainable tourism for community development, poverty eradication and wetland conservation, further classification of the tourism-wetland relationships is demonstrated with relevant examples. Contributing to the Millennium Development Goals, current trends of developing the pro-poor strategies among international organizations are mentioned. Furthermore, the question of inclusion of sustainable tourism into practice of wetlands conservation by the Ramsar Conference of the Parties is brought to the top as one of potential drivers for integrating the biodiversity conservation and sustainable tourism in one regime.

## **EX-SITU CONSERVATION**

### **P22.1**

#### **First Captive Breeding Success for the Critically Endangered Northern River Terrapin (*Batagur baska*)**

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The Northern River Terrapin, *Batagur baska*, was widely spread in India, Bangladesh and Myanmar. With less than 10 known females the species can now be considered ecological dead and unable to survive without major ex situ and in situ conservation efforts.

In 2010, two males and two females of *Batagur baska* were placed into Vienna Zoo from a private collection. At their arrival both females were gravid. Hormonal stimulation was used to remove the eggs. Since there were no known attempts of breeding *Batagur baska* in captivity, 11 eggs were incubated at temperature and humidity levels of the closely related *Batagur affinis* (33,5°C, 90 %). In addition, 6 eggs were incubated at experimental conditions (4 eggs: 29,5°C, %; 2 eggs: 31,5°C, 90%) . After 63 and 64 days respectively only two offspring hatched out of the batch incubated at 29,5°C. Even though *Batagur affinis* is closely related to *Batagur baska* incubation conditions are not applicable. In Vienna Zoo, first data on *B. baska* could be gathered. Currently a breeding group is established at Bhawal Nationalpark, Bangladesh, as an ex situ backup population within the country of origin and to gain more insight into *B. baska* reproductive biology.

## **P22.2**

### **Breeding Success of European Mink (*Mustela lutreola*) in Captivity**

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The captive population of critically endangered European mink in Tallinn Zoological Garden, Estonia, is the largest and most important one to maintain the species genetic diversity and demographic structure. Several years of captive management has revealed serious obstacle for effective conservation breeding. This may jeopardize the very aim of the program: long-term maintenance of genetic diversity of the species. It has been noticed that some males show abnormal courtship behaviour. In this study mating behaviour of male European minks was analyzed and the breeding success of wild and captive born males and females compared. Our results indicate that captive born males fail more frequently in mating than wild born males. Aggressiveness and passivity are identified as the main behavioural causes of observed mating failure. We suggest that aggressiveness and passivity are two expressions of an abnormal behavioural syndrome brought about by captivity: the same individuals were displaying both aggressive and passive behaviour. Abnormal behaviour also occurs more often when the males were paired with some particular females. However the breeding success still depends more on behaviour of males than that of the females.

## **P22.3**

### **Case Study for the Balkan Snow Vole in Croatia: Multi-approach Research of Elusive and Rare Species Helps to Define Conservation and Monitoring Strategy**

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The Balkan Snow Vole (BSV) (*Dinaromys bogdanovi*, Martino 1922) is a rare species, endemic to the Balkans, a Palaeolithic relict and the only living representative of its genus. It has a naturally discontinuous distribution and small isolated subpopulations, especially in the north-western lineage. A comparison of prey item composition from Tawny Owl pellets from the area with BSV presence and trapping results indicated that trapping is highly negatively selective for BSV. This fact disables the possibility of "in situ" research with adequate sample size and makes "ex situ" research necessary for understanding the species requirements and threats. Six individuals were captured in Mosor Mt. area and kept in the Zagreb Zoo where behavioural and diet research took place. Field research provided us with data about its habitat and sympatric species. As a result of "ex situ" research, a high level of neophobia is observed, which additionally explains the drawbacks of traditional "in situ" research and casts doubt on monitoring using small mammal traps. Dinaric kars conservation project includes actions for BSV and its habitat that are based on this research. This way we will establish long term monitoring and prevent negative human impact pushing BSV subpopulations into extinction.

## **P22.4**

### ***In vitro* Propagation as Effective Tool for *Ex situ* Conservation of *Serratula bulgarica* Acharoff Et Stoj., an Endemic and Endangered Plant Species**

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*Serratula bulgarica* is a Balkan near-endemic and critically endangered plant species growing in the herbaceous plant communities from wet meadows to steppes from North-Western Bulgaria and Eastern Romania. Populations are strongly fragmented and with low number of individuals. The main conservation measures taken concerns only *in situ* approaches. The proposed protocol relied on direct organogenesis pathway followed by the undifferentiated cells from preformed meristems. Multiple shoot buds were induced from explants derived from aseptically growing seedlings (epicotyl, cotyledons and hypocotyl). A maximum shoot primordia production (12 shoot per explant) was achieved from hypocotyl fragments inoculated on Murashige and Skoog medium (MS) supplemented with 1mg/l Benzyl adenine (BA) and 0.1 mg/l 1-Naphthyl acetic acid (NAA). The shoots elongated after transfer to a secondary medium with 1mg/l Kinetin (KN). The *in vitro* regenerated shoots rooted (85.5%) on half-strength MS medium with 0.1mg/l NAA. The micropropagated plants were established in soil with a survival frequency of 70%.

## **P22.5**

### **Breeding Biology of Wild and Captive Hand-reared Black-bellied Sandgrouse, *Pterocles orientalis* (Aves: Pteroclididae): Perspectives of Reinforcement of Declining Populations in an Arid Area of West Central Morocco**

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Aspects of the breeding biology of the Black-bellied sandgrouse were investigated in an arid area of west-central Morocco in the 2003 and 2004 seasons. Flock breeders originated from wild-laid eggs, were hatched, and hand-reared in captivity in the framework of a captive breeding programme. Egg-pulling procedure was used and eggs incubated artificially. Breeding parameters, hatchability, and post-hatching mortality were recorded. Back-dating wild clutches and broods indicated that successful nesting lasted 13-18 weeks from mid-April to late August. The mean clutch size was  $2.55 \pm 0.50$  eggs. The incubation period was 26 days and hatchability rate averaged 62.5%. The captive sandgrouse showed a seasonal breeding pattern with a laying period lasting 7 to 12 weeks. The clutch frequency reached up to 7 clutches/female/season. The clutch size averaged  $2.66 \pm 0.47$  eggs, and the mean inter-clutch interval was  $10 \pm 2.7$  days. The mean total egg production was  $12 \pm 5.83$  eggs/female (range: 8 to 18). Egg hatchability increased with age from 37.5 to 72.2%. Chick mortality occurred only in the first week after hatching, averaging 60.5%. The obtained results showed that black-bellied sandgrouse can be successfully bred in captivity with the possibility of controlling and maximizing their production for the reinforcement of the local declining wild populations.

## **P22.6**

### **Ex situ Conservation of *Ruscus aculeatus* and its Histological Particularities**

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The present study is part of the actual concerns in biodiversity conservation of endangered angiosperm species from The Natural Park of Comana. *Ruscus aculeatus* L. species is protected both at national and European level (through Habitats Directive of EU and Bern Convention). The aspects of *in vitro* morphogenesis through all the stages from inoculation, multiplication to rooting and acclimatization have been studied. The *Ruscus aculeatus* species is a relative refractory for *in vitro* culture owing to the high endogenous contamination degree and also because of the slow morphogenetic response. The results succeeded to establish a protocol for multiplication of shoots in this species with high biotechnological potential.

One of the main requirements in plant regeneration via *in vitro* culture is stability for both phenotype and genotype. Phenotypic diagnosis relies on morphological observations and histological investigations. A comparative study of morpho-anatomical traits of *in vitro* and *in vivo* grown *Ruscus aculeatus* plants has revealed that *in vitro* culture conditions did not influence notably the phenotype of regenerants at both morphological and structural level.

This work was cofinanced from the European Social Fund through Sectoral Operational Programme Human Resources Development 2007-2013, project number POSDRU/89/1.5/S/63258 "Postdoctoral school for zootechnical biodiversity and food biotechnology based on the eco-economy and the bio-economy required by eco-san-genesis".

## **P22.7**

### **Toward an Earth Biodiversity Cryogenic Saving**

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Working on coral reefs, we save the last two specimens of *Cydeastrea glynni* in AMNH cryogenic center, but *Millepora boschmai* is gone, due to ocean acidification. There are many initiatives, Frozen Ark for endangered species, in crucial lack of funds, agriculture Biobanking, environment monitoring... We are facing the 6th mass extinction. 1/4-3/4 of species will disappear. At first a micropaleontologist on Cretaceous/Tertiary, I know well that it will take 10 millions years to recover (consensus).

As member of Intergovernmental Panel on Climate Change, Working Group Impact and Adaptation, I think a one world federative program is to be launched, waiting for the IPBES, and strongly recommending to deciders.

Goal is to save a maximum biodiversity, theoretically 100 specimens of 10 millions species. Take a tenth, with 1) all threatened species 2) agriculture ones 3) all superior taxons 4) randomly the others 5) soils and waters ; also for monitoring and biological studies.

It needs 1000 cryogenic tanks containing 100 000 vials, a ridiculous investment of 50 millions \$. At 1-10 samples per day, it needs 5-50 000 people for ten years, a lot more will be involved.

So join IPCC/IPBES, we lack volunteers, or mobilise you and give your expertise.

## FOREST ECOLOGY AND MANAGEMENT

### P23.1

#### Effect of Stand Size and Microclimate on Polypore Diversity of Woodland Key Habitats in Northern Boreal Spruce Forests of Finland

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Woodland Key Habitats (WKHs) are set-asides in managed forests presumed to be diversity hotspots for red-listed species. We studied the effect of WKH size and microclimate on polypore diversity in boreal spruce forests in three size classes: S=< 0.25 ha, M=0.26-0.5 ha, L=0.51-3.6 ha, and in control areas C=6.5-44.7 ha. Coarse woody debris (CWD) and occurrence of polypores were studied in 10-m radius circular plots (S=23 plots, M=31, L=32 and C=48). The total species number and the number of red-listed species per plot were significantly lower in small WKHs compared with large WKHs and controls. Population densities of red-listed species were lowered in the areas < 0.5 ha. Temperature decreased steadily with increasing stand size. Difference in humidity between clear-cuts and small WKHs was significantly lower in than between clear-cuts and large WKHs or controls, indicating increased drought in small WKHs. Total volume of CWD explained best the variation in total species richness, but for red-listed species the size class of WKH was the only significant explanatory factor. The results indicate that the edge effect weakens the survival of red-listed polypores in the WKHs < 0.5 ha. Large WKHs should be favored when aiming to maintain viable populations of polypores.

### P23.2

#### What Can the Rough Habitat Variables Tell Us about the Occurrence Probability of Highly Specialized Forest Bird Species?

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The relationship between the presence of rare woodpeckers and small-scale structural habitat components, such as i.e. occurrence of decaying wood, has been thoroughly studied. However, the relationship between the occurrence of these species and stand-level variables describing forest habitats have been surveyed less frequently. We investigate whether the quality of forest habitats in Poland described by means of forest inventory database correlates with the occurrence probability of specialised birds - White-backed Woodpecker *Dendrocopos leucotos* and Three-toed Woodpecker *Picoides tridactylus*. The presence of birds was surveyed in the 2010-2011 on ca. 130 squares (2x2 km), using standard fieldwork methods, including playback. We have found significant positive relationship between forest quality and the probability of woodpeckers occurrence. We have also shown that the areas where these two woodpecker species were present, hosted higher numbers of birds from Annex I of Birds Directive. The study is one of few attempts of applying forest inventory database designed primarily for forest management, in bird conservation. This source of data might be very informative regarding forest quality at a wide geographical scale. Therefore it might be an important tool in selecting areas essential for preservation of habitat-specialised or threatened bird species.

### **P23.3**

#### **The Impacts of Woodfuel Harvesting on Woodland Butterfly Biodiversity; Can Woodland Management Increase Renewable Energy Supply and Improve Biodiversity**

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Development of a UK woodfuel industry has the potential to alleviate biodiversity declines, reduce fuel poverty, and contribute to our renewable energy commitments. Although the effects on biodiversity in woodland managed for conservation have been studied for a range of species, there is very little empirical data on the impacts of woodfuel harvesting on biodiversity in the UK. This study investigated habitat quality of three different woodland management techniques using species richness and abundance of diurnal butterflies.

Butterflies were sampled at two sites; Gait Barrows and Witherslack, and comprised three woodland management techniques: under-managed woodland (no recent intervention); traditional coppice management for conservation; harvesting for woodfuel.

Independent statistical analysis at each site showed that: (1) both coppice management for conservation and harvesting for woodfuel had significantly higher butterfly species richness and abundance when compared to under-managed woodland (2) butterfly species richness and abundance were not significantly different between the traditional coppice management for conservation and harvesting for woodfuel; (3) UK biodiversity action plan (BAP) fritillary species were not significantly different between the traditional coppice management for conservation and harvesting for woodfuel.

Results suggest that both conservation goals and renewable energy targets can be achieved through harvesting of woodland for woodfuel.

### **P23.4**

#### **Managed and Unmanaged Deciduous Woodland Key Habitats: Do They Differ in Bryophyte Species Richness and Structural Elements?**

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Woodland key habitats (WKHs) which are considered as small stands with high biodiversity are important components of forest conservation in Latvia. However little is known about the history and present biodiversity of these territories. We examined the past history of selected 12 WKHs and its relationship with epiphytic and epixylic bryophyte species richness. The study was conducted in the North Vidzeme Biosphere Reserve of Latvia. The results showed that five areas had been harvested during the past 80 years. There were no differences in species richness on different substratum between these managed and the others (unmanaged) WKHs. There was also a higher richness of bryophyte species on coarse wood debris in the unmanaged WKHs, indicating an effect of management. In conclusion, indicator species and high epiphytic bryophyte richness of WKH can be found in forests cut an even less than 60 years ago. Epixylic bryophyte species on downed trees are more limited by quality of coarse wood debris which is low in forests that have been managed in the past.

## **P23.5**

### **Biologically Important Forests' Status and Conservation at the Edge of EU - Poland as an Example**

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I present results of Biologically Important Forests (BIF) mapping, conducted in Poland in frames of wider cross-boundary project. BIFs are forests of high conservation value and restoration potential. While such habitats have mostly vanished from Western Europe, many still remain near the eastern EU edge. Poland, representing a variety of different forest types and a strong east-west naturalness gradient, is a good example. As data source, I used mainly forest inventories filtered by specific criteria. I compared the structure and share of BIFs between eastern and western Poland. In general, eastern forests harbour significantly more old-growth, uneven stands, rare species and BIFs in total. Around 11% of Polish forests qualify as BIFs; yet less than 5% of BIFs have legal, permanent strict protection status. The majority of Polish forests, similarly in the east and west are included in NATURA 2000, meaning that regardless of their actual value, all have equal protection status - virtually illusive. Everyday experience shows that 'sustainable management' in NATURA 2000 is often a mere greenwashing, not differing from regular 'before-NATURA 2000' use. NATURA 2000 will not solve the problem, unless supported with the strong preservation component, including none-intervention management as crucial part.

## **P23.6**

### **Genetic Diversity in the Conifer Species Inhabiting Italian Peninsula**

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Italian peninsula was an extremely important shifting region during the last glaciations, harbouring several known and still unknown refugia, and that is why Apennine forests are generally considered to be rich of genetically pure populations. These populations are important to preserve in the present time, considering that ongoing climate warming might cause local extinctions, and surviving populations could be the precious source of the genetic material in the afforestation programs. In Italy, conifers are abundant, often dominant species in the montane, temperate and Mediterranean forest ecosystems; they are an important component of the biodiversity, a source of income and a familiar part of the environment. In the past some of these forests were partly reforested with seeds from different provinces, and genetic admixtures were artificially promoted. In this research, chloroplast DNA markers were used to establish the genetic identity of various conifer tree individuals sampled in biogeographically prominent stands of the Italian Peninsula. DNA sequence variation was assessed also by comparison with samples from all around the Mediterranean area. Genetic differences between Italian populations were found in pine (costal and continental species) and yew forests and several unique genotypes were identified in specific regions of the Italian Peninsula.

## **P23.7**

### **Decline and Recovery of Bryophytes on Retention Trees during 30 Years**

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Green-tree retention (GTR) is a forest management method in which a certain number of living trees are left permanently on a logged area in order to sustain biodiversity. This study aimed to reveal the long-term importance of European aspen (*Populus tremula* L.) retention trees for epiphytic bryophytes. The bryophyte flora of 102 retained aspens was studied on 14 GTR sites and compared with respective 102 aspens in 14 mature forest sites. The GTR sites had been logged 2-30 years previously. The retention aspens had lower species richness and lower cover of bryophytes than the mature forest aspens and they also differed in their bryophyte community structure. The decline had occurred during the first two years after logging. As the time from logging increased to over 15 years, the GTR sites became more like the mature forest sites in their bryophyte species richness, cover and community structure. We conclude that retention aspen trees do not function as effective lifeboats for all bryophyte species. However, the results suggest that the bryophyte community has potential to recover with time after logging, i.e. bryophytes can benefit from the structural enrichment of the stands following GTR.

## **P23.8**

### **Can Tree Species Richness Buffer Edge Effects in Temperate Deciduous Forests?**

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Plant biodiversity has been shown to influence abundance, species richness and interactions among heterotrophs. In European forests, tree species richness is an important predictor of arthropod community composition. Since Central European forests are highly fragmented, tree diversity effects can be expected to be overshadowed by edge effects.

We are not aware of any studies independently assessing the relative importance of tree biodiversity effects vs. edge effects in forests.

We independently studied edge effects and effects of tree species diversity on herb and arthropod species richness in Germany's largest connected deciduous forest. We selected forest stands differing in tree species richness and in varying distances to the forest edge. Two main questions were addressed:

1. How large must fragment patches be to harbour intact core zones/true forest species?
2. Is this dependent on tree species composition?

We found that the proportion of total herb layer species richness increased with increasing distance to the edge. In addition, edge effects differed between forest stands.

We conclude that both tree species composition and forest fragment size need to be considered in conservation area planning.

### **P23.9**

#### **Bryophyte Succession during a 100 Year Period after Cessation of Human Disturbance in Forests of the Moricsala Island Nature Reserve, Latvia**

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To determine changes in bryophyte communities of forests in the Moricsala Island Nature Reserve, the data recorded by botanist Karl Reinhold Kupffer in the time period 1912-1913 on bryophytes in mapped forest stands were compared with those today. Part of the area was used earlier as pasture and meadow. Bryophytes were collected from forest ground, logs, and living trees in nine different forest site types in both study periods. In total, 148 bryophyte species representing twelve life forms were recorded. The life form approach was used to investigate bryophyte response to end of agricultural land-use on Moricsala Island. Many species disappeared from study area but new species took their place (35 and 38 species, respectively). Tall turfs, smooth mats, and rough mats were the most common life forms. An increase in substrate heterogeneity (dead wood and large-diameter trees) over 100 years has led to an increase in richness of epiphytic and epixylic species, and in their diversity of life forms. However, previous management by grazing and grass cutting favored higher richness of forest floor bryophytes, via diversity of microniches and mosaic structure.

### **P23.10**

#### **Climate-induced Divergence of Growth of Old Pine in Natural Forests - Possible Implications for Conservation**

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The aim of study was determine variation in tree ring width of Scots pine and find relation to climatic and environmental factors. Trees act as bioindicators that respond to environmental changes over a long period. Tree ring width, earlywood and latewood width are the most widely used parameters in dendroecology. Samples of Scots pine were collected in the Lake Engure Nature Park, which is a unique European wetland (*Natura2000*, *Ramsar site*). Trees in dry soil sites were sampled by coring in year 2011. Tree ring width, earlywood and latewood width were measured using WinDendro 2008 software. Scots pine on dry soil sites in Latvia shows a large increase of tree ring increment starting from the second half of the 20th century. This strong increase in ring width exists even in more than 200 years old trees, which halts the age-related decline of growth. Thus, in addition to the value of natural pine forests in conservation of biological diversity, these areas have increasing importance in carbon sequestration, as they can switch from carbon storage to increased sequestration functions. The added value of natural pine forests in carbon sequestration needs to be considered when planning forest management to mitigate global change.

## **P23.11**

### **Foraging Habitats of Bats in the Niepołomicka Forest, Southern Poland**

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Between May and October 2010 and 2011, data on the occurrence of bats and nocturnal insects in the Niepołomicka Forest (10.8 × 10<sup>2</sup> hectares), was collected. The bats were located by a Pettersson D-240x detector, then identified, in deciduous forest *Tilio - Carpinetum* (**Habitat A**) and mixed coniferous forest *Pino-Quercetum* (**Habitat B**). 491 echolocation signals were analysed, and the presence of 7 genera of bats discovered. 2793 nocturnal insects were captured. The numbers of echolocation signals detected per hour were similar in habitats A and B (i.e. 24.3 and 24.8 respectively), whereas the number of insects captured (individuals/hour) was higher in habitat A (153.6 vs 125.1). The number of echolocation signals was slightly higher in young forest plantations than in timber stands habitat A (13.6/h vs 11.2/h), whereas in habitat B, the number of echolocation signals was decidedly higher in young forest plantations, than in the timber stands (14.9/h vs 9.4/h). The number of insects captured per hour was much higher in young forest plantations than in the timber stand of habitat B (80.4 vs 45.3). In habitat A, however, the number of insects captured per hour was slightly higher in the young forest plantations than in the timber stands (89.9 vs 63.7).

## **P23.12**

### **A Comparison of Three Sampling Methods of Hoverflies**

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Hoverflies (Syrphidae) are one of the largest dipterous families, with 800 species are known from Europe of which about 440 species occur in Germany. They provide important ecosystem services, as adult feed on pollen and nectar, pollinating wild flowers and crops. Larvae of many syrphid species are important biological pest control agents as aphid predators. In this study efficiency of three sampling methods of hoverflies (Malaise trap, butterfly net, pan traps) was compared in clearcutting and area with shrubs and trees in Tharandt forest, East Germany, 2009. We took samples during four periods from May to August. Altogether 980 individuals of 62 species were collected. 48% of specimens were sampled by netting, 34% by Malaise trap and 18% by pan traps. According to general linear models we found no significant difference in the abundance and species richness of hoverflies among the two habitats. Comparing the three methods, netting and pan traps were less efficient than Malaise trap on the area with shrubs and trees. We found no interaction of the sampling methods and periods. Results suggest that hoverflies can be sampled effectively by netting, however on the area of denser vegetation Malaise trap was the most efficient sampling method.

### **P23.13**

#### **Carabids of the Primeval Forest of Białowieża and the Managed Forest in the Early Stages of Transformation**

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The last primeval lowland forest in the Central Europe is the primeval forest of Białowieża (BPF) in north-eastern Poland. Part of the forest is constituted of mosaic of the small area fragments of BPF and different age first generation managed forest patches (BMF). Author has put forward a hypothesis according to which species richness of carabids and their catchability are higher in the BPF as compared with the BMF. The second hypothesis specified that the presence of particular carabid species depends on the type of forest stand (BPF/BMF) and on the fertility and humidity of the habitat. To verify the hypotheses, the structure patterns of carabid assemblages were studied. The results suggest significant differences in the species structure patterns of the assemblages and in the catch rate of particular species, depending on the type of forest stand, and the humidity of the habitat. Forests fertility seems to be less important. General species richness was maintained nearly identical both in the BPF and BMF, this may have been result of the differentiated structure of the two stand types, the latter being influential for the presence of late successional carabid species in the BPF, and the early successional ones in the BMF.

### **P23.14**

#### **Changing the Nonlinearity Due to the Effect of the Parameters in a Logistic Model of Growth through Reparameterization**

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Due to the large and growing economic interest in the wood, non-native forests become an important part in conservation biology because it reduces pressure on native forests.

To describe and understand relationship between involved variables an important resource are the nonlinear regression models. When the models are nonlinear the parameters obtained usually haven't the properties of nonbiased, normally distributed and have minimum variance only asymptotically, however in some models when applied to certain data sets, their parameters exhibit characteristics even for small samples and these models are said to possess the physical property called property close to linear. The curvature of the nonlinear models can be divided in intrinsic(IN) and due to the effect of the parameters(PE). Value above 0,3 for PE or/and IN report that the nonlinear model don't possess this property. PE can be corrected by reparameterization of model. This paper uses data from planted forests to adjust height growth of *Eucalyptus grandis* and apply reparameterization to the three parameters logistic model. In the setting of the first model was obtained PE =10,1308 and IN = 0,0717 after reparameterization IN = 0,0064 and EP = 0,2803. This results validates other statistics such as t-test, f and others.

## **P23.15**

### **Rare Terrestrial Vertebrates of North-Western Part of Russia in the Habitat Changing Conditions**

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In 1994-2011 the research was carried out in the North-Western part of Russia (Leningrad, Pskov, Novgorod regions, south Karelia). The main task was to determine the changes of rare terrestrial vertebrates density populations and the species which are rare in the habitat fragmentation condition or in the condition of its loss. The rare animal species were divided into 3 groups: 1) rare species which can survive in the transformed ecological systems: species of open habitats, primarily, - meadows, fields (*Crex crex*, *Cyrus cyaneus*), bogs and wetlands (*Pandion haliaetus*, *Anas strepera*); 2) species, which are in danger of disappearing due to anthropogenic pressure as a result of habitat fragmentation: *Anguis fragilis*, *Lagopus lagopus*, *Aquila chrysaetus*, *Haliaetus albicilla*, *Lynx lynx*, *Pteromys volans*; 3) species, which are in danger of disappearing due to decreasing of their density population as a result of pollution, habitat destruction or disturbance: *Triturus cristatus*, *Gavia arctica*, *Cygnus Cygnus*, *Lutra lutra*, *Mustela lutreola*. Thus, the forest ecosystem (the second and third groups) species are the most endangered at the present in this part of Russia. Nowadays we require new methods, which will take into account social and economic conditions as well as ecological peculiarities of forest ecosystems.

## **FRESHWATER AND WETLAND ECOLOGY**

### **P24.1**

#### **Distribution, Habitat and Conservation Status of the Endangered Water Beetle *Graphoderus bilineatus* in Croatia**

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The dytiscid water beetle *Graphoderus bilineatus* is one of few beetles protected by both EU Habitats Directive and Bern Convention and listed as Vulnerable in the IUCN Red List. Although widely spread across Europe, in most countries its overall conservation status is 'Unfavourable-Bad'. So far, only two old records were known in Croatia (1907, 1943). During 2010 and 2011 we investigated the distribution and habitat of the species in order to designate NATURA 2000 sites and assess the conservation status in Croatia. In total, 83 sampling sites were selected and sampling was performed by pond-net and baited bottle traps. Additionally, we created a potential distribution model. We discovered new abundant populations of *G. bilineatus* (total of 69 specimens) at 20 sites restricted mainly to protected natural wetlands along the Danube, Drava and Sava rivers, which we proposed as NATURA 2000 sites for this species. 95 % of presence sites were within protected areas. The main habitats are flood-meadows, ox-bows and canals with stagnant waters and aquatic vegetation of medium density. Our first results indicate that *G. bilineatus* may have a favourable conservation status in Croatia. Its habitats are of suitable quality and sufficiently covered by existing protected areas.

## **P24.2**

### **Ecology and Morphological Polymorphism of *Aphanius fasciatus*. National Park of El-Kala (North-East Algeria)**

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Lac Our study focused on the ecology and polymorphism of an endemic Cyprinodontidae teleost freshwater fish, *Aphanius fasciatus*. The studied population is from the Lac Bleu of National Park of El-Kala (Northeast Algeria). This protected species live in a RAMSAR site and is on the IUCN Red List. We studied morphological polymorphism of the species. We compared our results to other populations of *Aphanius fasciatus* from Lac Nord of Tunis (Tunisia), Sidi Mansour (Tunisia), Chenini Oasis (Tunisia), Nil (Egypt), Istanbul (Turkey). We found no significant difference on RNP, RNV, RND, RNA, ELL between the studied population and Lac Nord of Tunis (Tunisia). This population should have a protection plan in light of the number of remaining populations in Algeria in order to avoid its complete disappearance as that of the *Aphanius apodus*.

## **GAME ECOLOGY AND SUSTAINABLE HUNTING**

### **P25.1**

#### **Understanding the Conflict between Wild Boar and Humans in the Department of the Moselle, France**

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France, like many European countries, has seen a dramatic increase in wild boar (*Sus scrofa*) numbers in the past 30 years. The aim of this study was to characterize the conflict which has arisen between wild boar and humans in the Department of the Moselle, France, through interviews with stakeholders. Both social and environmental risk factors were shown to fuel the overall conflict. Environmental factors included weather, urban sprawl, farming practices, and the characteristics of hunting lots, whilst the main social factor appeared to be presumed inequality between stakeholders. Wild boar, being an important game species, has often benefited from a certain degree of protection because of its economic value; hunting lot prices have increased in the Department in combination with animal numbers. Though management of wild boar appears to be changing, many stakeholders remain convinced that more is required in order to manage populations more responsibly. Particularly, the agricultural sector is concerned because of wild boar damages to crops. Though these damages are compensated for by hunters, it appears that others are not, such as damage(s) to ecosystems, the health of fauna and humans, and costs to society including a loss of amenity associated with the act of hunting.

## **P25.2**

### **Hunting and Capture Methods: Incidence on Conservation Status of Red-legged Partridge in Spain**

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Natural populations of red-legged partridge are commonly hunted in Spain although have declined substantially since the early 1970s. The main factors causing red-legged partridge population reductions are habitat change due to human activity, problems associated with game releases and excessive hunting pressure. Little is known about the real incidence of hunting and capture methods on local populations of red-legged partridge. The present study identifies areas that favour the presence of red-legged partridge and good hunting yields in Andalusia (S Spain), as well as overexploited regions using Generalised Linear Models (GLM). In the study area, 20% of the territory where the red-legged partridge is hunted is overexploited. Driven shooting is the capture method responsible for overexploiting this species in almost half the territory where this method is practised, whereas coursing and walked-up shooting and hunting with decoys are responsible for overexploitation in a quarter of the territory. According to the results, hunting with decoys is the capture method that has the least impact on the increase in hunting pressure on red-legged partridge, Nevertheless this game modality is currently under revision by the European Commission's (EC) Birds Directive because hunting may fall within the breeding period of the species.

## **P25.3**

### **Habitat Degradation in a Game Preserve**

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Hungary is well known of its high level game-management, a rapidly developing branch of which is indoor game keeping. Its main tasks are to relieve natural forests, and to reinforce sustainable outdoor game-management.

The scene of this work was a game-preserve which belongs to the Nyírerdő Corporation (Nyíregyháza). The game preserve is divided into three different units based on the density of the wild boars. We have conducted on these areas botanical surveys (plant coverage, life-form spectrum) in spring and autumn of the year 2010 and 2011.

After the botanical survey, it can be stated that the plant coverage in the control area corresponded to what was expected; a lower number of herbaceous species give high plant coverage. In the indoor areas this coverage percent was lower, and in the area with the highest wild boar/ha frequency the presence of herbaceous species was not detectable.

This is a considerable fact which the game manager has to keep in mind while planning the feeding, in order to achieve a sustainable, long term game management.

## GRASSLAND ECOLOGY AND MANAGEMENT

### P26.1

#### Small-scale Environmental Heterogeneity and Anthophenological Dynamics in a Lozoya Valley Pasture in the Central Iberian System (Spain)

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**Objectives:** The objectives of this study were to describe the manifestations of small-scale environmental heterogeneity (microenvironments) throughout the annual cycle; and to establish spatial and temporal guidelines and indicators associated with these microenvironments in supramediterranean pastures with dispersed trees and surrounded by shrubs.

**Material and methods:** The intensity of flowering and edaphic temperature and humidity were measured in 9 fixed squares of 0.5 m<sup>2</sup> every week for forty weeks (one annual phenological cycle). Canonical Correspondence Analyses (CCA) were used to analyze the results.

**Major results:** The differences in environmental parameters and flowering between the different squares indicate that the underlying environmental heterogeneity facilitates the existence of three microenvironments that evolve throughout the annual cycle, with a characteristic courtship of species.

**Conclusion:** The mosaic-like spatial structure and the temporal evolution of the observed microenvironments help to explain the high richness of herbaceous species and the heterogeneous chorology found in the pastures studied. National and European policies designed to perpetuate the traditional use of these pastures (livestock farming and extensive grazing) will be fundamental for the conservation of these “edge ecosystems”, which have traditionally been described as links between the Eurosiberian and the Mediterranean worlds.

### P26.2

#### Riparian Margins: Can They Promote Pollinators in Intensively Managed Grassland Landscapes?

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The intensification of agricultural practices and associated loss of habitat heterogeneity has resulted in a decline in farmland biodiversity throughout Europe. The erection of fences adjacent to watercourses has the potential to not only mitigate diffuse pollution, but also, through enhancing habitat heterogeneity, promote biodiversity. Pollinator (i.e. butterfly and bumblebee) populations were monitored using standardised transect walks on a range of riparian margins and grassland fields to determine the impact of riparian management on pollinator diversity. Bumblebees were more abundant, and populations were richer and more diverse, in riparian margins (i.e. both fenced and unfenced margins) than grassland fields. Furthermore, bumblebee diversity was greater in wide margins (i.e. > 5m wide) than narrow (i.e. < 3m wide) or unfenced margins. While more butterflies were recorded in fenced riparian margins than the adjacent grassland fields, the same did not hold true for open margins. Flowering plant species richness showed a strong positive relationship with pollinator abundance, diversity and species richness, and for butterflies, differences between fenced riparian margins and grassland fields could solely be attributed to plant species richness. Fenced riparian margins therefore have the potential to be multi-functional delivering agronomic, diffuse pollution and biodiversity objectives in intensively managed grasslands.

### **P26.3**

#### **The Importance of Grasslands to Migrating Wild Geese in the Hortobágy, Hungary**

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The Carpathian basin is an important breeding, migrating and wintering area of Eurasian wild geese species. The Hortobágy National Park is a stopover place for several bird species, typical habitats are grasslands, wetlands and fishponds surrounded by agricultural areas. The greylag goose (*Anser anser*) is the only breeding goose species in the region in increasing breeding population. Most of the migrating geese are white-fronted goose (*Anser albifrons*) in increasing population trend. The number of migrating bean geese (*Anser fabalis*) are significantly decreased in recent years. The Hortobágy is traditional stopping place of the globally endangered lesser white-fronted goose (*Anser erythropus*) and the red-breasted goose (*Branta ruficollis*) also observed each year often in remarkable number. Our results showed significant increase in number of overwintering geese, and we have found several changes in the timing of goose migration caused by climatic factors. The grasslands are important feeding areas in wintering period and in spring migration.

### **P26.4**

#### **What Is the Effect of Cattle Trampling on Vegetation and Soil Compaction in a Long-term Grazing Experiment?**

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The vegetation development after 12 years under different grazing regimes, in comparison with grazing without trampling, was studied in the species-rich temperate grassland through species responses and soil compaction in the long-term. The experiment was performed in the Oldřichov Grazing Experiment (Czech Republic). There were five treatments: intensive (IG) and extensive (EG) grazing, cut for hay in June followed by intensive (ICG) and extensive grazing (ECG) and grazing with no trampling (NT). The pasture was continuously stocked by young heifers every year from May to September. The abundance of plant species (%), sward height (cm) and soil compaction were recorded in 2010. The NT treatment significantly differed from the others treatments in all studied variables: plant species richness, equitability and composition, sward height and in soil compaction. The dominant of those plots resulted to be mosses. Species with the highest abundance under the IG and ICG were *Trifolium repens*, *Veronica serpyllifolia* whereas under the EG and ECG *Aegopodium podagraria* and *Hypericum maculatum*. The main message from this experiment is that trampling is one of the key factors necessary for creating typical structure of pasture vegetation. Grazing together with trampling is an inevitable management tool for conservation pasture community.

## P26.5

### An Assessment of Plant Diversity along Roadside Verges on the Baltic Island Gotland (Sweden): Measuring Plant Responses to Varying Nitrogen Levels

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Humans have altered the global environment mostly by land distribution and fragmentation and this have negatively affected the biological diversity. Another threat has been nitrogen enrichment in soil, as being major threat to the plant species diversity in terrestrial ecosystems. Nitrogen is often the limiting factor for plant growth and since most of plant species are adapted to nutrient-poor conditions they can only compete successfully on soils with high nitrogen levels with (the few) fast-growing and highly competitive plants. An increase in nitrogen will cause a drastic loss of plant diversity because of competitive exclusion. Roadsides are mown regularly because of safety reasons, which enrich the grassland species composition. Gotland's roadside verges has a rich flora and fauna and it contains species worthy of protection. My study highlights the combined role of competition and nitrogen in influencing the diversity of roadside verges on Gotland. Species chosen will be sown in the same plot and I will apply increasing level of nitrogen for every plot. My study aims to test the hypothesis that high nitrogen levels the soil will cause a decline in plant species diversity. I will use one-way analysis of variance to test my hypothesis using R.

## P26.6

### Meadows of *Molinion caeruleae* alliance in the south – western part of Krakow in aspect of floristic diversity

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The aim of the study was an appraisal of floristic diversity of the alliance *Molinion caeruleae* occurring in the Pychowice and Kostrze. There have been 45 phytosociological relevés by Braun – Blanquet method, in June and July, 2010 and 2011. This alliance forms floristically interesting associations, due to big biodiversity and occurrence of some rare and legally protected plant species. It is distinguished by specific plant species, where the important role is played by showy and colourful perennial plants of monocotyledons and dicotyledons. Plant species that are of particular importance, are for example: *Dianthus superbus*, *Gentiana pneumonanthe*, *Gladiolus imbricatus* and *Iris sibirica*. Other rare vascular plant species of this area are: *Inula salicina*, *Serratula tinctoria*, *Thalictrum flavum*. Meadows of that alliance are traditionally mowed once while lasting each vegetation period and unfertilized. They occur in places that are periodically wet – in spring and autumn, however during summer they stay dry. In the area of Poland this type of meadows has been utilized in the different way than other typical meadow associations, and is used not as a fodder but as a bedding material which makes it unprofitable for keeping. This problem in Pychowice and Kostrze is even more extensive, as they are parts of Krakow, located near the city centre, where there is a big social demand for developing better infrastructure and building another housing estates. As a result of recent abandonment of mowing and also due to transforming some parts of that seminatural habitat by building the residential settlements, there is a serious threat for the biodiversity of this area. It is reflected by shrinking surface of typical associations connected with *Molinion caeruleae* and by disappearance of species typical for the alliance. Preservation of meadows belonging to this alliance depends mainly on the maintenance of traditional extensive forms of their use.

## P26.7

### The rare and endangered species of *Cnidion dubii* alliance in the vicinity of Sandomierz - aspect of utilization on biodiversity

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The alliance of *Cnidion dubii* has been indicated in the area of Sandomierz, in Winiarki about 170 km from Kraków. This is a seminatural formation of extensively utilized meadows, that are sparsely scattered in the area along the Vistula River basin. The study has been conducted in 2010-11 and its purpose was the evaluation of floristic diversity by carrying out the Klapp assessment method. According to this method the vegetation of particular meadows is divided into 3 groups: *Poaceae*, *Fabaceae* and other dicotyledons species. The important aspect of this study was also estimation of utilization and fertilization on forming the association of this alliance. There have been noted some rare species of vascular plants as: *Cnidium dubium*, *Allium angulosum* and *Lathyrus palustris*. These species can be found in „The red list of plants and fungi in Poland” as vulnerable (V), which means that they are isolated in their localities and rare in Polish flora. That causes that they are very valuable for the local plant diversity and the type of utilization of that kind of meadows should be done in the proper way. In the explored area, there have been isolated 3 variants of meadows of *Cnidion dubii*: I – for monitoring - 1 cut for the meadows without fertilizing, II – 2 cuts without fertilizing, III – 2 cuts, fertilization with N<sub>60</sub>P<sub>20</sub>K<sub>40</sub> (60 kg N, 20 kg P, 40 kg K · ha<sup>-1</sup>). In the variant that was used only for monitoring (1 cut, no fertilization), there were isolated 3 fractions of vegetation: fraction of species from dicotyledons group that made up 59%. Within that 19 species were noted, where the most abundant was *Cnidium dubium* (23%). Among other, rare species *Allium angulosum* took up to about 1%. The next fraction according to quantity was the group of grass family (41%), which was represented by 10 species. The *Fabaceae* was represented by *Lathyrus palustris* (3%). As a result of 2 cuts in the vegetation period there has been noticed the increase of quantities of *Poaceae* up to 62 %, on the other hand the quantities of monocotyledons dropped to 38%. Furthermore, there was visible decrease of *Cnidion dubii* to 14% and also small decrease of *Lathyrus palustris* (2%). Two cuts and fertilization during the vegetation period have made further changes – the increase of *Poaceae* fraction up to 74 % and lower quantities of dicotyledons – 26%. It was also noted the drop in the number of species of dicotyledons to 16. That shows that fertilization and more intensive utilization can negatively affect the species diversity, especially those considered as rare and endangered.

## HABITAT FRAGMENTATION AND METAPOPOPULATION DYNAMICS

### P27.1

#### Conserving Biodiversity in Fragmented and Changing Habitats: How Many Species of *Ctenomys* Inhabit the Iberá Wetland?

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The South American subterranean rodents *Ctenomys* are highly speciose, with 62 species that appeared in the lapse of 3 million years. Within the genus, the “perrensi” group, formed by three named species and a group of forms of unknown taxonomic status, inhabits the Iberá wetland, in northern Argentina, which changes periodically altering the amount and disposition of suitable habitat for the species. In order to understand the evolutionary processes operating in the group, we examined mitochondrial DNA sequences and microsatellite genotypes. The mitochondrial DNA phylogeny evidenced two different groups, separated by one of the main rivers of the region. Clustering methods based on microsatellite genotypes, delimited 12 different populations and 5 metapopulation lineages. Some of the genetic clusters found included localities with very different chromosomal numbers, which points to the existence of gene flow despite chromosomal variation. A bayesian analysis revealed that habitat fragmentation is the only significant environmental factor shaping the genetic structure of the system. The evolutionary future of these five lineages seems to be tightly controlled by the dynamics of their habitat, if stable they may become distinct species, otherwise they may collapse into a hybrid swarm forming a single evolving metapopulation.

### P27.2

#### Metapopulation Dynamics of Dry Grassland Species - Lessons for Species Conservation

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Dry grasslands belong among the most threatened ecosystems in Europe representing unique habitats for many threatened species. We are dealing with dry grassland habitats in northern Bohemia, Czech Republic. In this area, dry grassland patches occur within a largely agricultural landscape and are thus surrounded by a large agricultural field. In spite of still being considered as remnant habitats by some people, these grasslands in fact have a very diverse history of past land use and some of these grasslands were in fact arable fields still in 1980's.

The results show that some of the species are able to colonize the habitats within a few decades or even less. Other species, are, however, confined to habitats with long continuity. Most of the species in the area also show evidence of dispersal limitation suggesting that protection of these species should include not only habitats currently occupied by the species but also those that are currently unoccupied.

Recent changes in the land use in the area leads to abandonment some of the large arable fields. In the future these habitats may in fact become new habitats for the dry grassland species, while the current dry grasslands undergo slow succession towards forest.

## IMPACT OF TRANSPORT INFRASTRUCTURES

### P28.1

#### Potential Impact of Motorways and Express Roads upon Distribution of Wolves in Poland

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Since 1990 number and length of motorways and express roads has increased every year in Poland. In 2020 there will be 2000 km and 5237 km of motorways and express roads respectively. We analyze range of wolf distribution in 1990 and in 2010, to determine impact of traffic volume and road density wolf populations over 2 decades. We obtained records on wolf distribution and their migratory pattern from 431 forest districts and 23 national parks and detected significant relationship between integrated traffic volume and wolf distribution. This relationship is statistically significant ( $r=0.70$ ;  $p=0.012$ ) and it indicate that traffic volume is responsible for about half ( $R^2=0.49$ ) of wolf distribution changes during 1990-2000 period. In 2010 wolves were present in 182 forest districts and national parks. Because of high traffic volume some movement corridors disappeared and population in some regions became extinct. There are 4 hot spots where motorways and express road under construction may stop wolf movement. Currently it is difficult to predict the scale of the negative impact of wolf habitat fragmentation in Poland due to new roads. However there is a high probability that distribution of wolves may decline, especially in the western part of the country.

### P28.2

#### Impact of De-icing Salt on Roadside Collembola and Microorganisms

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There are a lot of contaminant sources relating to traffic influence. In colder climate regions are commonly exposed to de-icing salt application to improve traffic safety during winter. NaCl is the primary de-icing agent but excessive amounts of chloride ions are known to damage ecosystem function and structure through degradation of habitat quality and toxic effects on soil organisms. Soil biota is a vital force which serves to maintain the health of soils and soil biodiversity should be protected because of their functional properties. The main, basic and secondary roads by two replicate were selected, the main roads have average year traffic of 4500-9400 vehicles and a speed limit of 90 km h<sup>-1</sup>, basic roads have 500-700 vehicles and secondary roads have 195-200 vehicles with speed limit of 70 km h<sup>-1</sup>. Collembola samples were collected 5, 10 and 20 m from the edge of the road with soil corer (Ø 5 cm) to soil depth of 20 cm. The microbial biomass and basal respiration of microbial community were determined from oxygen consumption data. Despite the salts, road edges seem to positively affect the diversity of Collembola. Respiration of microbial increased in autumn compared to the results of the spring.

## **P28.3**

### **Impact of Road Kills on Population Parameters of Terrestrial Vertebrates**

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The aim of this work was to study the impact of road kills on population parameters of terrestrial vertebrates. The surveys, performed by car at 30 Km/hour, occurred every 2 weeks between May 2010 and May 2011, along 59 km of secondary roads in the northeast of Portugal. During each survey all dead animals and their characteristics were registered. Results showed that at least 49 species were affected by road kills during the studied period. From these, it's important to highlight 5 species according to their current conservation status in Portugal: Iberian painted frog (*Discoglossus galganoi*), Wryneck (*Jynx torquilla*), Black-eared wheatear (*Oenanthe hispanica*), Woodchat shrike (*Lanius senator*) and European rabbit (*Oryctolagus cuniculus*). Females and adult individuals were the most affected and a progressive increase in mortality rates from winter to autumn was also registered. According to our results, road kills represent a negative key factor in the population dynamics of terrestrial vertebrates, contributing to increase mortality and potentially interfering with birth-rates and the input of individuals from migration.

## INTEGRATIVE/INTERDISCIPLINARY APPROACHES TO CONSERVATION

### P31.1

#### ALTER-Net (A Long-Term Biodiversity, Ecosystem and Awareness Research Network)

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ALTER-Net is a network of 25 partner institutes from 17 European countries. ALTER-Net integrates research capacities across Europe: assessing changes in biodiversity, analyzing the effect of those changes on ecosystem services and informing the public and policy makers about this at a European scale. Originally funded by the European Union's Framework VI program to stimulate a collaborative approach, ALTER-Net is now operating independently. ALTER-Net activities, collaboration projects and achievements are highlighted.

### P31.2

#### Systems for Coastal Dolphin Conservation in the Ligurian Sea (ARION)

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Bottlenose dolphin (*Tursiops truncatus*) is one of the Mediterranean cetaceans listed in the Annex II of Habitat Directive. The main objective is the creation of a virtual corridor for monitoring and surveillance of the transient and resident bottlenose dolphins. Concrete conservation actions take place in the Portofino MPA (Italy). We show the implementation of an interference avoidance system capable to track the dolphins, to identify threats and to prevent collisions by diffusing real time warning messages to all categories involved. Two detection units are placed one kilometer off the coast of Portofino headland. Each unit is a particular type of marine buoy (elastic beacon) equipped with four hydrophones and an acquisition system which can record the typical "social communication whistles" emitted by the dolphins and the sounds emitted by boat engines. Signals are then sent on shore, via wi-fi, and elaborated to get the real time position of dolphins and boats. Upon reception of the warnings the boats present in the area will be invited to follow a protocol of conduct supervised by the Coast Guard. This approach will improve the species protection, the sustainable coexistence of dolphins and anthropic activities and will promote responsible usage of the sea.

### **P31.3**

#### **Possible Physiological Biomarkers for Evaluation of Marine Organism Status and its Implementation in Environmental Assessment**

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One of the main challenges of modern ecology and conservation is the development of methodology for correct environmental assessment. In indication of biological effects of the contaminants the recording of the invertebrate cardiac activity to evaluate organism physiological state is widely used (Depledge, Andersen, 1990; Kholodkevich et al., 2007, 2011). The aim of the study was to test implementation of the developed method of cardiac monitoring in selected invertebrates (mollusks and crustacean) and methodological approach with standardised test-stimuli used as functional load to evaluate physiological state of studied key species for the purpose of biomonitoring. Great attention was payed to caged mussels experiments, in which mussels (*Mytilus edulis* L.) are transplanted from reference site to sites with different ecological status and deployed there for certain time period, and applicability of the results for the purpose of impact assessment. Authors showed that time of recovery after test stimuli (e.g., experimental rapid change in water salinity used as load), and coefficient of heart rate variation could be applicable in evaluation of organism physiological state. The obtained data could be used as a signaling function for both management and habitat quality evaluations.

### **P31.4**

#### **Protocol for the Evaluation of Sanitary Status of Domestic and Wild Fauna That Share Pathologies and Potential Habitat with the Iberian Lynx - Project LIFE+ Enhancing Habitat for the Iberian Lynx and Black Vulture in the Southeast of Portugal**

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Wildlife diseases can represent a serious conservation threat for free-living populations of endangered species. Small, geographically isolated and genetically depleted populations, suffer from a progressive loss of diversity that potentially increases their susceptibility and decreases their response to infectious agents.

Coordinated programs to evaluate the sanitary status of animal populations reveal to be very important to the success of both *in situ* and *ex situ* conservation of endangered species with declining populations, such as the Iberian Lynx.

For this purpose, an epidemiological survey was drawn, consisting on a sample collection and laboratorial testing of biological material from domestic and wild animals to detect and quantify the presence of pathogenic agents that might affect the Iberian Lynx at the areas of the project. Based on the scientific data available, the protocol has set up priority species and pathologies and based on existing population data a representative sampling of the domestic and wild populations was determined. According with the available scientific data, the expected prevalence for each pathology and group species was determined. Based on that, the sample size was calculated for a chosen confidence level.

The information gathered will allow the elaboration of a monitoring/control plan for the major pathologies found.

## **P31.5**

### **Wildlife Management: A Tool to Foster Coexistence or to Increase Conflict?**

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Around the regional natural reserve "Nazzano-Tevere-Farfa", Italy, controversies have emerged as human-wild boar conflicts have increased, creating the need for an integrated wildlife management. To understand how the application of different wildlife management strategies influences public perceptions, attitudes toward preventive methods, compensation, and wild boar population control were explored. Face to face interviews were carried out with the general public ( $n= 288$ ), hunters ( $n= 57$ ), commercial farmers ( $n= 53$ ), and subsistence farmers ( $n= 54$ ) in 2009-2010. Differences were detected between interest groups in attitudes toward preventive methods ( $\chi^2(12)=45.14$ ,  $p< .001$ ), compensation ( $\chi^2(12)=36.03$ ,  $p< .001$ ), capture and removal ( $\chi^2(12)=99.77$ ,  $p< .001$ ), and culling ( $\chi^2(12)=78.71$ ,  $p< .001$ ). However, the Potential for Conflict Index, a new graphic technique that facilitates the understanding and applicability of human dimension findings, showed that, overall, interest groups supported preventive measures and compensation systems. This was not the case for wild boar population control. Understanding different views held by residents helps to identify which management options are widely supported by local communities, avoiding the design of conservation programs that apply controversial management options and thus lower public tolerance toward wild boar.

## **MEASURING BIODIVERSITY (INVENTORY, MONITORING)**

### **P33.1**

#### **Archaeological Evidence for Massive Biodiversity Loss between the Pre- and Post-industrial Landscape**

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Biodiversity loss in the world's early industrialised regions is often hidden from objective scrutiny, because the process of species extirpation outpaced the accumulation of high-resolution inventory data. To overcome this knowledge-gap, we report exceptional preservation of lichen and moss epiphytes on pre-industrial building materials (< 1750), which were locally-sourced into traditional low-status homes. Focussing on England (one of the earliest industrialised regions) we demonstrate massive biodiversity loss between the pre- and post-industrial landscapes. Our results highlight a systematic bias in base-lines and targets, when these are developed using modern datasets (post-1960s). Because these modern data discount the recent history of biodiversity loss, conservation targets for developed (industrialised) nations will be easy to achieve, being concerned with a recalcitrant subset of what was previously (1400-1750 AD) a diverse species assemblage. Thus, while developing nations should be expected to conserve biodiversity, for parity, developed nations should better restore extirpated species and remedy environmental degradation. Archaeobotany provides the toolkit to make this possible.

### **P33.2**

#### **Human Impact on the Savannah Habitats and Bird Species Diversity of Akagera National Park, Rwanda**

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The war in Rwanda between 1990 and 1994 has been reported to cause a decline in bird diversity of Akagera National Park (1085km<sup>2</sup>). However, Akagera is still among the richest parks in bird species in East Africa. We studied human impact on Savannah habitat by comparing the former part of the park, today exploited by farmers, with the present park. We focused on Savannah habitat structures, bird species richness and diversity. The analyses were based on >300 systematic plots measured once or repeatedly between 2009 and 2011. Human effects on grassland habitat were large. The grass biomass was reduced with 55% and tall grass with 74%. Plots with total vegetation destruction were 12 times larger outside than inside the park. Bushes and trees did not show significant differences. Despite these human effects on habitat, bird species richness (Chao2) was significantly higher outside than inside the park at different spatial scales. Bird diversity (Simpson index) was, however, not significantly different. Higher species richness outside the park supports the disturbance hypothesis, stating that humans cause a shift in competition among species. Larger species detectability outside the park (more open habitat), with 20% average increase in detection probabilities, can alternatively explain this result.

### **P33.3**

#### **An Investigation of Invertebrate Diversity and Limiting Factors in the Alkaline Fens of the Maritime Lowland, Latvia**

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Alkaline fens are particularly protected habitat in Europe (Code 7210, 7230, however the invertebrate fauna are still poorly investigated. An objective of the complex research was to state fen invertebrate fauna and the main limiting factors. Epigeic invertebrates were studied on sample plots using pitfall traps, grass-dwelling - entomological sweep-net, soil invertebrates - using soil sampling in eight fens of Maritime Lowland in 2009-2011. Vegetation significantly differed in the investigated fens, hence the invertebrate fauna was specific for every particular fen. More than 50 species of cicadids, 70 - spiders, 50 grass-dwelling beetles, 9 - grasshoppers, 30 - bugs, more than 60 taxa of other groups. Of epigeic invertebrates - 10 species of Diplopoda, 2 - Oniscoidea, over 120 Coleoptera, of soil invertebrates - >30 gamasina, >70 oribatida, 6 - whorl-snails. Vegetation was the main limiting factor for the phytophagous species (Cicadodea, Orthoptera, Heteroptera, some Coleoptera, Diptera etc.), while soil pH are the most important for snails and millipedes. The predatory and saprophagous species weakly depended on vegetation. Indicator species, e.g. *Cymus glandicolor*, *Dolichonabis lineatus*, *Cicadella viridis*, *Conocephalus dorsalis* etc. was selected for fen habitats. The origin of fens also influenced the invertebrate fauna.

### **P33.4**

#### **Assessing the Conservation Status of Dorcadionini Flightless Longhorn Beetles in Romania**

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The decline of many species in the tribe Dorcadionini is favored by intrinsic characteristics: low dispersal ability, limited geographic distribution and ecological specialisation to open grasslands. Although taxa of this group exhibit a high level of endemism and many have evidently declined during the last decades, the information concerning their conservation status is limited compared to other conspicuous flightless beetles such as *Carabus* species. This is probably due to the lack of good identification keys, low diversity in Central and Western Europe and the limited activity period of adults which hampers the ecological studies. The evaluation of the regional conservation status is based on the study of museum and private collections, published data and ten years of continuous field investigations. Out of the fifteen species known to occur in Romania two were not yet evaluated, one species is data deficient, one is near threatened, four are vulnerable, two are endangered and five are least concerned. The degradation of the remaining habitats in the steppe and forest-steppe zone by overgrazing or by their transformation in agricultural land and the inadequate afforestations are the main identified causes of species decline in the tribe Dorcadionini. This work was financially supported by POSDRU/89/1.5/S/49944.

### **P33.5**

#### **Climate Effects on the Habitat Preference of Amphipians at the Tápió-Hajta Region (Hungary)**

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The Great Reed besides Farnos stretches at the Tápió-Hajta Protected Landscape Area, where every year tens of thousands of amphibians go to breed. To prevent the mass from being overrun on Road 311, which crosses their migration routes, a temporary drift fence was built at first in 2007, with the length of approximately 1,5 km. Since then the frog saving project runs every spring. Besides saving the amphibians we record the number of specimens, their species and the habitat where they were found. Between 2007 and 2011 we observed 9 amphibian species in the area. 95% of the saved amphibian specimens were common spadefoot toads (*Pelobates fuscus*). The drift fence with the pit-traps is located along 4 main habitat types (salt meadow, agricultural area, sand grassland, scrubland). We observed differences in the timing of certain species' migration intensity between habitats. The amphibian species were found in different numbers in the various habitat types. Their preference showed dissimilarities between years too. The climatic variables can explain these differences, especially precipitation conditions. The high precipitation in summer can influence the habitat choice while the high annual precipitation obscures the diversity differences between the habitats.

### **P33.6**

#### **Change in Species Diversity in the Eastern Part of Lower Austria (Pannonian Region): The BOKU Herbarium as a Witness**

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By dint of historical herbarium specimens, we show how the retreat of indigenous species and habitats can be reviewed and how these findings correlate with certain historical events. Our work is based on a digital database of herbarium specimens of the BOKU herbarium, which can be assigned to the Pannonian Region in eastern Lower Austria. The complete dataset (N=6436 specimens) was analysed with the aid of statistical methods (multiple regression; general linear model), from the first herbarium specimens (dating back to 1830) to the present (2007). In doing so, a new *modus operandi* for analysis was developed. It can be used as a method for major digitised herbaria in future. As a result, a significant decrease in some habitats (above all humid meadows, nutrient-poor grasslands, fens and water bodies) was detected. For humid meadows and water bodies, this decrease correlates with the time of the Danube regulation. Furthermore, a retreat of today's endangered species as well as an increase of ruderal species was asserted during the observation period (1830-2007).

### **P33.7**

#### **Diversity of Lichens in Forest Systems in NW Spain**

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Changes in forest land use may have important consequences for ecosystems and biodiversity conservation. In Galicia (NW Spain) tree plantations, particularly of eucalypts, have replaced natural forests in many areas, contributing to their increasing fragmentation. We analysed the diversity and composition of lichens on tree trunks of the three most common forest communities in the region: natural forests dominated by *Quercus robur*, and plantations of *Eucalyptus globulus* and *Pinus pinaster*. We used a nested design with sites (5 per habitat) nested within habitat and trees (5 per site) nested within sites. We found a total of 75 taxa. Species richness (total observed and estimated, and average per site and per tree) was lowest in eucalypt plantations and highest in natural forests. The Lichen Biodiversity Index was again lowest in eucalypt plantations (21.68), and higher in pine plantations (69.12) and *Q. robur* forests (62.2). Eucalypt plantations and *Q. robur* forests showed the highest differences in terms of lichen species composition ( $t = 2.38$ ,  $P = 0.001$ , PERMANOVA), with pine plantations being intermediate. Eucalypt plantations thus showed the lowest conservation value for regional lichen biodiversity.

### **P33.8**

#### **Three Species of the Lichen Genus *Peltula* Nyl., New to Europe**

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The lichen genus *Peltula* Nyl., with approximately 40 species known worldwide, occurs predominantly in arid and semi-arid regions of the world, or wherever arid microclimates are found. The diversity of *Peltula* is particularly high in the Iberian Peninsula, which hosts seven out of the eight species known so far from the European continent. During recent field studies in the Upper Douro region (Portugal), it became apparent that *Peltula* had been largely overlooked in this somewhat neglected region of the Iberian Peninsula, located approximately 200 km upstream from the river Douro estuary. The lithology is dominated by intensely folded and faulted metasedimentary rocks, including schist, greywacke and quartzite, ranging in age from the Precambrian to the Ordovician. The climate is predominantly dry meso-Mediterranean, sheltered from the Atlantic influence by mountains to the north and the west. However, topographic thermo-Mediterranean microclimates are usually produced in most river valleys, where temperature frequently reaches 50°C in summer and mean annual precipitation is often below 500 mm. As a result of this study the number of *Peltula* species in Europe rises to eleven, since *Peltula bolanderi* (Tuck.) Wetmore, *Peltula farinosa* Büdel and *Peltula zahbruckneri* (Hasse) Wetmore have never been previously reported for this continent.

### **P33.9**

#### **Assessment and Analysis of Gorilla (*Gorilla G. gorilla*) Nest Decay Rate at Mikongo Conservation Centre, Gabon: Refining Population Density Estimates**

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Conservation strategies for endangered primates rely on population estimates that commonly follow line-transect survey protocols, where indirect sightings of animal presence (such as dung or sleeping nests) are converted into animal densities using sign production and decomposition rate. International experts have called for the refinement of these methods mainly due to error introduced by using non-site specific index decay rates. The decay process is subject to change across time and between sites, these variations are poorly understood and need further investigation. In the context of gorilla population density estimates at Mikongo Conservation Center, a total of 157 nests were monitored weekly over a 10-month period using a 5-stage decay score. Data on nest-specific characteristics and environmental factors allowed to investigate the effect of 9 variables: nest type, size and height; average rainfall, construction date and season; topography, habitat and canopy cover. Results highlighted 3 factors significantly influencing decay rate: (1) it increases with increasing nest elaboration and proportion of tree material; (2) dramatically decreases when nests are built on steep slopes; and (3) accelerates with increasing rainfall. This study provides an explanation to the variation in decay rates that can be applied to provide more accurate population estimate figures.

### **P33.10**

#### **Difference in Biodiversity Depending on Level of Protection and Habitat Type in the Adriatic Sea**

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The research of macrobenthos was carried out at three sites on the Croatian coast: Kabal peninsula on island Hvar, island Šćedro and National park Kornati Archipelago. Data was collected at ten or more locations along each site. Marine species and habitat mapping methodology developed during previous research was used in this survey. Data was analyzed by calculating species richness and beta diversity (multivariate measures), and comparing the results for all three sites. As expected, island Šćedro had the lowest species richness and beta diversity due to monotonous habitat around the island. However, Kabal peninsula showed higher beta diversity than Kornati Archipelago and also high species richness. The significance of this data was quantified so it could be possible to propose a plan for protection and creating a marine protected area for Kabal peninsula. Regarding the comparison of biodiversity along habitats, lowest beta diversity and species richness were found in seagrass *Posidonia oceanica* meadows, while they were highest in coralligenous habitat.

### **P33.11**

#### **Monitoring Genetic Diversity in Populations of *Capsella Bursa-pastoris* - Intraspecies Gene Pool Dynamics in Common Garden Experiments**

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Consequences of climatic fluctuations due to the general warming are ever-present in Austria. Apart from changes in edaphic conditions, the global change also causes a shift in the vegetation period which enables the natural invasion of plant species from other floristic regions. In particular, weeds and pioneer species from the sub-Mediterranean and Mediterranean region are common invaders on agricultural land and pioneer sites. In these habitats *Crambe hispanica*, *Diplotaxis erucoides* and *Capsella rubella* are recent examples.

Demographic processes and gene pool dynamics under the influence of climatic fluctuations will be monitored in natural populations of *Capsella bursa-pastoris*. The annual to biennial weed has been selected as a model species, since its ecotypic differentiation, germination behaviour and fitness are well known. Two Botanical Gardens have established long-term sites to monitor demographic parameters (life-cycle, seed bank). On each site, seeds of at least 20 individuals will be sampled annually over a period of ten years. Molecular analyses may reveal changes in genetic diversity patterns over time. The results may also reflect a successful colonization of a pre-adapted genotype, i.e. a possible invasion of warmth-dependent ecotype/genotype. In this context it will be highly interesting to correlate genetic results with ecological factors.

## LAND USE PLANNING FOR CONSERVATION

### P34.1

#### **Climate Change and Land Use Change in Scotland: Impacts on Landscape Connectivity and Trade-offs between Ecosystem Services**

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In the context of a changing climate, we investigate the potential impact of future land use change in Scotland. Using a range of methods, such as spatially explicit (GIS-based) analysis of change in land capability for agriculture and forestry, assessment of permeability to species dispersal, interviews and behavioural games with land managers, and Agent -Based Models, we investigate the effect on biodiversity conservation through the use of stylised land use change scenarios, and highlight trade-offs between landscape connectivity, carbon stocks and agricultural use.

### P34.2

#### **A Novel Method for Assessing Flow and Patch Importance in Spatial Networks of Habitat Patches**

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Range shift is a potentially important strategy for species to respond to anthropogenic climate change. However, species need to disperse across landscapes in which suitable habitat is fragmented. Where should conservation effort be focussed for maximum benefit? Previous models of habitat connectivity consider flow in all directions, but this is not appropriate when considering flow over large temporal and spatial scales. Here we developed a model for directed flow across networks of habitat patches by drawing an analogy with electric networks. In order to set up a directed flow across the network we defined a source area (the 'battery', being the species' current distribution or source of colonisation) and a target area (the 'earth', being the distribution of suitable patches under future climate predictions). We used 'current' to assess the relative importance of each patch within the network and identified the most important patches in real landscapes. Strikingly, the pattern of patch importance varies according to the location of the source and target, showing the importance of considering directed flow in large-scale spatial networks. This information can be used to inform conservation policy in order to facilitate species movement in the face of climate change.

Key words: Complex spatial networks, landscape ecology, electric network theory

## LANDSCAPE ECOLOGY AND CONSERVATION

### P35.1

#### Evaluation of Consequences of Accident Spill of Landfill Leachate to Fish

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Urban waste landfills are among the main environmental polluters associated with negative effects on the environment and human health, posing a hazard for population ecology and conservation. The landfill leachate is full of persistent pollutants which concentrations are even hundred times greater than their maximum-permissible-concentrations. When the leachate penetrates into natural waters, it becomes the primary and secondary sources of pollution, which can cause irreversible changes in the aquatic ecosystem, and disturb water animal population ecology. The toxicity of the receiving pond water (after accidental spill) was evaluated using the complex biotests on rainbow trout *Oncorhynchus mykiss* in ontogenesis. The assessment long-term exposure of fish to polluted water showed, that it can caused the negative consequences to the functioning of the organism: oxygen supply, anemia, process of metabolism, reproduction, and to the offspring quality. The water toxicity could be characterized as a "threshold-toxic" to fish. Alterations in morphological, physiological, and behavioral responses that occur at the earlier stages of development of fish can induce negative consequences for the well-being of an individual during spawning and rearing, distinction of several species and survival of the fish population in general as well as limit the overall effectiveness of fish habitat restoration.

### P35.2

#### Do Flower Strips Increase Pollinators and Pollination in the Landscape?

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Adding wildflower strips to a landscape as a means of restoring semi-natural habitats lost due to the intensification of agriculture, and/or benefiting game, has proved to increase pollinator communities on a local scale, i.e. in the strips. This study aimed to investigate the effect of adding flower strips on pollinators and pollination on a landscape scale. Nine 1 km radius landscapes containing sown flower strips were selected along a gradient of landscape complexity (amount of field borders and pasture) in Scania, southernmost Sweden. Landscapes without flower strips along the same gradient were used as controls. Pollinators were surveyed through sweep netting along transects randomly placed across the landscapes. Phytometers were placed in a natural field margin next to a cereal crop in both types of landscape, and next to a sown flower strip in the experimental landscapes, to measure pollination of field bean. Preliminary results suggest higher pollination in landscapes with added flower strips.

### **P35.3**

#### **Restoration of Disturbed Wetlands in Lower Dyje River Floodplain**

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Human interaction with the river Dyje basin dates back thousands of years. By the end of the Middle Ages significant deforestation took place in Moravia. This caused flooding and sediment storage in the lower part of the Dyje river basin. The so-called flood sediments are imposed over the old gravel-sand alluvia in the layer of 100 - 200 cm. From 1975 to 1989 massive water engineering projects drastically altered the lower Dyje river floodplain. Construction of three dams VD Nove Mlyny, regulation and damming of the river Dyje had the opposite effect. Water management works reduced flooding and deposition of sediments in the river floodplain. The Zamecka Dyje floodplain was separated from the straightened river Dyje watercourse by a dike and this floodplain suffered from water shortages during the dry season. In order to restore the water flow, the system of revitalization was designed. In total 12 km channels were built in 1998 (area: 6,8 square kilometers). By January 2009 the canal system had been revitalized and wetlands like Azant, Herdy and Pastvisko ponds were once again full of water. The water-level fluctuation due to alteration of hydrological regime has affected the composition of a wetland's flora and fauna.

### **P35.4**

#### **Assessing the Historical Land Cover /Use Changes in a Riparian Corridor of Western Greece**

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Riparian corridors are among the most threatened landscapes in the world, mainly due to human activities and land cover changes. In recent decades, Mediterranean landscapes have been experienced more rapid changes in land cover that affects ecological functions and processes. In the current survey we investigate the land cover/use changes in the Acheron River, from 1945 to 2006. The riparian zone is mapped in a fixed buffer zone of 200m and multi-temporal maps created over a period of about 60 years, based on aerial photographs, helped to assess land cover changes. These changes were associated with human interference and major socioeconomic processes occurring in the area during the study period. In 1945, riparian forests, inland marshes, and wetlands dominated the river corridor. Spatio-temporal analysis shows that during the study period there is an enormous increase in artificial surfaces, mainly due to urbanization and roads constructions. Subsequently, these lands cover types severely reduced in coverage, and agricultural areas dominated the landscape. These interventions have changed the river beds, increased landscape fragmentation, and led to the degradation and loss of wetland habitats. The current research is a valuable tool for the river managers to develop area-specific policies that minimize human influences.

### **P35.5**

#### **Structure, Ecology and Plant Diversity Patterns along a Fragmentation Gradient: An Insight Into “Apennine Beech Forests with *Taxus and Ilex*” (92/43/ECC - 9210\*)**

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We analyzed the structure, ecology and diversity patterns, of native and diagnostic species (92/43/ECC Habitat Directive), in *Fagus sylvatica* forests of southern Italy. On the basis of a forest map classified into three fragmentation levels, vascular plant species data were collected following a random stratified design. We assessed ecological and structural differences between fragmented forests analyzing life forms composition, Ellenberg indicator values and the presence of edge and clearing species. We compared the biodiversity patterns of the fragmentation levels by using rarefaction curves of diagnostics (9210\*) and of all sampled species. We found significant higher values in fragmented forest of: terophytes, phanerophytes and nanophanerophytes, light Ellenberg value and edge and clearing species diversity. Rarefaction analysis showed two opposite trends: the diagnostic species diversity decreased on fragmented forests as the overall diversity increased. Fragmentation is associated with the ecology, the structure and with significant changes on diagnostic species diversity. The arrival of border and neighboring habitat species increases diversity levels on fragmented forests. A decline on diagnostic species may represent an early alarm sign of diversity and ecological functioning loss. We can define diagnostic species (92/43/ECC) as “focal” species and its diversity patterns could orient the sustainable management of natural forests

### **P35.6**

#### **Conservation Conflicts at the Landscape Scale - Insights from Grassland Passerines in Large Floodplains**

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Hay meadows and hedgerows habitats have declined for several decades in Western Europe. Conservation policies promote their protection but conflicts may arise when attempting to apply separate policies on two landscape components in the same area. We investigated this issue in the lower Loire river drainage. Grassland is the main land use but landscape matrix varies greatly from large meadow patch to dense hedgerow lattices. Unfortunately, landscape matrix heterogeneity is not considered in local conservation policies. We tested the effect of patch size and hedgerow density on the occurrence and species richness of grassland passerines. In agreement with earlier studies, birds preferentially settled in large meadows and avoided patches with vertical elements disrupting patch continuity. Policies currently promote hedge planting in open grassland. Although species richness may increase in these zones, negative impacts on the smaller grassland bird community and the reduction of local avian diversity are expected to occur as generalists may replace specialists. Additionally, subsidising grassland birds protection in dense hedgerow areas seems inappropriate. In contrast, adaptive management of such ecosystem may be required. This may imply some level of landscape planning to promote the maintenance of varied landscape matrices.

### **P35.7**

#### **The Flora and the Grassland of the Regional Landscape Park “Nadsyansky” (RLPN)**

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RLPN (area of 19 428 hectares) disposes in the Ukrainian Carpathians, the Upper Syan river (Ukraine, L´viv region), is part of International Biosphere Reserve “Eastern Carpathians”. Results first field researches (2005-2011) of Plants Cover are present. J. Braun-Blanquet´s metod (1928) used for the classificacion vegetacion, J. Kornas´s classificacion (1968) used for the analysis synanthropic species. The floristic list of the Vascular Plants included 645 species. The synanthropic fraction of flora composed 91 apophytes and 93 adventives species (from them 39 archaeophyte, 59 kenophytes). The grassland presented by 5 classes (Phragmitetea, Molinio-Arrhenatheretea, Scheuchzerio-caricetea nigrae, Oxycocco-Sphagnetetea, Nardo-Callunetea), 8 orders ( Phragmitetalia, Plantaginietalia majoris, Molinietaalia caeruleae, Arrhenatheretalia elatioris, Caricetalia davallianae, Nardetalia, Calluno-Ulicetalia), 14 alliances (Phragmition, Magnocaricion, Sparganio-Glycerion fluitantis, Polygonion avicularis, Filipendulion ulmariae, Molinion caeruleae, Calthion palustris, Arrhenatherion elatioris, Cynosurion, Caricion davallianae, Sphagnion magellanici, Nardion, Violion caninae, Pohlion-Callunion).

### **P35.8**

#### **Impact of Historic Land-use Change on Shifts in Pollinator Communities**

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Pollinators are not only an important component of biodiversity in their own right, but they also provide vital pollination services both to agriculture and to wild plant populations. There is growing evidence that wild and managed insect pollinators have declined in both abundance and diversity and while the main causes of decline in pollinators remain unclear one of the most likely causes is shifts in land use, mostly due to agricultural intensification. Our project explores this issue by analysing spatial correspondence between past land use change and historical shifts in pollinator communities. Using a land-cover map of 1930s Britain as well as a current land-cover map (LCM 2007), we test for land use changes in sites with historic pollinator data. Twenty-four sites were chosen as they had contemporaneous data with the land-cover maps of the 1930s and included areas of Bedfordshire, Cambridgeshire, Dorset, Kent and Yorkshire. These sites were re-surveyed in 2011 and the change between historic and contemporary species richness were analysed in conjunction with land-use changes at various spatial scales. This project is the first of its kind to test for the impact of historic land-use change on pollinator communities in Britain and our results will contribute towards providing guidance to help mitigate detrimental effects.

## MARINE CONSERVATION

### P36.1

#### Anthropogenic and Natural Impact on Macroalgal Communities in the Eastern Part of the Gulf of Finland (Baltic Sea)

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The eastern Gulf of Finland is a shallow water body, characterized by low salinity (0-5‰) and high level of eutrophication. In our study we attempted to evaluate how macroalgal communities reflected anthropogenic (eutrophication, dredging works) and natural (salinity and weather conditions) impact. Sampling was conducted on five points along the coast in 2002-2011 by scuba-diving method. Our data showed increasing the role of opportunistic macroalgae in the community, which was expressed at a high biomass of *Cladophora glomerata* (450 gDWm<sup>-2</sup>) and the formation of decaying mats. In turn dredging works led to partial disappearance of rare species (*Pseudolithoderma subextensum*, *Hildenbrandtia rubra*) and significant decline of total macroalgal biomass. Natural factors also influenced on coastal communities. Changes of salinity determined distribution of marine species in the eastern Gulf of Finland. At the same time correlation analysis showed significant link between average seasonal biomass (depth 0.5 m) of macroalgae and average wind speed during sampling season ( $R=-0.94$ ,  $p<0.05$ ) and NAO-index and interannual dynamic of biomass ( $R=-0.53$ ,  $p<0.05$ ). Our study showed, that increase of anthropogenic press on the eastern Gulf of Finland could result disappearance of sensitive species of macroalgae. At the same time natural factors significantly influenced on coastal community.

### P36.2

#### Can Common Species Benefit from Marine Protected Areas in the Adriatic Sea?

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Many marine protected areas (MPAs) in eastern Adriatic fail to meet their management objectives. Goal of this study was assessment of average proportions of most severely declining species inside and outside MPAs and their temporal stability. We compared long-term data (1997-2010) of commercial marine invertebrates (*Corallium rubrum*, *Palinurus elephas*) and fishes (*Scorpaena scrofa*, *Epinephelus marginatus*) assemblages in the National Park Kornati, NP Mljet and NP Telašćica, areas closed or semi-closed to commercial fishing, with adjacent fished areas. Spiny lobster showed no difference in abundance or size between the MPAs and adjacent control areas, all in negative trends. Data suggest fishing pressure within MPAs is at least as high as at other 'fished' sites. On average, spiny lobster was up to twelve times more abundant in marine PA's in 1997 than in 2010. MPAs had the lowest mean numbers and sizes of studied populations in all areas, no-take or open to fishing. The lack of recovery of these species within the MPAs, despite exclusion of commercial fishers and other restrictions to recreational fishing, indicates that populations were almost exterminated. Considering the biological implications of decreased biodiversity, management should be supported by additional regulations in order to protect vulnerable species.

### P36.3

#### O Turtle, Where Art Thou? Sea Turtles of Sipadan, Sabah, Malaysia

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Sipadan Island, on the east coast of Sabah, Malaysia is famous for its green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) turtles, however very little is known about them. An underwater census was conducted between August 2010 and October 2011 to determine the resting location of the resident turtles in the 208 hectare reef of Sipadan. The turtles were caught in their natural habitat, and then brought aboard the research vessel where they were photographed, measured and tagged. Field trips were limited to 3 days every 2 months during the study period. We found that all the turtles preferred resting in the top 20 metres of the reef. The total number of turtles caught was 540, and captures at the 12 established dive sites ranged from 0 to 133 (mean =  $45 \pm 13$  SE) throughout the entire study period. Statistical analysis showed that the turtles significantly favoured some dive sites over others. Further analysis showed that juveniles were the most abundant (73.0%), indicating a healthy recruitment. Green turtles were the dominant species with a ratio of 96:1. Our findings will be used towards the conservation of the resident turtles and their natural habitat at the Sipadan Island Marine Park.

#### **P36.4**

#### **Recent Imposex Monitoring Reveals that the OSPAR Ecological Quality Objective for TBT is neither Met in Southern Atlantic Europe**

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The dogwhelk *Nucella lapillus* (L.) is a carnivorous intertidal gastropod distributed in Atlantic Europe from Iceland to southern Portugal. As in many other related species, females suffer from imposex (*i. e.* the superimposition of male sexual characters, penis included) in response to pollution by tributyltin (TBT) from antifouling paints; in extreme cases imposex has resulted in female sterilisation and subsequent population extinction. These findings largely contributed to a 2008 worldwide TBT total ban that was anticipated to 2003 in the European Union. In order to assess water quality improvement, the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic established an Ecological Quality Objective (EcoQO) based on imposex monitoring. While pollution has generally decreased, reports to date on northern Europe areas show that the EcoQO is not yet met in sites under the influence of shipping activities such as harbours. We have been studying imposex in Galician (NW Spain) *Nucella lapillus* populations since 1996. The results we will present of the last monitoring survey in 2009 concur with the scenario above: the EcoQO is now met in some open coast and aquaculture sites but not near ports. Optimism can thus only be moderate.

## P36.5

### ***Ascophyllum nodosum* ecad *mackayi*: A Partnership Approach to Conservation of a Rare Seaweed on the Edge of Europe**

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The brown seaweed, *Ascophyllum nodosum* ecad *mackayi* is an 'ecad', a distinctive *form* of a species that develops in response to particular environmental conditions. The 'parent' plant, Knotted Wrack *Ascophyllum nodosum*, is common around Britain. In sheltered sea-lochs with a strong freshwater influence, broken fragments of the attached form often grow into unattached, extremely-branched forms of the plant but lacking the bladders of the attached form. The undisturbed conditions allow growth to continue for many years, leading to large, wig-like plants that form small-to-large intertidal beds.

In Europe, *A. nodosum* ecad *mackayi* is restricted to the north-west 'edge' of the continent, mostly in Scotland. Maybe once more widespread, the rarity, small size and fragility of its remaining sites are the main reasons for its conservation priority.

Since 1993, voluntary recording, NGO campaigning and conservation agency action have coalesced into an informal Scottish partnership. This aims to improve and promote understanding of '*mackayi*' distribution and conservation status. We show the importance of combining data from historical and current sources to provide a current total of c.170 known sites (from < 60 in 1993). We describe conservation action undertaken and propose an agenda for further conservation of this rare conservation priority.

## METHODS AND ANALYTICAL TOOLS

### P37.1

#### **Advanced Photodocumentation as a Non-invasive Method for Individual Recognition of a Critically Endangered Newt, *Neurergus kaiseri* (Schmidt, 1952, Fam. *Salamandridae*)**

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*Neurergus kaiseri*, a newt endemic to Iran with a typical black-and-white pattern, is listed in Appendix I of the Convention in the Trade of Endangered Species (CITES), 2009. However, it is not possible to mark individuals using standard transponders or tags to track an animal's origin. The aim of the project was to examine the development of the markings during the body growth of the larvae and juveniles and determine whether and to what degree the markings of an individual remain constant over lengthier periods enabling recognition of individuals by their skin pattern.

The study was restricted to one year. Thirty-six larvae of the *N. kaiseri* from three different captive breeding stocks were photographed at intervals of 7 days. Each individual was therefore photographed 156 times.

The macroscopic comparison of the individual photos, run through a new image editing software SALAMACULA, exhibited that the greatest quantitative changes in the markings in the first 8 months of life. The data clearly reveal a tendency towards decreasing dynamics in the markings with increasing age of the specimens. Due to this near-constancy after the age of 8 months photodocumentation is a suitable tool for individual recognition in the species *N. kaiseri*.

### **P37.2**

#### **Spatial Concordance between Statistical, and Expert-based Habitat Suitability Models for Terrestrial Mammals**

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Data on the spatial distribution of species are fundamental to identify conservation priorities. In the past, due to the lack of high quality data, large-scale studies have been based on species' extent of occurrence, which are very coarse as they assume internal homogeneous species distribution. Habitat suitability models (HSM) - statistical models based on point locations, or expert-based - have the potential to overcome such limitation. In order to assess the concordance between the two approaches, statistical HSMs were developed for a subset of 400 terrestrial mammals using climatic and land-use predictor variables. These were compared with expert-based HSMs built on the IUCN Red List of Threatened Species. We assessed model prevalence and compared model accuracy using Kappa and True Skill statistics. Statistical models based on land-use were strongly influenced by map resolution and spatial error. Statistical models also, in general, showed less detail, appearing smoother than expert-based models.

### **P37.3**

#### **Methods and Tools for Health Assessment of Aquatic and Terrestrial Ecosystems Basing on Bioelectronic Systems for Measuring Physiological and Behavioral Biomarkers in Invertebrates**

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In the 1990s the authors have developed a fiber-optic measurement of noninvasive cardiac activity of hard outer covering invertebrates (crustaceans, mollusks with shell and arthropods). The aim of this paper is introduction to main principles and approaches for using of bioelectronic systems for elaboration of criteria for indication and monitoring of ecosystem status at different anthropogenic loads. The improvement and adaptation of the computer software used for analysis of cardiac rhythm variability for selected species in normal or stress conditions is important as well as development of automatically working system for collection of information, control of water quality and management. We have experience in manufacturing a number of operating bioelectronic monitoring systems in real time. We monitored: 1) the toxicity of surface water (mollusks, crabs and crayfish); 2) the toxicity of biologically treated municipal waste water discharged into area fishery water bodies (crayfish); 3) toxicity of the sludge smoke incinerator of municipal wastewater treatment plants (terrestrial pulmonate mollusks *Achatina fulica*). Assessment of freshwater and marine ecosystems state (health) is based on the analysis of the adaptability of native invertebrates to short-term functional loads (within tolerance of these species).

## **P37.4**

### **Do Fires on Peatlands Mean Biodiversity Has to Go with the Wind or Is Yesterday the Key to Tomorrow? A 'Baseline' Study of a Wet Upland Moorland Site for Use in Modelling the Fire-Biodiversity Relationship to Support Local Management**

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The study aims to test the hypothesis that species diversity throughout the Holocene is associated with 'intermediate' fire regimes at 2 upland moorland sites. By analysing multiproxy data to explore transitions between stable and metastable states, further insight into the complex relationship between the historic drivers of landscape change in the UK uplands can be investigated. To achieve this, a new method for digital analysis of macrocharcoal fragments has been developed and applied to samples from Robinson's Moss, Peak District using the freely available software, ImageJ. Use of this method, means that large quantities of high resolution contiguous macrocharcoal data can be processed quickly and efficiently and provide detailed information on past fire regimes. These data, in conjunction with other multiproxy datasets including independent climate proxy data, will be compared to pollen data to test the diversity hypothesis. Holocene reconstructions of vegetation and fire will be compared with output from the climate driven dynamic vegetation model LPJ-GUESS to disentangle human and climate driven vegetation changes that will be of value in management plans for upland moorland. High resolution data will assist in the testing of the model and interpretation of the results.

## **MISCELLANEOUS TOPICS**

### **P38.1**

#### **Effects of Wind Power on Terrestrial Mammals - a Review**

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We synthesised available knowledge on the effects of wind power development on terrestrial mammals (excluding bats). Wind energy is on a strong increase in Sweden, and most new wind plants are planned in the boreal forest region. Concerns are hence raised on the impact on forest wildlife and semi-domestic reindeer. Studies of terrestrial mammals in relation to wind power are however few, so the conclusions must to a large extent be extrapolated from research on related impacts, such as noise, disturbance from roads, construction work or recreational activities, and habitat changes. The review give at hand that ungulates and large carnivores may be disturbed by i) human recreation (including hunting and leisure traffic) facilitated in wind plants by the new road network, and ii) construction work (intensive but of short duration). Wind plants will often be sited in hilly or rugged terrain far from human settlements; areas which often serve as refugia for large mammals, in particular large carnivores. Hereby, wind power development may despite a limited geographical extent have population level effects. We point out the importance of assessing the cumulative effects of multiple wind plants, and to establish scientifically sound monitoring programs to improve the knowledge base.

### **P38.2**

#### **Electrophoretic Analysis and Histological Structure of Hamster (*Mesocricetus auratus*) Infected with *Schistosoma haematobium* Cercariae**

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The present work aims to evaluate the effect of infection with *Schistosoma haematobium* cercariae on parasitological and biochemical parameters as well as histological structure on liver of hamster. The present results showed viable Bilharzial eggs deposition, with related granulomas of a chronic inflammatory cellular collection having a portal location in the liver of hamster infected with *S. haematobium* cercariae. Electrophoretic analysis of liver homogenate's total protein showed a remarkable deviation (40.44%) in the liver homogenate of hamsters infected with *S. haematobium* in comparison with control non infected group. In addition, there was a remarkable deviation (39.32%) in the serum homogenate of hamsters infected with *S. haematobium* in comparison with control non infected group. Also, the activity of transaminase enzymes (Aspartate amino transferase (AST) and Alanine amino transferase) in Serum and liver tissue of infected hamsters showed a significant decrease than that in the control hamsters. On conclusion, *S. haematobium* causes serious histopathological changes on liver of hamsters. In addition, infection with *S. haematobium* had a strong effect on protein profile of liver homogenate and serum homogenate of hamsters.

### **P38.3**

#### **Mercury Contamination in Gulf of Mexico Pelagic Fish**

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Mercury is a naturally occurring element that can be hazardous at high concentrations. Major anthropogenic mercury sources are industrial waste such as chlor-alkali plants and fossil fuel combustion. Once mercury enters marine systems it can be converted in the sediment by microbes to its most toxic form - methyl mercury. Methyl mercury is a neurotoxin and poses a great risk to human health and is especially dangerous to pregnant women and developing fetuses. Mercury bio-magnifies from small benthic invertebrates to large pelagic fish thus it reaches the human population through fish consumption. The current focus of my research is the rate of mercury bio-magnification in large pelagic marine fish. Mercury concentrations were measured in eight pelagic fish species using DMA 80 analyzer in order to determine mercury accumulation rates in different species. Knowledge of the methylation process and mercury transfer in the food web is essential to ensure protection of the environment and human health.

### **P38.4**

#### **Efficacy of Six Plant Extracts as Molluscicides Agent against *Biomphalaria alexandrina* Snails and *Schistosoma mansoni***

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In the present study, the efficacy of 6 different species of plants against *Biomphalaria alexandrina* snails and *Schistosoma mansoni* stages were examined. During screening test of water suspension and methanol extract, Results revealed that *Oreopanax reticulatum* had the strongest molluscicidal activity against *Biomphalaria alexandrina* snails followed by *Azadirachta Indica* and *Dizygotheca kerchoveana*. Methanol extracts revealed more molluscicidal potency as compared to water suspension. Also, the effect of methanol extracts of *O. reticulatum*, *A. Indica* and *D. kerchoveana* on the survival rate and cercarial production of *B. alexandrina* infected with *S. mansoni*, as well as on free living stages of *S. mansoni* were studied. The results show that the sublethal concentrations of plants caused a considerable reduction in the survival rate of the snails and in the infectivity of *S. mansoni* miracidia to the snail. Reduction in the number of cercariae per snail during the patent period and in the period of cercarial shedding was also, observed. The prepatent period for snails exposed to sublethal concentrations of the tested plants during their exposure to miracidia has been shortened. The mortality rate of miracidia and cercariae and adult worms were elevated gradually by increasing the exposure period to methanol extract of these plants

### **NATURE CONSERVATION AT THE LANDSCAPE LEVEL IN AGRICULTURAL AREAS: IMPLICATIONS FOR POLICY MAKING.**

### **P38.5**

#### **Management of *Bromus tectorum* and *Melilotus indica* through Allelopathy**

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The aim of the present study was to investigate the potential allelopathic effects of *Zygophyllum album*, *Euphorbia guyoniana*, *Retama retam*, (donor species) aqueous extract on germination efficiency of two weeds (*Bromus tectorum* and *Melilotus indica*) and one crop species (*Triticum aestivum*) under laboratory conditions. The germination percentage, plumule and radicle length of *Bromus tectorum* in mixed culture was completely inhibited at the highest concentration of aqueous extracts of the donor species level (10%). the two recipient species exerted weak measures as affected by the highest concentration level of all donors. This inhibition was markedly in obvious *Bromus tectorum* than in *Melilotus indica* indicating that *Bromus tectorum* is more sensitive to all of tested donors, while the *Melilotus indica* is more adapted to the aqueous extract than the *Bromus tectorum*.

**Key words:** Allelochemicals, Medicinal plants, Germination, Weeds. Bioherbicides

## BEHAVIOURALLY INFORMED CONSERVATION AND MONITORING - 10 YEARS ON, HAVE WE MOVED FORWARD?

### P38.6

#### Area Fidelity of Urban Hooded Crow (*Corvus cornix* L.)

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The appearance of Hooded Crow has been observed in many European countries since 1960. Many studies tell about the crow's settlement and continuous population increase. The main factors of this phenomenon are the possibilities provided in urban settings for nesting and diverse sources of food. As a nesting species, we note the appearance of the Hooded Crow in Debrecen (Hungary) in 1959, at present is a common breeding species of the city.

In year of 2007 we started a colour ringing program for the Hooded Crow in Debrecen to study the area fidelity of the species. We caught the birds at nest thanks for a crane basket. During five years we banded 90 nestlings before flying away. Besides scheme ring we used 1-, 2-, later 3 colour plastic rings for future individual identification. The records that we got back until now show young birds stay near by their birth place; they do not leave the city. Consequently they increase the crow population year by year.

## POPULATION ECOLOGY AND CONSERVATION

### P40.1

#### Changes in Migration Phenology of European Robins (*Erithacus rubecula*) Depend on Biometrics

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Environmental processes can remarkably affect population level migratory behaviour of short-range migrant birds. We used the records of 29 000 short-distance migrant European Robins (*Erithacus rubecula*) caught and ringed between 1990-2010 at a Hungarian stopover site to investigate changes in migration phenology. Quantile regression were used to analyse the changes in the timing of pre and post nuptial migration, while model-based recursive partitioning was used to identify homogenous groups of birds with similar biometrical traits where the changes in phenology are different. Median spring arrival date shifted 10.5 days earlier, while median autumn arrival shifted 3 and 6 days later in adults and juveniles respectively. However, the model-based recursive partitioning pointed out that the changes are greater in case of longer winged individuals. Birds with longer wings and large body mass arrive the earliest in spring. In autumn, birds with higher body mass leave the study site the latest in both age groups, while we cannot detect any changes in mean wing lengths nor partition populations based on biometrics in this period. Our results demonstrate that it is useful to identify homogenous groups of birds to fully understand migration ecology and demographical changes even in case of common birds.

## P40.2

### Variation in performance across gradients in microclimate evaluated by means of transplanted bryophytes

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If the climate gets warmer northerly distributed species might survive in limited areas called refugia, probably due to a locally cold microclimate. Understanding the factors controlling the distribution and growth of the species is critical to successfully predict their future status. The aim of this study is to find out the controlling factors behind variation in growth and fertility of four bryophyte species. In 2011 both northerly and southerly distributed bryophytes were transplanted along a climatic gradient in the county of Ångermanland, a boreal forest landscape in the middle of Sweden. At the same 36 sites, consisting of north and south facing slopes, temperature was measured by loggers. Preliminary results for *Hylocomiastrum umbratum* imply a tendency of better growth near the coast than further inland. Additionally, this species grew better with increasing ground temperatures, a bit unexpected, as this is a northerly distributed species. However, the transplants grew equally well regardless of orientation of the slope, in spite of lower ground temperature at north facing slopes. Furthermore, field observations indicate a higher abundance of *Hylocomiastrum umbratum* at north facing slopes. Therefore additional factors or time periods may be of importance for the growth and distribution of this species.

## P40.3

### The Impact of Human Trampling on *Anchusa littorea* Moris (Boraginaceae), a Coastal Threatened Mediterranean Plant

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In a 5-year study (2007-2011) we examined the effects of human trampling on the last remaining population of *Anchusa littorea* on the sandy coastal habitat of Sardinia (Italy). This species, considered extinct in the wild for several years, was accidentally rediscovered in a small population at Is Arenas (SW Sardinia). We monthly monitored six trampled and six untrampled permanent plots, mapping individuals and recording their size and reproductive variables. Trampled and untrampled plots showed significant differences with respect to plant density, plant size, flowers and fruits production and demographic performance (survival, growth and reproduction). The evidence of human trampling damage was also demonstrated in a logistic regression analysis, since *A. littorea* cover and plant size were significant variables. This study demonstrated that human trampling represents a severe threat to the conservation of *A. littorea* and urgent measures should be taken in order to exclude trampling from the site. In parallel, ex situ conservation measures (i.e. seed banking and in vitro propagation) should support its in situ conservation and the conserved material should be used to reinforce the existing population and reintroduce the species in known areas of previous distribution.

#### **P40.4**

##### **Importance of Artificial Brackish Water Ditches for the Conservation of Small Teleosts in the Venice Lagoon**

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Venice Lagoon is characterized by many different shallow-water habitats, where salt marshes represent important habitats for many nektonic species. On the other side, small lagoon islands show a typical landscape dominated by agricultural gardens and orchards, that still host small ditches once used in traditional fishery activities but now abandoned. Aims of this study is to determine the ecological and conservation value of these habitats for the nektonic community, particularly referred to the small teleost *Aphanius fasciatus*, listed in Annex II of 'Habitat' Directive 92/43/CEE. One year monthly samplings were performed in 2 sites: a natural salt marsh and a system of artificial ditches. All collected fish were photographed and then released. Only a sub-sample was preserved for laboratory analysis. Data show that the artificial habitat hosts a different nektonic community, with no marine migrants, due to its isolation from lagoon waters. Even so, *Aphanius* population results abundant and well structured, presenting size/age structure comparable with that found in the salt marsh, but with a different sex-ratio. Furthermore, females exhibit a longer spawning season, producing a lower number of bigger eggs. Results of this study highlight the relevance of these artificial habitats in the conservation of fish natural populations.

#### **P40.5**

##### **Comparing the Structure of Richness on Three Communities in Northern Minas Gerais**

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Trails are areas of infiltration and recharge to maintain a constant water flow on Cerrado. The objective of this study was to compare the structure of the richness in tree community trough of six trails identified here as PI, SF, BG, CA, AG and AL under different environmental impacts. In each area were distributed 100 plots of 100 square meters (6 hectares), where all individuals were sampled shrubs and trees  $\geq 3$  cm of dbh. Were identified 202 distinct species and through cluster analysis with Euclidean metric there is a greater similarity of the areas distributed as presented in the following groups: (PI and SF), (BG and CA), (AG and AL), with groups (PI and SF), (BG and CA) show greater similarity among groups. The highest proportion of shade-tolerant species and demanding light was found in less disturbed areas. The study confirms that environmental impacts affecting the community structure.

## **P40.6**

### ***Juniperus oxycedrus* L. Subsp. *macrocarpa* (Sibth. & Sm.) Neilr. Recruitment in Four Populations of Southern Sardinia**

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We present the results of *J. macrocarpa* recruitment in four populations of southern Sardinia, being all of them inside Sites of Community Importance. With the aim to determine whether anthropic pressure influences recruitment we compared two populations affected by an intense seaside tourism with two of the best preserved Sardinian populations.

Eleven plots per population were placed (44 plots in total, of 1 m x 1 m each). All plots were monitored every three months, during the last two years, to mark new seedling and to record survival and growth of marked seedlings.

The results show significant differences on the total seedlings density by both population and monitoring period. Winter was the season that had the highest number of seedlings (favored by the autumn rains), while the beginning of autumn had the lowest density. This reduction was due to the high summer mortality of seedlings (mainly due to prolonged drought), confirming that this period is the most critical for survival (García 1998, García *et al.* 1999).

This work was carried out in the framework of PROVIDUNE LIFE+ project (LIFE07NAT/IT/000519).

## **P40.7**

### **Droppings as Crystal Balls: DNA-based Estimates of Population Size and Movements of an Endangered Grouse**

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Counting rare, elusive animals, and assessing the extent of their movements in the wild, are basic yet challenging issues. We set out to estimate population size and movements between breeding territories for an endangered population of grouse, Cantabrian capercaillies living in NW Spain. These elusive birds live in rugged, forested habitats; capturing and handling them is not allowed, thus genetic identification of feces could be the only way of gathering the much needed data. We collected droppings as source of DNA in the vicinity of 25 leks, areas where capercaillie gather in spring to display and mate. We genotyped 141 droppings, and identified 89 individuals from 7-9 microsatellite loci in a 110 km<sup>2</sup> study area. We estimated a population size of 234 individuals with a single-session capture-mark-recapture model (156-252 95% CI; recapture rate = 1.6 obs/indv.). Fourteen individuals were identified more than once. Remarkably, distances among samples of the same individual showed movements shorter than 1 km, always within or between contiguous leks. Our results show that genetic identification of indirect signs of presence is a reliable tool to estimate population size and range of movements for relatively small, elusive forest vertebrates.

## **P40.8**

### **The Danish Bat Monitoring Programme 2005-2010**

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Denmark has initiated systematic monitoring of species included in Annex II and Annex IV of the Habitats Directive through the launch of the National Nature monitoring programme (NOVANA) in 2004. The monitoring programme primarily monitors distribution and range of populations in order to provide the scientific background to assess conservation status for each species

To assess conservation status according to the article 17 of the Habitats Directive a monitoring programme of bats has been running in Denmark for the period 2005-2010 and will be repeated for the period 2011-2015.

Monitoring of bats in Denmark is based on the "Site Species Richness Method", which must be regarded an "extensive" surveillance method, because it gives no possibility to actually count bats. However it is "intensive" when it comes to finding all species. Quantification and analysis in the "Site Species Richness Method" is based on presence/absence data at a number of sites in each surveyed region. Bats have been monitored in sites in app. 150 UTM squares of 10 km<sup>2</sup> spread all over Denmark

Monitoring results for 17 species of bats found in Denmark showing the distribution of each species and some comments to explain this will be presented in the poster.

## **P40.9**

### **Morphology, Phenology, Ecology and Conservation Status of a Threatened Endemic Species in Turkey: *Allium ilgazense* N. Özhatay**

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Genus *Allium* L., currently included in Amaryllidaceae, contains numerous local endemic species in Turkey. *Allium ilgazense*, one of the endangered local endemic species of this genus, has a limited distribution area in Kastamonu province (Ilgaz and Yaralıgöz mountains, and Campus of Kastamonu University). In this study, morphological, phenological and ecological features of *A. ilgazense* were determined, and also threat status of the species was re-assessed according to IUCN criteria. Morphological results indicated that there were significant variations among the quantitative characters within whole three populations, some of which such as length of pedicels and lateral cusps, also width of inner filaments and ovary were not affected by different ecological parameters, while the others were distinctly changed. It was observed that grazing pressure, touristic and recreational activities, insect damage and building construction were the most serious threats on the species. Also this species has little "extent of occurrence" (952 km<sup>2</sup>) and "area of occupancy" (36 km<sup>2</sup>). It is concluded that because of the wide range of variations in terms of the quantitative characters, *A. ilgazense* is a polymorphic species. Moreover, due to the ongoing threats and its limited distribution area, "Endangered" is recommended as a new threat category for this species.

## **P40.10**

### **Distribution and Assessment of Endangered European Ground Squirrel Populations (*Spermophilus citellus gradojevici*) in South-Eastern Macedonia (FYROM)**

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The European ground squirrel (*Spermophilus citellus*), a rodent with a pronounced preference for short-grass steppe environments, is protected by the EU Fauna-Flora-Habitat Directive (FFH), but has no conservation status in Macedonia. Colonies are scattered and rapidly diminishing, due to habitat loss caused by building activity and intensive agricultural management (loss of fallow land, abandonment of traditional pasturing). Knowledge on these small colonies is incomplete and their protection and management is demanding the most urgent action. As a first step it was thus essential to document the current distribution of colonies. This will allow subsequent monitoring and assessment of their genetic structure. We focussed on the south-eastern populations in the lowlands of the River Vardar and the Dojran region. The area was surveyed from March to October 2010 and 70 settlements (630 burrows) in 15 colonies, all patchily distributed and imbedded between fields and vineyards, were mapped. These could be attributed to four distinct populations, more or less isolated by topographic barriers. Thirty-nine individuals were live-trapped and genetic material preserved for subsequent analysis. We compared the current distribution with historic data as a basis to the understanding of the biogeography, demographic constraints, and conservation needs of *S. citellus* in Macedonia.

## **P40.11**

### **Population Genetics of *Lobaria pulmonaria* in a Primeval Beech Forest Landscape (Carpathian Biosphere Reserve, Ukraine)**

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We assessed species richness and composition of epiphytic lichens on 353 permanent plots in the Uholka-Shirokyj Luh primeval beech forest landscape and investigated the population genetics of *Lobaria pulmonaria* - a well-known indicator species of ecological forest continuity. More than 1500 specimens were genetically analysed with highly variable and symbiont-specific microsatellite markers for the myco- and photobiont. Bayesian analysis of population structure revealed two distinct genepools for both symbionts: one genepool for both symbionts was connected with high altitudes, i.e. mountain ridges close to the alpine timberline and the second genepool was limited to low altitudes at the bottom of valleys along small rivers. Compared to previously published analyses the primeval forest reserve revealed a high level of genetic diversity for both symbionts and low levels of clonality even at small spatial distances. Our results clearly demonstrate the importance of large primeval forest reserves for the conservation of high genetic diversity of a tree colonizing lichen species. Because of the heterothallic mating system of *L. pulmonaria* sexual reproduction of the fungal symbiont is only possible in genetically diverse populations. Primeval forest landscapes thus facilitate recombination, even among different genepools, as shown by our investigations.

## **P40.12**

### **Camera-Trapping Large Mammals and Evaluation of Conservation Areas in North-Western Anatolia Forests, Turkey**

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Long term camera-trapping were conducted in the forest habitats in North-Western Anatolia, which is known to be important worldwide in terms of large mammal species, to reveal relative abundance, distribution and daily-annual activity patterns of large mammals. Systematic camera-trapping were carried out within ~7.500 km<sup>2</sup> study site from December 2007 to September 2010; 26.921 camera-trap days and 6.119 camera-trap records belong to *Canis aureus*, *Canis lupus*, *Capreolus capreolus*, *Cervus elaphus*, *Felis silvestris*, *Lepus europaeus*, *Martes foina*, *Martes martes*, *Meles meles*, *Sus scrofa*, *Ursus arctos* and *Vulpes vulpes* were obtained. Wild boar has the most common (87%) distribution while golden jackal has the lowest (11%); gray wolf, red deer and wild boar have cathemeral daily activity pattern, brown bear and wild cat are mostly nocturnal, and roe deer is the only diurnal species. Evaluation of the conservation areas (Kartdağ Wildlife Reserve, Küre Mountains National Park, Sökü Wildlife Reserve) reveals that the borders of Sökü WR is not sufficient for conserving the large mammal richness since it covers only a part of the forest habitat; and it is concluded as Kurtgirmez forest, adjacent to Küre Mountains NP, due to high abundance of gray wolf and red deer should have a conservation status.

## **P40.13**

### **Testing for Factors That Influence Crop Raiding Behaviour in African Elephants**

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Due to the ever-expanding human population resulting in the continued loss of natural habitat, the incidence of human-elephant conflict (HEC) is increasing. One common form of HEC is when elephants feed in or otherwise damage agricultural areas, a behaviour termed crop raiding. Crop raiding is dangerous and potentially deadly to both elephants and humans, and can make efforts to conserve them more difficult. In order to better understand crop raiding events, we need more research on the mechanisms underlying the behaviour. A pilot study found that crop raiding individuals had higher levels of glucocorticoid metabolites in their dung than non-crop raiding individuals. We have tested for stress hormone levels between crop raiders and non-crop raiders on a larger scale and added a parasite component. Our results suggest that crop raiding may not have a strong influence on stress and parasite levels, but that habitat type is the best predictor of these variables. While we only included dung samples from African savanna elephants (*Loxodonta africana*) in our study, the individuals lived in either forest or savanna habitat. The associated dietary differences with each habitat are likely to have an impact on the stress and parasite levels in individual elephants.

#### **P40.14**

##### **Trace Back the Origin of Cardamine Pratensis (Brassicaceae) at a High Plateau in the Swiss Alps - Genetic Analysis and Monitoring of the Populations Status Quo**

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One major effect of the general warming is an extension of the vegetation period which may lead to the invasion of species into new habitats. Such range expansions take place in a latitudinal but also altitudinal manner. The latter is focus of our investigation on *Cardamine pratensis* at a high plateau (Urnerboden) in the alpine region in Switzerland. Referring to early studies, *C. pratensis* has not populated the Urnerboden before the 1990, whereas other closely related *Cardamine* taxa which occupy a similar ecological niche did occur before. The supposed recent "invasion" of *C. pratensis* might be the result of the ongoing warming and may have serious impacts on the population dynamics of other *Cardamine* taxa at the plateau such as spatial suppression of other species or introgression as a consequence of hybridization processes among closely related taxa. In the current project we, however, address the question of the origin of *C. pratensis* at Urnerboden, e.g. did it originate from populations at the southwestern or northeastern valleys below the plateau? Sequencing has been done to identify individual patterns among populations sampled along an altitudinal gradient to trace back the settlement history and field work has been undertaken to survey population dynamics.

#### **P40.15**

##### **Influence of Time of Sampling from Nature on Growth and Reproduction Activity of *Helix aperta* Snails Submitted to Controlled Conditions of Temperature and Photoperiod**

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We studied reproductive activity and body growth of *Helix aperta*, from hatching to maturity under laboratory controlled conditions. The study of the growth is undertaken on three samples of snails all born in laboratory: the samples 1 and 2 were obtained from parents collected from nature in autumn and in spring respectively; the sample 3 was constituted of individuals of the fourth generation of parents reared in laboratory. The study of the reproduction carried out independently from the growth analysis (different samples), regarded individuals produced in laboratory and individuals collected from nature in autumn. The results show that the season of birth has significant effect on growth of *Helix aperta*. The subjects from parents collected in spring, with heavier mean body weights at birth, have a faster growth compared with the individuals born in laboratory and those from parents collected in autumn. Furthermore, the data showed the environment in which the animals reared has a significant influence on the reproductive activity of *Helix aperta*; the snails born in laboratory were characterized by higher mating and egg-laying frequencies as well as longer periods of reproduction than those collected from nature.

## **P40.16**

### **Heavy Metal Allocation and Tolerance in *Biscutella laevigata* - Evolutionary Traits in Populations from Southern Poland**

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Extreme environmental conditions due to heavy metal contamination can promote rapid adaptation in plant populations. Thus, pseudometallophytes growing on contaminated and non-contaminated soils are ideal models to assess phenotypic differentiation driven by natural selection. Here we investigate sixteen *Biscutella laevigata* populations from southern Poland and determine their mechanistic relationships between metal compartmentation and tolerance. Thereby we focus on varying genotypes, phenotypes, metal accumulation and tolerance traits. Initially, sampled populations were categorized as metallicolous (M) and non-metallicolous (NM) according to the total concentration of zinc (Zn) in the soil. Zinc tolerance in both edaphic types was assessed by performing exposure experiments under hydroponic conditions. Additionally, Zn allocation and compartmentation in foliage cells and tissues was analysed using cytochemical and microanalytical procedures involving transmitted light, fluorescence and electron microscopy. Finally, the genetic structure of populations was investigated using molecular analysis of ten nuclear microsatellite loci. Combined results showed that due to evolutionary selection, M populations are more tolerant towards heavy metal contamination than NM. Metallicolous plants developed less stress symptoms, allocated more Zn in other tissues and proved genetically less variable. These findings improve understanding of plants' microevolution and adaptation mechanisms triggered by altered local environmental conditions.

## **P40.17**

### **Temporal Trends in Marbled Murrelet Abundance in Canada (1996-2011) Based on Radar Counts**

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The Marbled Murrelet (*Brachyramphus marmoratus*) is a small Pacific seabird listed as 'Threatened' in Canada by the Species at Risk Act. The species is an unusual seabird because it nests solitarily at low densities on moss covered branches of old growth trees, up to 30 km from the ocean. The cause for listing is loss of old growth forest nesting habitats. We report the population trend of the Marbled Murrelet in Canada based on a monitoring program which uses marine radar to detect birds as they enter the forests. Population trends were assessed with time series data from 876 dawn surveys at 59 radar monitoring stations within the six Marbled Murrelet Conservation Regions of British Columbia. Population trends of the Marbled Murrelet were analyzed with a mixed model approach which controlled for variation in radar tilt and day of year, and random terms for station nested in region, observer, make and type of radar units, and study area-wide year effects. A non-significant trend suggests a stable population between 1996 and 2010 for the study region as a whole. The Conservation Region on the East Coast of Vancouver Island showed a decline from 2003-2011.

## **P40.18**

### **Exploring Causes for the Egyptian Vulture Population Decline in Bulgaria**

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Many vulture populations are declining around the world, but even in Europe the causes for population declines are often poorly understood. Over the past 9 years we have documented a 44% decline of the Egyptian Vulture (*Neophron percnopterus*) population in Bulgaria. To explore whether population declines were caused by low productivity or high adult mortality, we monitored every Egyptian Vulture territory in Bulgaria from 2003 to 2011, and recorded the number of adults and fledglings in each territory. We estimated annual adult survival probability from territory occupancy rates. Reproductive output was on average 1.31 fledglings/pair, and thus equal to stable populations elsewhere. However, 29% of territory-holding pairs did not initiate a nesting attempt. Annual adult survival probability was too low (0.84, 95% confidence interval 0.77 - 0.90) to maintain stable populations, and we conclude that adult mortality is the most likely cause of the observed population declines. Suspected causes of unnatural mortality are the illegal use of poisons against carnivores and the shooting of adults for taxidermy purposes. The main conservation challenge to save Egyptian Vultures is a better understanding of migration routes and sources of mortality in eastern Europe, the Middle East and Northern and Central Africa.

## **PROTECTED AREA PLANNING AND DESIGN, NATURA 2000 & MPAs**

### **P41.1**

#### **Conservation when Nothing Stands Still: Moving Targets and Biodiversity Offsets**

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Conservation is particularly difficult when we want to protect something that is highly mobile. 'Moving targets', like migratory species, or landscapes subject to rapid environmental change, are of crucial ecological importance. Traditional conservation involving 'static' tools, such as fixed protected areas, may be ineffective for moving targets. This shortfall needs addressing urgently. More dynamic approaches to conservation have been suggested, which we describe, but these remain for the most part theoretical. The question addressed is how to implement these novel ideas, demonstrating their effectiveness in practice. The concept of 'biodiversity offsets' has swept through the conservation community in recent years. It is not without flaws. However, due to their flexibility and unique 'no net loss' requirement, we find that offsets provide an excellent platform for implementing these dynamic conservation approaches. Here we explore the potential of offsets for conserving moving targets, illustrating these themes using a 'perfect storm' of a dynamic conservation problem: the Saiga antelope (*Saiga tatarica*) in Uzbekistan.

## **P41.2**

### **Habitat Suitability Assessment for the Lesser Kestrel (*Falco naumanni*) in Croatia with Implications for Conservation**

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After the Lesser Kestrel (*Falco naumanni*) had become extinct in the second half of the 20th century in many European countries including Croatia, in 2010 the anew breeding of this endangered bird species was recorded in Croatia on the island of Rab in the northern Adriatic. Hence, the recovery and appropriate management of the Lesser Kestrel population is of primary interest for conservationists. Our objective was to identify most suitable habitats in Croatia by ecological niche modelling (ENM) using Maxent and to asses the extent to which the potential distribution of Lesser Kestrels is encompassed by national protected areas and proposed NATURA 2000 sites. The results of the ENM clearly indicated additional suitable habitats on the nearby islands of Cres, Krk and Pag which should be taken into account for conservation measures such as the installation of artificial nesting sites and appropriate grassland management in order to increase the current population of Lesser Kestrels in Croatia. Moreover, those areas might be used as stop over sites during migration and as foraging areas during post-fledging dispersion and pre-migration movements. We also demonstrated that proposed NATURA 2000 sites sufficiently cover suitable habitats of Lesser Kestrels in Croatia.

## **P41.3**

### **Representativeness of Natura 2000 Network in the Romanian Alpine Biogeographical Region**

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European Natura 2000 network from Romania covers over 20% of the territory but still is not complete, and it is necessary to be extended in order to fulfill European regulations. Romanian territory overlaps five European Biogeographical regions Continental, Alpine, Steppic, Pannonian, and Black Sea, which host 518 protected plant and animals' species and 89 habitats of conservation concern.

Alpine Region includes 117 Sites of Community Interest (SCI), and 32 Special Protection Areas (SPAs). Although Natura 2000 network covers 41.83% from Alpine Region, its effectiveness is questionable. Using up to date presence/absence data we tested representation of species of conservation concern in the Alpine Biogeographical Region, and the effectiveness of these protected areas. Finally we identified the most representative planning units and priority areas for conservation actions. The actual design without accounting for these principles, has led to the overrepresentation of species with an extended range, while those with small and fragmented range have been insufficiently covered by the existing network of protected areas. Therefore it is necessary to extend the network. Our results indicated that designing the Natura 2000 network using spatial conservation planning principles generated an optimal network for species of conservation concern without expanding the actual coverage.

#### **P41.4**

##### **Graph Theory for the Assessment of Connectivity as a Criterion for Ecological Coherence of Marine Protected Area Networks**

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The European Marine Strategy Framework Directive, as adopted in June 2008, recognizes marine protected areas and their integration into coherent and representative networks as an important contribution to reach and maintain a good environmental status in the European seas. To establish and assess these networks existing regulations and guidelines have to be taken into account. These include the ecological coherence criteria adequacy, replication, representation and connectivity as stipulated within the framework of the Helsinki- and the OSPAR-Convention. Therefore, quantitative assessment tools are required which are straightforward and insusceptible to data-poor situations. With respect to the assessment of connectivity such mathematical instruments are readily available and applied in various scientific disciplines including social and computer science as well as terrestrial landscape ecology. As one such example we analyse graph theory regarding its suitability for connectivity assessments in the marine realm based on its application to the Baltic Sea Protected Areas network. Both advantages and disadvantages of respective connectivity measures are discussed within the scope of an eco-coherence assessment as required through the Helsinki Convention and likewise the Marine Strategy Framework Directive.

#### **P41.5**

##### **"Plans of Conservation Measures" for Natura 2000 Sites in Poland: Nature Conservation NGO Experience**

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"Plans of conservation measures" (simplified form of management plans) will be prepared for more than 400 Natura 2000 sites in Poland in 2011-2013 y. Planning process is organised as participatory planning with inclusion all relevant stakeholders, nevertheless is also strictly lograged: 'local conservation status' of each protected feature (species or habitat) is assessed on the base of common parameters and indicators; conservation objectives are established on the base of this assessment, conservation actions are proposed to achieve objectives. Conservation NGO's participate actively in the planning processes.

The main problem identified is lack of full scientific information about detail distribution of protected features in Natura 2000 sites. Planning based only on existing information cannot guarantee avoiding habitats deterioration and significant species disturbing (requirement of Habitat Directive art 6(2)). Precautionary principle must be used: under such uncertainty, some conservation measures must be applied redundantly, also for potential localities of species and habitats. Improving inventory must be one of the planned measures and plans must use adaptive planning approach.

Including stakeholders to the planning process (participatory approach) may be useful for developing implementable plans, but requires not fully predictable time and financial resources, and therefore is not so easy to practical implementation.

## **P41.6**

### **Methods Used in the Evaluation and Management of Threats in the Iron Gates Natural Park, Romania**

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Iron Gates Natural Park is located in the south-west of Romania, at the border with Serbia, covering an area of 1156 km<sup>2</sup>. It is described as the region with a rich biodiversity, covering 27 habitats and 62 species of community interest. The Iron Gates Natural Park is managed as a category V IUCN (protected landscape/seascape), which emphasizes nature conservation and interactions with humans through traditional management practices.

In order to optimize the management process, we've located and hierarchised the main threats for certain species of community interest using IUCN inventorying protocol and WWF Threat Ranking method. The correlation of the obtained data with the distribution area of the analyzed species and the zoning map of the park led to the identification of the "hot spots" in the Iron Gates Natural Park which requires immediate actions. In addition, we used the results in developing sustainable management scenarios for this region.

## **P41.7**

### **Gap Analysis Using Protected Flora Data in Comunidad Valenciana (Spain)**

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One of the main tools for conservation biodiversity is protecting areas (e.g. NATURA 2000). In this study we evaluated using gap analysis the NATURA 2000 net in Comunidad Valenciana (SE of Spain) using georeferenced data from protected and endemic flora. This data was provided by the Biodiversity data base (BDB, Valencia). Environmental variables used included climate, topographic, lithological and land use. Habitat modelling for 25 threatened species was done using software MAXENT. Afterwards, a compilation of the 25 models was made into a GIS layer, summing the values of the habitat quality index of each cell, weighing the species according to its threat level in the protection laws. Comparing the results with the protected areas network, we found some gaps, areas with high quality habitat index for this protected species, which could be included in the network and/or used in conservation or reintroduction plans.

## P41.8

### Evaluation of the Conservation Status for Priority European Habitat: *Pannonic and Ponto-sarmatic Salt Steppes and Salt Marshes* in Romania

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The main purpose is the evaluation of the conservation status for halophytic habitats and their distribution on the biogeographic regions in Romania. The priority European habitat: **\*1530 Pannonic and Ponto-Sarmatic salt steppes and salt marshes** has a particular status of conservation in Romania. Prior to 2008, it were legally designated - on a national scale - 21 Sites of Community Importance (SCIs) in Natura 2000 network including this particular habitat. The habitat is present in four biogeographic regions: Pannonic (PA) Continental (CO) Steppic (ST) Pontic or Black Sea (BLS). For the Pannonic region, the following action is required: designation of additional sites or extension of the existing ones. In the Continental region a number of SCIs were proposed to be extended in order to include this kind of priority habitat. At the end of 2011, another 10 SCIs were designated and included in the upgrade legal act (Environmental Ministry Order no. 2387 from 27 November 2011). The map show GIS distribution and range within the biogeographic regions, at national scale.

Some background information on habitat type *\*1530 Pannonic salt steppes and salt marshes* is shown on the map in relation with SCIs for *\*1530* in EU27 (AT, BG, HU, RO & SK). The description of *\*1530* habitat at European level is the following: Pannonic and Ponto-Sarmatic salt steppes, salt pans, salt marshes and shallow salt lakes, highly influenced by a pannonic climate with extreme temperatures and arid summers. The enrichment of salt in the soil is due to high evaporation of ground water during summer. These habitat types are partly of natural origin and partly under a distinct influence of cattle grazing. The halophytic vegetation consists of plant communities on dry saltpans and steppes, humid salt meadows and annual plant communities of periodically flooded salt lakes with typical zonation. The method for the field research in Romania is using the following range of indicators in order to describe the situation: 3 = Complete survey, 2 = Estimate based on partial data with some extrapolation and/or modelling, 1 = Estimate based on expert opinion with no or minimal sampling, and 0 = Absent data.

Characteristic plant species identified in the field of many sites are: *Artemisia santonicum*, *Suaeda corniculata*, *S. pannonica*, *Lepidium crassifolium*, *Puccinellia peisonis*, *Aster tripolium*, *Salicornia prostata*, *Camphorosma annua*, *Plantago tenuiflora*, *Juncus gerardii*, *Plantago maritima*, *Cyperus pannonicus*, *Pholiusus pannonicus*, *Festuca pseudovina*, *Achillea collina*, *Artemisia pontica*, *Puccinellia limosa*, *Scorzonera cana*, *Petrosimonia triandra*, *Peucedanum officinale*, *Halocnemum strobilaceum*, *Frankenia hirsuta*, *Aeluropus littoralis*, *Limonium meyeri*, *Limonium gmelini*, *Nitraria shoberi*, *Carex distans*, *C. divisa*, *Taraxacum bessarabicum*, *Beckmannia eruciformis*, *Zingeria pisidica*, *Trifolium fragiferum*, *Cynodon dactylon*, *Ranunculus sardous*, *Agropyron elongatum*, *Halimione verrucifera*, *Lepidium latifolium*, *Leuzea altaica*, *Iris halofila*, *Triglochin maritima*, *Hordeum hystrix*, *Aster sedifolius*, *Scorzonera austriaca* var. *mucronata*, *Kochia laniflora*, *Festuca arundinacea* ssp. *Orientalis*, etc.

The fauna found inside the 1530 habitat's SCIs is composed by amphibians (*Bombina bombina*, *Triturus cristatus*, *Triturus dobrogicus*, *Bombina variegata*), invertebrates (*Lycaena dispar*, *Callimorpha quadripunctaria*, *Lucanus cervus*, *Arytrura musculus*, *Catopta thrips*, *Coenagrion ornatum*) and mammals (*Spermophilus citellus Lutra lutra*, *Mustela eversmannii*). Fishes are also present, and reptiles, like the european pond turtle *Emys orbicularis* or *Vipera ursinii*. Some of this species are not well adapted to the conditions present in this habitat and are living in adjacent or related habitats.

**Results:** It was acquired an equivalence between Romanian specific habitats (as described by Donita & al., 2005, 2006) with *\*1530* habitat. The description of floristic composition of each habitat types was realised between 2008 and 2011 for the reporting period 2007-2012 under the Article 17 of the Habitats Directive 92/43/EEC. An important species of fauna presented in SCIs are nominated.

At biogeographic level it was nominated the range within the region. According with the documentation available and field researches done between 2008 and 2011, it were designated 10 new SCIs included in Natura 2000 network. The distribution of SCIs representatives for biogeographic regions is the following: 15 in Continental region, 10 in Pannonic region, 8 in Steppe region and one in Black Sea region (note: 3 SCIs are distributed on two biogeografic region).

**Conclusion:** For the first time in Romania the evaluation of the priority habitat *\*1530* has taken into consideration a number of parameters, including specific structures and functions (incl. typical species) in order to give a mark to the existing conservation status, using the indicators: a) Favourable

(FV) / Inadequate (U1) / Bad (U2) / Unknown (XX) . All parameters were nominated according with reporting under Article 17 of the Habitats Directive -“Assessment and reporting under Article 17 of the Habitats Directive, Reporting Formats for the period 2007-2012, May 2011”.

Note: This study was done in the project RO1567-IBB04/2012: *Identification and research of natural habitats and endemic, rare and / or endangered species in Romania* (all authors have equal contribution to this study).

## **P41.9**

### **A Multi-criteria Assessment and Evaluation of Conservation Area Networks. A Case-study from Greece**

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Natura 2000 network represents the cornerstone of nature conservation policy in Europe. Sites of the network were selected on the basis of two EU directives, aiming to conserve priority species and habitats. Still, for several member states, management authorities have been established for only a limited number of sites. Here, we investigate whether ecological, economic or socio-political criteria represent the basic drivers for the establishment of management agencies within the national network of Greece. We apply an Analytic-Hierarchy-Process to assign 'weights' at different criteria, rank alternative sub-networks and identify a preferred set of alternatives. We further compared the “most effective” sub-networks with the sub-network composed by sites that have a management agency. A sensitivity analyses was applied to test the robustness of the ranking of each alternative set. The two highest ranked alternatives were sub-networks consisted of sites having the lowest population densities and those being subjected to increased environmental education and awareness projects. In contrast, the sub-network composed by sites with a management agency was ranked significantly lower in the list. Our results pose some questions on whether the conservation policy at National level does always follow pure ecological criteria or is driven by socio-political decisions.

## **P41.10**

### **Applying Graph-Theory to Explore the Properties of the Natura 2000 Conservation Network**

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The application of graph theory is becoming increasingly popular in ecological studies focusing on connectivity among patches, landscapes, habitats considering a variety of different taxa. Graph networks offer a framework for linking large datasets of spatial elements over large scales with potential connections reflecting ecological-relevant distances for animal movements. Still, the majority of studies that have so far utilized network analysis for conservation purposes, have focused on structural or functional connectivity of spatial components for single species and within limited number of sites largely ignoring the potential for assessing connectivity and robustness of existing conservation networks operating over large spatial scales. Here, we employed a graph-theoretic approach to construct and analyze the properties of sites linked together on the basis of a) various threshold distances that could respond to potential dispersal abilities of organisms and b) degree of similarities in terms of habitat composition. Network properties were assessed for Natura2000 sub-networks of different biogeographical zones. We suggest that assessment of conservation efficiency should be both species and site specific, while we argue towards the establishment and application of adaptive tools such as flyways, buffer zones, corridors and stepping-sites that would facilitate connectivity, improving network capacity to protect biodiversity.

## RESTORATION ECOLOGY AND RECOVERY OF ENDANGERED SPECIES

### P42.1

#### Suppression of Common Ragweed in a Grassland Restoration Experiment: Case Study of the Hungarian Great-Plain

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Common ragweed (*Ambrosia artemisiifolia*) occurs as the most abundant species after the first years of land-use abandonment in the Hungarian Great-Plain. Since common ragweed is the most significant aero-allergen in Hungary, great efforts are made to eradicate it. In our grassland restoration experiment we have sown *Festuca pseudovina*, a native grass for this area, and *Lolium perenne*, that is only found in degraded natural habitats. We tested if seed-sowing itself combined with annual mowing can be a useful technique in ragweed control. We also wanted to know which treatment is more effective in ragweed suppression. The experiment was conducted in Tiszaalpár, the Middle-Tisza Region on a recently abandoned field, surrounded with salt, sand and loess-steppe meadows. We had three repeats of each treatment. Between 2009 and 2011 we collected data in 18 samples of each treatment, and fixed the cover of all the species found in the sample units. We used linear models to compare the abundance of ragweed in different treatments. We found that sowing grass species reduced the cover of ragweed, *Lolium* more effectively than *Festuca* in the second year. After the third year of the experiment quantity of ragweed was strongly reduced in all treatments.

### P42.2

#### Landscape Effects on the Recovery of Plant and Insect Communities in Restored Grasslands

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Due to abandonment and conversion into arable land and forest, only about 10% of the historically managed grasslands in Sweden remain. Much research has focused on the negative effects of habitat fragmentation, habitat loss and simplification of ecosystems. Despite large investments to restore semi-natural grasslands very few studies have addressed how efficient restoration efforts are in terms of the recovery of biodiversity, species interactions and ecosystem functions. Especially the effect of landscape context on the efficiency of restoration programs is poorly studied.

Species response to restoration measures and the prospect of species recovery following habitat restoration is likely to be dependent on the proportion of and distance to source habitats in the surrounding landscape and on the life-history traits of the species studied. We investigate how the geographical isolation of restored grasslands and time since restoration affects A) the re-colonization of plant and pollinator populations and B) the community composition. We will also assess if species' probability of re-colonization after habitat restoration can be predicted from their life history traits, and if these traits are different from the traits that predict extinction risk.

### **P42.3**

#### **The Efforts to Preserve the Local Population of *Parnassius apollo* (Lepidoptera: Papilionidae) in a Man-made Habitat in Gorski Kotar Region (Croatia)**

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The only known locality of endangered butterfly, *Parnassius apollo*, in Primorje and Gorski kotar County, in Croatia is a small, steep rocky clearing created during the railroad construction. According to old literature data the previous distribution was a much larger area, but nowadays only a small, isolated population on this locality survived. The local butterfly enthusiast has been monitoring the population for the past 30 years and a big decline has been noticed. Twenty years ago around 10 individuals could be seen daily, and in the year 2011, only 10 individuals were found during the whole year. A decline of number of feeding plants (*Sedum spp.*) was also noticed. Possible causes for this decline are destruction of habitat due to construction, manure disposal and natural succession. In order to restore the habitat in two separate occasions trees, shrubs and vines were removed from the slope. An education project was arranged with local school where they would grow the feeding plants which would then be introduced into the habitat. The questions that now arise are: is it wise to introduce feeding plants from other locations and how will the maintenance work in the habitat affect this already fragile population?

### **P42.4**

#### **How Much Is Not Enough? Baselines for Assessing the Conservation Status of Eagles in Great Britain**

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The conservation status of recovering species is conventionally assessed (in part) against past range and population size. Selection of appropriate baseline reference values is therefore critical in this process, and subsequent allocation of resources. For species that have undergone long-term decline, using the earliest "known" distribution may greatly underestimate actual past range and population size. Using GIS, we compared current and documented historical distributions in Great Britain of two species of eagle (*Aquila chrysaetos* and *Haliaeetus albicilla*) with (1) reconstructed historical distributions based on placename evidence and (2) maximum potential range based on simple habitat models. For both species, the distribution of potential habitat corresponded better with the reconstructed past range than with the earliest documented distribution. Therefore, the geographical scope for assessing the recovery of both species in Britain is significantly larger than conventionally described - and consequently the relative importance of potential constraints (and remedial actions) may require reassessment in future plans for population recovery.

## **P42.5**

### **Reintroduction Plan of Sturgeon (*Acipenser oxyrinchus oxyrinchus Mitchell*) in the Nemunas Basin (Lithuania)**

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Before extinction in Lithuania sturgeons were usually caught in the Baltic Sea and the Nemunas River. Last sturgeon in Lithuanian waters was caught in Baltic Sea in 1975. The main reasons of sturgeon extinction were uncontrolled commercial fishing, construction of dams, water quality deterioration and destruction of spawning and nursery habitats. Genetic studies proved that in Baltic Sea were are Atlantic sturgeon instead of common sturgeon as previously thought and that Atlantic sturgeon inhabited Baltic Sea long while ago and pushed out common sturgeon. This fact has opened new possibilities for the restoration of sturgeon in Lithuania. In year 2010 Lithuanian reintroduction plan of Atlantic sturgeon was accepted, which includes various measures for long-term reintroduction program: artificial breeding and rearing; herd formation for reproduction purposes and annual stocking. Intense radio telemetry studies are scheduled to assess migration and survival in rivers. Based on historical data and present ecological and habitat status two rivers were chosen for sturgeon introduction - Neris and Šventoji River. First juvenile sturgeons released in year 2011 in Lithuania were from Poland, Inland Fisheries Institute. All specimens were tagged with PIT and floy tags. Up to date more than 4600 juveniles were stocked in Lithuanian rivers.

## **P42.6**

### **Reintroduction of Hungarian Meadow Viper (*Vipera ursinii rakosiensis*)**

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Remaining Hungarian meadow viper (*Vipera ursinii rakosiensis*) population was estimated below 500 individuals, with three major occurrences in Hungary and one in Romania. A complex conservation program was started in 2004, supported by the EU LIFE-Nature fund.

Viper Conservation and Breeding Centre was started with 10 adult individuals, collected from 4 different subpopulations, and after eight successful breeding periods number of vipers bred exceeded 1000 by 2011.

First reintroduction took place in March 2010, releasing 30 snakes into a reconstructed habitat in Kiskunság National Park. Snakes were released by removing them together with their artificial burrow, at the end of the hibernation period. During regular monitoring we checked these burrows by using pipe-camera.

Other amphibian and reptile species started to use these burrows as well. We recorded *Triturus dobrogicus*, *Bombina bombina*, *Pelobates fuscus*, *Podarcis tauricus*, *Lacerta viridis*, *Natrix natrix* and *Coronella austriaca*.

We recorded vipers 54 times during these visits, 44 times in or around these burrows. Altogether 9 individuals were identified by photos. In February 2011 additional 70 vipers were released in 15 burrows at the same site. We plan to continue release of snakes in new sites from 2012, some equipped with VHF-transmitters that are tested recently.

## **P42.7**

### **Selecting Priority Areas for Implementing Conservation Measures for the Cinereous Vulture (*Aegypius monachus*) in Southeast Portugal**

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Biodiversity conservation is often dependent on very limited resources. Therefore, it is crucial to objectively select areas where conservation actions will be most effective. One of the first tasks of the LIFE-Nature project 'Habitat Lince Abutre' was to identify key areas for implementing conservation measures benefiting cinereous vultures (*Aegypius monachus*), in SE Portugal. We selected four variables after a thorough bibliographic search: land use, food availability, disturbance and topography. These were divided into a number of sub-variables, and suitability classes were defined in each. All variables and sub-variables were weighted for their relative importance. They were then combined to obtain suitability maps showing the best areas where two main measures would be implemented: the installation of vulture feeding stations and the construction of artificial nests. The identification of priority areas allowed us to list proprietaries and game estates within, or close to, those areas. The landowners and game managers were then contacted, to present and negotiate management agreements for the implementation of the two measures. To date several artificial nests and feeding stations have already been built; with the project ongoing more will be implemented, thus giving an important contribution for the survival of the cinereous vulture in Portugal.

## **P42.8**

### **Management of Threatened Plant Populations Knowing That Floral Traits and Pollination Are Intraspecific Labile Traits: The Case of *Anchusa Crispa* Viv. (Boraginaceae) on Mediterranean Islands**

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Gene flow estimation within and among populations constitutes the very basis of restoration plans for threatened plant populations since translocation of maladapted genes can render conservation efforts unsuccessful. In most flowering plants, male and female organs develop in a unique structure, the hermaphroditic flower, so as many flowering plants are self-compatible and exhibit mixed mating system. Rare and endangered species are known to develop in small populations and then tend to exhibit higher selfing rates. This assumption has conducted managers of rare plant's populations to consider the potential inbreeding and its lethal evolutionary consequences (inbreeding depression) in restoration plans. But on the other hand, self-pollination can permit reproductive assurance when mates or pollinators are scarce in plant populations. Therefore knowing to what extent threatened populations can self-pollinate and its consequences are of relevant interest in restoration ecology. We studied several populations of the endemic borage, *Anchusa crispa*, which develops in small populations on Corsica (France) and Sardinia (Italy). The populations exhibit different rates of self-pollination but most of all, different rates of inbreeding depression and also the opposite process, namely outbreeding depression. These results are of particular importance for translocation processes conducted in those populations by managers.

## **P42.9**

### **Successful Restoration of Sandland as a Part of the Action Plan for *Dianthus arenarius* subsp. *bohemicus* (Bohemian Sand Pink) in the Czech republic - Good Example or Conservation on the Edge with Gardening?**

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Bohemian Sand Pink (BSP) is a heliophilous species growing in communities of open sand and sandy soil grasslands. An imperative condition for successful establishment of seedlings is open (disturbed) substrate, as the species is not able to withstand the competition. Main causes of threat are (1) tree plantations at the BSP habitats in the 1940's and (2) successional changes within the habitat due to changed land use, especially abandonment of traditional management. The humus layer was generated over years without grazing and mowing and allowed colonization of the habitat. Only two recent localities occur in the CR.

The objective of the restoration was to create conditions suitable for the development of BSP. The humus layer was removed to a depth of 20-40 cm to a gravelous sand substrate on a segment almost 0.55 ha large. The monitoring of BSP shows that the restoration measures lead to an increase of population. Before the restoration all the sowing experiments were unsuccessful, after the restoration, almost 5% of sowing is successful (ratio of number of one year old seedlings to sowed seeds). Is this good example of applying an endangered species protection measure or an example of gardening in a natural area?

## **P42.10**

### **New Habitat for *Phengaris (Maculinea)* Butterflies**

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*Phengaris (Maculinea) teleius* and *P. nausithous*, are obligate myrmecophilic butterfly species listed in the Habitats Directive. To protect the only populations of these species in The Netherlands, together with their rare damp meadow habitat Junco-Molinion, a Natura 2000 site has been delineated. Major parts of this area still consist of agricultural land. In the future, sustainable populations of both endangered butterfly species will live on sites which are still corn fields and cattle pastures nowadays. It involves removal of top soil, restoration of damp meadow vegetation and restoration of the animal communities of these vegetation types. Results from successful small scale management experiments, aiming on improvements of habitat quality for the butterflies and their host ants, will guide the process to large scale restoration. In addition, in low quality habitat with sufficient host plants and low densities of host ant nests, the vegetation structure will be diversified, leading to more host ant nests and better colonization probabilities for the butterflies. Now, the butterflies occur on 3 ha high quality habitat. To achieve sustainable (meta)populations, at least 40 ha is needed within a project consisting of changing 140 ha of farmland into nature.

## **SCIENTISTS AND MANAGERS: BRIDGING THE GAP**

### **P44.1**

#### **European Wildlife Network of Wildlife Managers and Researchers (EWN)**

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In Europe, wildlife policies and management are mainly addressed at a national level, even though many countries share the same species and face similar challenges. To more efficiently meet these challenges, an initiative has been taken to facilitate the exchange of knowledge and experience among wildlife managers and researchers in Europe through a new network. The European Wildlife Network (EWN) will promote and facilitate the responsible, scientific and ethical management of European wildlife populations for ecological, cultural, social and economic sustainability. Our focus is on the management of wild terrestrial mammals and birds, and their habitats, in Europe. More specifically, the EWN will provide a web-based platform for a network of professionals involved in wildlife management, policy/decision making or research with the desire to; (1) bridge the gap between management and research in various ways, (2) contribute to reviews of existing knowledge, evaluations of experience-based management practices and horizon scans of emerging issues, and (3) promote greater understanding of wildlife issues in the wider biodiversity and ecosystem services policy debates and among the general public. An increased dialogue between researchers, decision makers and practitioners is the first step towards achieving an adaptive, science-based and sustainable management of wildlife resources.

### **P44.2**

#### **Innovative Collaboration among Scientists and Foresters in a National Forest Biodiversity Program**

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The Forest Biodiversity Programme for Southern Finland (METSO) aims to halt the ongoing decline in forest species and habitats, and establish favourable trends in Finnish forest biodiversity by 2016. The program was launched by the Finnish Government in 2008, and it is financed through the state budget by the Ministry of the Environment and the Ministry of Agriculture and Forestry. The annual funding amounts to approximately 40 million euros. Funding is mostly used for improving the network of protected forests through voluntarily conservation agreements with private forest owners, and for developing biodiversity-friendly forest management practices including restoration. Substantial part of the funding is directed to research and development, which stems from taxonomic, ecological and socio-economical research to more applied forestry development. In my presentation I will show how these projects combine strengths from both science and forest management, with participation of researchers, foresters and forest owners. Functioning social network including all major stakeholders is the key to a successful project. Altogether these target-oriented projects offer fresh and innovative tools for adaptive forest management. They also enhance national forest conservation by building a knowledge-base that can be exploited in the development of the METSO program.

## SUSTAINABLE FISHERIES & AQUACULTURE

### P45.1

#### Effect of Probiotic Bacteria *Bacillus firmus* CAS 7 on Growth, Survival and Color Enhancement of Marine Angel Fish *Apolemichthys xanthurus* (Bennett, 1833)

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In the present investigation was carried out to study the growth, survival and colour enhancement of Smoke angel fish *Apolemichthys xanthurus* (Bennett, 1833) by administering *Bacillus firmus* CAS 7 as probiotic. Primarily, the probiotic bacteria *B. firmus* CAS 7 was cultured in the culture flasks incubating for 48 hrs 28°C with pH7.5 (150 rpm). The cell growth reaches its maximum during logarithmic phase (24<sup>th</sup> hr). After incubation, the broth was lyophilized and used to evaluate the effect of probiotic on marine angel fish *Apolemichthys xanthurus*.

The cultured probiotic bacteria *Bacillus firmus* CAS 7 was added at the concentrations of 100, 200 and 300 mg kg<sup>-1</sup> with basal diets. The experimental results revealed that fishes fed with diet supplemented with probiotic at 300 mg kg<sup>-1</sup> produced significantly better growth and survival rate than basal diet (Control). Carotenoid analysis depicted that higher carotenoid content (6.79 mg g<sup>-1</sup>) was recorded when fishes fed with 300 mg kg<sup>-1</sup> than control (4.48 mg g<sup>-1</sup>) pellet diet. Adequate experiments have also been conducted towards acclimatisation, feeding and colour enhancement. However, further studies are required towards breeding, rearing and development of this group so as to enable the aqua entrepreneurs to stock adequately for supplying the retailers.

### P45.2

#### Heavy Metals Levels in the Liver of Two Marine Fish Species *Pseudotolithus senegalensis* and *Pseudotolithus carienensis*

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Heavy metals are major components of industrial wastes especially in highly urbanised and industrialized areas such as most Nigerian coastal cities. They are soluble in oil and fat but have low solubility in water and therefore accumulate in food chain, to impart serious health problems..This study is an investigation of some selected heavy metals (Fe, Zn, Co and Cr) in the liver of two fish species in Lagos, Nigeria. The samples were collected and analyzed in the laboratory using standard methods. The recorded mean concentration of Zn in *Pseudotolithus. senegalensis* (20.3838mg/kg) and in *Pseudotolithus. carienensis* (19.68mg/kg) were within the WHO recommended maximum limits in fish. The mean concentration of Cr (15.52 mg/kg and 15.58 mg/kg) for *Pseudotolithus. senegalensis* and *Pseudotolithus. carienensis* respectively were high when compared to WHO limits in food fish. It was observed that the heavy metals levels in *P. senegalensis* which is indigenous to Nigeria were higher than in the non-indigenous *P. carienensis* except in Cr and this implies a low quality of this local fish species.

## SPATIAL ECOLOGY AND CONSERVATION

### P46.1

#### Minimal Effects of Wind Farms on Bird Distributions in the Breeding Season

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Renewable energy is a key component in the fight against global climate change, and wind power is an important source of renewable energy. However, the rapid expansion of wind farm development in recent years has raised issues about potential harmful effects on wildlife, especially birds. In particular costly agri-environment schemes, sometimes targeted at birds, may potentially be affected by wind turbines on farmland. We evaluated the effects of wind farms on the distribution of birds at two different sites. We collected data on bird distributions during the breeding season (six visits between April-June) at two areas with operational wind farms using common bird census surveys. Our analyses suggest that wind turbines have only a minimal effect on distributions of over 30 species, including red listed species such as Skylark, Lapwing, Linnet, Song Thrush and Yellowhammer; instead, bird distributions were largely predicted by environmental factors such as topology and land use. Our results suggest that birds on farmland in the breeding season are not likely to be affected by the presence of wind turbines.

### P46.2

#### Environmental Determinants of the Spatial Patterns of Breeding Bird Species Richness in the Lesser Caucasus Ecoregion (Turkey)

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We explored the contributions of environmental factors in explaining the large-scale spatial patterns of breeding bird richness for the Lesser Caucasus Ecoregion in north-eastern Turkey. Point counts were conducted for the period 2003-2006, within 336 UTM mapping grids of 10 x 10 km. The data comprised 1572 presence records of 42 breeding bird species in 329 grids. Seven grids with no counts were excluded from the analyses to prevent false absences. 23 environmental determinants of three types (climatic, topographic and physical) that could potentially affect the occurrence of breeding birds were checked for collinearity and 14 of them were used in the analyses. We applied Geographically Weighted Regression (GWR) with a Gaussian kernel to figure out the relationship between environmental determinants and spatial variation in species richness. Results indicated that most of the variation in breeding bird richness is associated with altitude, annual temperature range, diurnal temperature range, isothermality, precipitation seasonality, relative humidity of coldest and hottest month, and solar radiation of hottest month. It appears that distributions of breeding birds in the Lesser Caucasus Ecoregion are mostly governed by climatic factors. This indicates that breeding birds are likely to be affected by projected climate change in north-eastern Turkey.

### **P46.3**

#### **Habitat Preferences of the Great Spotted Woodpecker *Dendrocopos major* (Linnaeus, 1758) in a Mosaic Habitat**

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Among the nine woodpecker species occurring in Hungary, the Great Spotted Woodpecker is the most common species in the study area (Ócsa Landscape Protection Area, Pest County) and is the only species that breeds there, living in grove-like habitat with minimal competition.

We used the data of mist-netted birds from the Ócsa Bird Ringing Centre from 1983-2010 (n=1476) and the data of the spatial distribution of the birds from 2007-2010 (n=282). Questions asked were: What is the typical territory size for this species in the study area? How optimal is this habitat for the species? Which tree species are preferred? How do the foraging, resting and vocalising birds distribute spatially in the habitat?

This habitat is almost optimal for Great Spotted Woodpeckers, as 2-3 pairs breed in the circa 20 hectare woodland. Though the vegetation is a mosaic (reedbeds, scrub and woodland proper) and diverse in structure and composition, the foraging and resting woodpeckers mostly preferred the upper part of the trunks and thinner branches of willow and poplar species. Woodpeckers making territorial calls mostly preferred the canopy of the highest trees, though tree species seemed unimportant.

### **P46.4**

#### **Analysis of Spatial Movement Patterns in a Reintroduced Raptor Population Aids the Setting of Conservation Priorities**

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Red Kites, *Milvus milvus*, were reintroduced to the Black Isle, Scotland, in 1989. After an initial period of rapid expansion, the population growth rate has unexpectedly stagnated, despite the abundance of seemingly suitable and available habitat. This contrasts dramatically with the success of nine other UK Kite reintroductions. Illegal killing, through the use of poisoned baits, has been suggested as the prime cause of the restriction in population expansion (Smart *et al*; 2010; *Biol. Cons.*; 143). Analysis of movement data, gained from a combination of radio telemetry, satellite tracking and visual sightings of individually marked birds, revealed patterns of habitat use hitherto unexpected. Individuals displayed discrete, uncorrelated movements; however, the formation of temporary home ranges was widespread. Habitat use showed a marked aversion to upland areas and a strong association with lowland pastures as well as areas of intense lowland game management. These observed behaviours match the assumed scavenging nature of Kites. Combination of movement and land use data allowed for the identification of high risk areas where Kites are most likely to encounter poisoned baits. These results allow conservation managers to prioritise areas of Red Kite conservation activity, including the focusing of poisoning education campaigns.

## **P46.5**

### **A Bayesian Approach to the Integration of Environmental and Spatial Information in Species Distribution Models**

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The aim of this study was to assess a Bayesian approach to incorporate information from different environmental and spatial variables to the modeling of species distribution. We selected 21 threatened and endemic terrestrial vertebrate species from mainland Spain. With species distribution data and a set of environmental variables (climatic, topographical and habitat) and spatial used as predictors, we modeled distribution patterns of each species using multivariate logistic regression. On one hand, we made a partial model in which all the environmental variables were included in the modeling process, and the spatial component was incorporated in a later step to build an eco-geographical model. On the other hand, we made three partial models related to topo-climate, habitat and space. These partial models were combined using a Bayesian approach to obtain a final model. The topo-climate model was combined with the habitat model, and the result was combined with the spatial model to obtain an eco-geographical model. The models obtained with both methods were very similar in their predictive ability. Within each method, the greatest differences were obtained between the partial and eco-geographical models.

## **URBAN ECOLOGY AND CONSERVATION**

### **P47.1**

#### **The Red Data Book of St. Petersburg as a Tool for Rare Bird Conservation under Conditions of the Intensively Developing Megalopolis**

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In 2004, the Red Data Book of St. Petersburg (RDB SPb) has been published, but it was not a legislative document. The act «About the RDB SPb» of the St. Petersburg Government came only in August, 2010. In 2007-2011, we have carried out investigations aimed to estimate the modern status of species listed in the RDB SPb, to reveal the key parameters of their favourable biotopes and elaborate conservation measures. The recent intensive infill development and suburban infill rapidly change habitats. We propose a multilevel approach to the conservation of rare species: in SPAs, natural unprotected habitats, city parks and man-made areas. The legitimacy of the RDB will allow the regular monitoring of the rare species and a wider use of the possibilities on protection of their habitats outside the SPA network, among them, through supervising and judicial instances. The new order will promote implementation of our recommendations for park management taking into account requirements to rare species habitats. It will also allow a wider practice of compensatory measures. The important stopover sites in the Neva Bay stay under the threat of disappearance. RDB SPb is the additional tool for solving this problem by establishing a SPA of federal level.

## **P47.2**

### **Physiological Characteristics and Antioxidant Enzymes of Some Exhibited Plants Grown under Atmospheric Air Pollution at Aljubail Industrial City, KSA**

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The present work deals with effects of ambient air O<sub>3</sub> on cultivated and non-cultivated plants species exhibited at Aljubail Industrial City by comparing exposed plants to ambient air in two polluted localities (high and low). Three cultivated (*Bougainvillea spp.*, *Nerium oleander*, *Tevetia neralfolia*) and three non-cultivated plants species (*Moltkiopsis ciliate*, *Heliotropium bacciferum* and *Zygophyllum album*) were studied. Plant samples were collected from plants growing at these localities at three time periods; mid December 2006, February 2007 and April 2007. Complete monitoring of major gaseous air pollutants (O<sub>3</sub>, SO<sub>2</sub>, NO<sub>2</sub>) during these periods was made. Physiological parameters (sugars, pigments and antioxidant enzymes) for all plant samples were determined. Gradual increases in the concentration of air pollutants gases was found starting from August to May reaching high levels in August and September. O<sub>3</sub> concentrations at these months were three to four times the normal levels. At high polluted localities Ambient O<sub>3</sub> pollution lead to a significant decrease in total sugars, pigments and antioxidant enzymes activity in cultivated plants species. The results also showed that *Bougainvillea spp.* was more sensitive to O<sub>3</sub> pollution compared to other cultivated plant species, while in non cultivated *Moltkiopsis ciliate* was more resistance than other plants.

## **P47.3**

### **Comparative Study of the Homogenization Ratio of Both Small and Medium Size Wild Carnivore Communities in Mediterranean Landscapes with Different Humanization Rate**

*Arija C.M.*<sup>1</sup>

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Biological homogenization is a process of modification in animal communities composition by replacing specialist native species by those more generalist or exotic taxa. Several factors could be the cause of this change, including human activities. Therefore, our target is to compare the homogenization rate of both small and medium size wild carnivore communities in two Spanish provinces with similar characteristics and extension, Madrid and Palencia, but with a different human density (35:1). To do this, 55 sing surveys have been made quantifying not only the richness of species but also the habitat variables, the percentage of urbanized area in the nearest environment and the human population density in the corresponding municipality. Our results show that there are only significant positive correlations between the urban area and homogenization and negative correlations between the same factor and richness. When Conditional Autorregresive Models including urban coverage have been made, we have found out that there are significant differences in the richness of species and the homogenization rate in each province. Madrid, with higher human pressure and global landscape transformation, has a lower richness of carnivores and a higher degree of homogenization than Palencia.

## **P47.4**

### **The Effects of Urbanization on the Distribution and Abundance of Birds in Kolozsvár**

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In this study I examined the distribution and temporal dynamics of the bird species of Kolozsvár, in relation to the degree of urbanization and other variables.

Using a grid in Google Earth I divided the area of Kolozsvár into squares of 200x200 m. I sorted these squares into different categories depending on the level of urbanization. I selected 65 squares by stratified random sampling and measured variables such as the percentage of blocks of flats, houses, roads, other human facilities, parks, gardens, other green spaces, and the distances to the nearest semi-natural area, also in Google Earth.

The bird censuses were carried out in each season.

71 species were observed. The species richness was the highest in spring, winter coming secondly. The synantropic birds were dominant in all seasons, but the semi-natural areas near neighborhoods were rich in species such as the wryneck, the red-backed shrike, the great gray shrike, the pheasant, the great reed warbler, the reed warbler and the partridge. Human disturbance had a significantly negative effect on species-richness. Omnivorous and cavity nester species were more successful in urban environments, insectivorous, long distant migrants, ground nester and open-cup nester species proved to be at a disadvantage.

## **P47.5**

### **Cities and Ecosystems - A Managerial Analysis Using the Intermediate Disturbance Hypothesis**

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Nature conservation belongs to the wider constituency of sustainability studies - largely recognized among professionals as necessarily problem solving-oriented. Further, cities are development engines, meaning in practice both (i) pivots of current nature destruction and (ii) harbingers of future solutions for nature protection/sustainability. But beside its physical (infrastructure) and social entity (social construct), any city has also an ecological entity (basically, a colony of *Homo sapiens*) - though this is the least studied (as led by urban ecology, a very young discipline). Building on recent studies on urban ecosystems (often using biodiversity indices as proxies for ecosystem status), this paper investigates the potential consequences of the Intermediate Disturbance Hypothesis (and the Island Biogeography) on urban environment management, and identifies a basic urban taxonomy: Low Ecosystem Disturbance Areas - LDA (small city; city periphery), Intermediate Ecosystem Disturbance Areas - IDA (medium size city; city near-central), and High Ecosystem Disturbance Areas - HDA (large city; city centre). Each area type corresponds to different ecological realities, and requires differentiated managerial approaches. For example, not all disturbances are bad - urban areas begetting intermediate disturbance levels may be beneficial for biodiversity and nature conservation goals, while high/low disturbance areas may need contrasted treatments.

## **P47.6**

### **Theoretical Framework and Methodological Proposal for Urban Biodiversity Assessment**

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Biodiversity is one of the most accurate indicators of the quality of an ecosystem and, specifically, urban biodiversity has a key role in sustainability culture. Along history, human societies have kept a closed relationship with nature by means of metabolic fluxes in a process to socialize nature and to naturalize society. Thus, urban territory becomes a hybrid ecosystem expressed in the landscape where social and ecological compounds interact with each other. In this sense, the future of any kind of approach of sustainable society depends on how a city is structured and managed. In order to turn cities into permeable urban areas with regard to adjacent systems formed by recharge nodules, it is proposed to define a process of naturation by creating management strategies on urban green spaces and so establishing a net of corridors that would favor an attraction of biodiversity, and to produce, as a consequence, the naturalization of this urban system. Naturation techniques are based on the establishment of areas for breeding and shelter (genotop) and for feeding (trophotop) in relation to fauna. So as to evaluate naturation and naturalization processes in urban systems, a methodology based on a set of indicators and monitoring is proposed.

# ECCB2012 Symposia

## INVASIVE SPECIES - BLURRING THE EDGE IN CONSERVATION MANAGEMENT

### RT1

#### The European Food Safety Authority (EFSA)'s New Guidance on Environmental Risk Assessment (ERA) of Plant Pests

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The Plant Health Panel of EFSA developed a methodology for assessing the environmental risks posed by harmful organisms that may enter, establish and spread in the EU. The Panel first reviewed the methods for assessing the environmental risks of plant pests that have previously been used in pest risk assessment. The limitations identified by the review led the Panel to define the new methodology for ERA. Emphasizing the importance of assessing the consequences on both the structural (biodiversity) and the functional (ecosystem services) aspects of the environment, this new approach includes methods for assessing both aspects for the first time in a pest risk assessment scheme. A list of questions has been developed for the assessor to evaluate the consequences for structural biodiversity and for ecosystem services in the current area of invasion and in the risk assessment area. To ensure consistency and transparency of the assessment, a rating system has been developed based on a probabilistic approach with an evaluation of the degree of uncertainty. Finally, an overview of the available risk reduction options for pests in natural environments is presented, minimum data requirements are described, and a glossary to support the common understanding of the principles is provided.

## CONSERVATION ECOLOGY OF EUROPE'S RAINFOREST EPIPHYTES

### SY48.1.1

#### Putting European Relict Rainforests on the Global Map of Temperate and Boreal Rainforests

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Europe's lichen and bryophyte-rich forests are scattered along northern coastal latitudes receiving enough precipitation (1,539 mm to > 4,000 mm) to qualify as rainforests. These relict rainforests are part of a global network of temperate and boreal rainforests that make up 2.5% (~100 million ha) of the world's forests and Europe's portion comprises 17% of the global temperate and boreal rainforest network. European rainforests occur in Norway (4.9 million ha), Great Britain (5.1 million ha), Ireland/Republic of Ireland (1.6 million ha), Northeast Alps and Swiss Prealps (0.75 million ha), Southwestern Alps and Northwest Balkans (0.58 million ha), and Bohemia (0.22 million ha). Additional areas marginally qualifying as rainforests include the Hyrcanic (2.0 million ha) and Colchic (3.0 million ha) humidity-dependent forests of the western Eurasian Caucasus. Examples include boreal and boreonemoral forests of Norway, the highest-latitude rainforests in the world; sessile oak woodlands and pine forests (e.g., Celtic broadleaf, Caledonian Forest) of the UK; spruce-birch forests of Central Europe and Northwest Balkans; spruce forests of the Alps; and the Caucasus mixed forests (late-Tertiary refugia). Centuries of human expansion and land conversion have eliminated or altered nearly all these rainforests and restoration is complicated by lack of baseline.

## **SY48.1.2**

### **Epiphytic Lichen Species of Northwestern European Rainforest Relicts: Conservation Status at National, European and Global Levels**

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Lichenologists have long imparted significance to the restricted occurrence of a suite of oceanic epiphytic lichen species in the wettest outer coastal areas of parts of Ireland, western Scotland and central coastal Norway. It is only relatively recently however that these areas have come to be recognized as European outposts of a broader temperate-boreal rainforest formation. In particular, ever more similarities have been documented between the epiphytic lichen floras of these regions and the distant Pacific coastal rainforest flora of North America, though some species are restricted to the European part of the biome.

Until now no large-scale overview has been presented of the occurrence of epiphytic rainforest lichen species in northwestern Europe and their conservation status at national, European and global levels. We will provide a synopsis of some of the most important species and their occurrence in Europe set against a broader biogeographic background. We will also highlight their basic life forms and known ecosystem functions and discuss past and current threats to maintaining populations of epiphytic rainforest lichens in Europe.

## **SY48.1.3**

### **Geographical Patterns of Epiphytic Bryophytes Associated with Humid Forests**

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The purpose of the presentation is to summarize aspects of distribution patterns of epiphytic bryophytes associated with forests and trees growing under conditions of high climatic moisture, at spatial scales from the European to the regional. The main question asked is if distributions at broader scales reflect the finer-scaled distributions at which conservation priorities are made. We address different aspects of distributional uniqueness of both epiphytic mosses and liverworts; 1) to what extent are species associated with forests and trees also associated with regions with high precipitation, and 2) to what extent are epiphytes represented among species recognised as rare, and are such species predominantly found in regionally wet conditions. We use maximum entropy modelling with climatic predictors to model the Norwegian distribution of species belonging to Orthotrichaceae. Data from selected W Norwegian fjord systems, which comprise very large climatic variation over short geographical distances, are used to evaluate the national model's ability to predict distributions at the regional scale. Logistic regression analyses of the regional test data sets suggest that the transition between areas dominated by mosses with western and eastern distribution, respectively, occurs near peak hygothermy.

#### **SY48.1.4**

##### **Global Change in Context - Future Scenarios for Epiphytic Lichens in a Warmer, Wetter and Nitrogen Enriched World**

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Poikilohydric organisms, such as lichens, may be particularly sensitive to the altered temperature and precipitation patterns associated with global climate change. Many species are also sensitive to increased anthropogenic nitrogen deposition, a trait that may in part be linked to their symbiotic life-style. In addition to these stresses, epiphytic lichens are also threatened by fragmentation of their forest habitats and the shorter rotation times of managed forests. I will present data from two lines of research, setting global change in context for epiphytic lichens. Firstly, we have developed a model to predict local responses of epiphytic lichens to regional climate change based on two scenarios for northern Europe. In both scenarios we found that lichens will likely be outcompeted by bryophytes that are better adapted to dark and wet conditions. Secondly, we have followed lichen community responses to increased nitrogen deposition since 2006 in a large-scale manipulative experiment in an area with low background deposition. Depending on the exposure level the lichen community has deteriorated to various degrees already after three to five years, with the pendulous species *Alectoria sarmentosa* suffering from an induced phosphorous limitation, in combination with an imbalanced C:N:P stoichiometry between its bionts.

#### **SY48.1.5**

##### **Conservation of Epiphyte Metapopulations in Dynamic Forest Landscapes**

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Rare epiphytes form patch-tracking metapopulations on the trees (the so-called 'phorophytes') they colonize. Often, trees are suitable habitat only once they have reached a certain age, and specific microhabitats have been formed. Also, epiphytes tend to occur either only on trees with a nutrient-rich bark (many deciduous trees), or only on acidic substrates (e.g. conifers). An epiphyte's potential to colonize new habitats may be naturally limited if the preferred tree species is found in low density, and distances between patches are high. Using the example of the epiphytic lichen *Lobaria pulmonaria* in a simulation approach, we show that the dynamics of the lichen population is intimately linked with the dynamics of its phorophyte. For the long-term persistence of the lichen in a dynamic landscape in the presence of disturbance, a substantial amount of long-distance dispersal is required. Based on our simulations, we discuss suitable conservation strategies in dynamic forest landscapes. We find that epiphyte species with patch-tracking metapopulation dynamics require specific attention in conservation, because their survival depends on the presence of suitable tree habitats; the correct age classes of the preferred tree species have to be present at all times in the future.

## **SY48.1.6**

### **Conservation of European Rain Forest Habitat**

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Resources in practical conservation are limited. Hence, there is an urgent need for scientific knowledge to support management actions and prioritisation of areas for biodiversity. The study of the European rain forests is still in its infancy, and in this talk we address some basic questions that are important for an optimal use of resources in conservation of these forests. (1) Why focus on humid forests in Europe, (2) how should these forests be properly defined in terms of environmental conditions, (3) what is known about their former, present, and future distribution in Europe, (4) are there species and species groups that are more or less restricted to these forests, (5) if true, what are the important threats to the habitats of these species, and (6) what is the conservation status of humid forests across Europe? We examine these questions by using some examples from studies in Norwegian temperate and boreal rain forests, and suggest some topics for future research.

## **SY48.1.7**

Young Wood: a woodland beyond the edge

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Young Wood, near Mungrisedale, in the Lake District National Park is the highest Atlantic oakwood in England. This makes Young Wood the current upper altitudinal limit for semi-natural ancient woodland in England. This iconic woodland was fenced by Natural England in autumn 2008 to remove grazing sheep in order to conserve and enhance biodiversity.

It is hypothesised that management of semi-natural habitats to conserve and enhance biodiversity may also protect, and possibly increase, carbon storage in the landscape. However, very little research has specifically tested this in long-term field studies. The fencing of Young Wood provides a good opportunity to improve the evidence base. Immediately prior to fencing soil samples were taken to provide baseline carbon and nitrogen concentrations. Soil bulk density samples were also taken to enable an estimation of soil carbon content. Data from this initial soil survey were analysed to compare current soil concentration and content under different types of vegetation. The potential implications of the results for future carbon storage are discussed. Future repeat surveys will determine how carbon storage is actually affected by the removal of grazing sheep.

To begin to monitor changes in biodiversity, a ground vegetation survey was undertaken in summer 2009 and a baseline lichen survey was undertaken in 2010. Data from these baseline surveys are briefly described. A follow up ground vegetation survey was undertaken in 2011. Data are compared to the baseline 2009 survey. The possible implications of early changes in ground vegetation composition are discussed.

The aim of this paper is to provide a reference to the baseline survey work undertaken at Young Wood. It is hoped that further surveys of soil, ground vegetation and lichens will be undertaken in future, but also that surveys of other measures of biodiversity, and of carbon stocks and fluxes, can be commenced.

## ECOLOGICAL NETWORKS: ON THE EDGE OF SCIENCES AND POLITICS

### SY49.1.1

#### Regional Adaptation of the Emerald Network: An Example of the European Russia

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We aim adapting the Emerald Network principles to the conditions of the European Russia. More than 200 researchers have collected data on about 800 potential Areas of Special Conservation Interest. We have compared the lists of species of European importance with the Russian national and subnational red lists as well as analysed the distribution of target species of different groups on the ASCI's and their local conservation status. The similarity of the Russian and Pan-European priority conservation lists of species decreases from the Nord-West to the South-East. A conservation status of target species decreases from the Nord-East to the South-West in contrast of the role the ecological corridors in supporting it. Animal species inhabiting linear habitats as river banks are the most depending on the landscape integrity. Species of European importance being not specially protected in Russia sometimes inhabit disturbed areas. The spatial distribution of species protected in Russia is linked more with low disturbed natural areas and so may be used for assessing potential ASCI's if implementing all the criteria mentioned in the Recommendation No 16 of the Standing Committee of the Bern Convention.

## IMAGE IN CONSERVATION - EVERYTHING OR NOTHING?

### SY51.1.2

#### The Use of Camera Traps to Study Behaviour in Wild Populations: A Case Study of the Brown Bear *Ursus arctos*

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Research on endangered species often relies on behavioural information to acquire data throughout a range of fields. The demographics of a population can be directly measured, yet the study of social behaviour, plasticity, and interactions is somewhat restricted. Brown bears are a species which, due to their solitary and wide-ranging ecology, are thought to rely heavily on chemical signals as a means of communication. Conducted off the west-coast of British Columbia, Canada, we used camera traps orientated towards bear marking trees to assess behavioural differences between age/sex classes, and by season, to interpret the function of chemical signalling in the species. With camera trapping technology advancing, we are now better equipped to study animal behaviour in less invasive ways in the field. By developing techniques we have been able to study complex interactions and behaviours not possible of bears in captivity. Non-invasive methods used in population assessment (e.g. DNA from hair snares) have begun to make use of scent marking behaviour. However, prior knowledge of the relationship between these sites and the species being studied is required to allow for better estimates to be derived, by accounting for behavioural bias in sampling.

### **SY51.1.3**

#### **The power of the camera trap image: wildlife photography, science, and our relationship with nature**

*Diment A.*<sup>1</sup>

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For over 100 years, camera traps have given us stunning and intimate images of wildlife in their own environment. Since the 1990s, the increasing commercial availability of camera trap equipment has led to an explosion in their use for surveying elusive animals. The stated aim of much of this work is to collect scientific data, though in reality a good deal of camera trapping is simply wildlife photography, with data collection objectives lost to the visual power of the image itself. Can the potency of these images for public awareness and advocacy trump more scientific objectives? Or is the collection of photographic anecdotes unjustified within a science-based approach to conservation? And how might further advances in technology, such as real-time access to imagery, affect our perceptions of the natural world?

## **APPLYING CITIZEN SCIENCE GENERATED SPECIES OCCURRENCE DATA IN ECOLOGY AND CONSERVATION RESEARCH**

### **SY52.1.1**

#### **Symposium Introduction: Applying Citizen Science Generated Species Occurrence Data in Ecology and Conservation Research**

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Citizen science biodiversity data, which are generated by members of the public, are increasingly collected in faunal and floral databases worldwide and compliments historical data in natural history museums. The ever-increasing accessibility of species' occurrence databases, recent internet advances in areas such as social media, Geographic Information Systems (GIS) and statistical quantification of species-environment relationships is making possible novel applications of citizen science data as part of scientific enquiry. As the field advances, it is necessary to evaluate the potential of synthesizing and analyzing citizen science generated species occurrence data in scientific research. This symposium brings together a number of highly qualified European scientists to critically explore the application of citizen science generated species occurrence data in ecology and conservation research. Current challenges with opportunistic data include taxonomic biases in the groups represented, presence-only data, unstandardized methods of data collection, biased spatial coverage and data validation. Opportunities for applying citizen science arise in diverse fields such as population ecology research, conservation prioritization, assessment of emerging threats, as well as a means of monitoring the environment and involving and educating the public. Is 'Science by the people' becoming a 21<sup>st</sup> century phenomenon?

## **SY52.1.2**

### **Developing a Lifewatch Infrastructure for Integrated Analysis of Biodiversity Data**

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Biodiversity and conservation research is restricted by limited availability of detailed, large-scale and harmonized data in space and time. The European initiative *LifeWatch* will be an e-science and technology infrastructure for biodiversity data and ecosystem research. The Swedish LifeWatch integrates and publishes biodiversity data already encompassing >40 million species observations by citizens (Artportalen/The Species Gateway), research, monitoring, governmental inventories, and museum collections, in easily accessible formats. Tools for exploring, analyzing and presenting data will also be supplied at the LifeWatch Portal. The data of the Swedish Gateway contains some 34 million observations of 23,000 species, and a new observation is uploaded every 4<sup>th</sup> second 24 hrs/7days a week. The success of the Gateway is largely due to users considering it as a tool for their own benefit (compare Facebook) rather than submitting data for other purposes. With large amount of quality declared data available, including species properties and independent environmental variables, easy to use tools, workflows and computational capacity, LifeWatch will offer totally new possibilities for integrated analyses, predictive models and identification of conservation measures. Certain parts are already in place and ready for scientific exploration, while other parts of the Swedish LifeWatch will be fully operational during 2013–2014.

## **SY52.1.3**

### **Occupancy Modelling of Opportunistic Data Facilitates Biodiversity Monitoring**

van Strien A.J.<sup>1</sup>

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Monitoring biodiversity is difficult to achieve in practice, because standardized field work is demanding for volunteer fieldworkers. Collecting opportunistic data on presence and absence of species is much less demanding, but such data suffer from biases. We show that occupancy models can be helpful to reduce biases in opportunistic data, especially those caused by temporal variation of observation effort and by incomplete reporting of sightings. Occupancy models account for imperfect detection of species and yield estimates of the probabilities of occupancy, colonization, and survival of species at sites and enable to create annual distribution maps. By accounting for detection, they correct for among-year variability in observation effort.

We fitted dynamic site-occupancy models in a Bayesian mode of inference to long time series of opportunistic presence-absence data of many species of butterflies, dragonflies and grasshoppers. Detection records were obtained from a database containing opportunistic records data and nondetection records were deduced from records of other species of the same group. The analyses showed that occupancy trends based on opportunistic data were generally similar to those based on monitoring data. We conclude that opportunistic data analyses by occupancy models can be useful surrogates for monitoring schemes to assess distributional trends.

## **SY52.1.4**

### **The Use of Historical Collections to Estimate Population Trends**

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For most species long term data to estimate population trends are lacking. Natural History Collections (NHCs) can provide such data for a wide array of taxa, but may suffer from biases due to e.g. varying sampling effort and changes in collector behaviour. In a case study utilizing Swedish longhorn beetles we analyzed population trends using data collected over 100 years, and focusing on a critical evaluation of sources of bias. Variability in sampling effort over time and space was controlled for using a species-specific estimate of effort, and we also took the increasing interest in threatened species during the 20th century into account. We found large intraspecific variation in population changes, from large declines to several hundred percent increases. However, most species showed stable or increasing ranges, and few seemed to decline in range. For some rare species, publication of new information on biology produced a drastic impact on the estimated abundance, and novel methods of detection sometimes affected species evaluations. Changes in collector's preferences over time showed that estimated trends are likely to underestimate actual changes, both positive and negative. The results also suggested that species' declines may be overlooked if estimated only from changes in species range.

## **SY52.1.5**

### **The Impact of Data Realities on Conservation Planning**

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Conservation planning decisions are typically made on the basis of species distribution or occurrence data. Agencies are constrained in the data they can collect, often pragmatically prioritising groups such as threatened species, or methods, such as volunteer surveys. This mismatch between goals and realities inevitably leads to bias and uncertainty in conservation planning outputs, yet few studies have assessed how data realities affect these outputs. We conducted a sensitivity analysis on the Protection Index, a method for assessing conservation progress and priorities, using an extensive dataset derived from the Florida Natural Areas Inventory. Our analysis simulated a 'data poor' scenario typical of many real situations; assessing the effects of data paucity and bias on the value of potential conservation sites, and planning priorities. Certain high value sites with only a few important species occurrences were more sensitive to data depletion than those with many occurrences. To maximise benefit from surveys from a planning perspective, it would be better to focus on poorly surveyed areas rather than adding occurrences in already well represented sites. This study demonstrates the importance of sensitivity analysis in conservation planning, and that the effects of uncertainty and data quality on planning decisions should not be ignored.

## **SY52.1.6**

### **Improving Conservation Prioritization by Combining Local Environmental Data with Species Occurrence Data That Are Voluntarily Reported by the Public**

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The aim was to investigate whether the conservation prioritization differed depending on which types of local data that are used: only environmental data, observed species occurrence data, or model-predicted species occurrence. Also, did the conservation prioritization differ depending on the focal group of wood-inhabiting red-listed species: bryophytes, polyporous fungi, or beetles that are associated with spruce, pine or broad-leaved trees? The analysis was conducted at the spatial scale 300 m x 300 m all across Sweden. The environmental data were constituted by satellite-based estimates of forest variables, climate variables and a soil moisture index. The species occurrence data were constituted by presence-only reports of species occurrences by the public and governmental organizations to The Species Gateway ([artportalen.se/default.asp](http://artportalen.se/default.asp)). Using these data, we developed the models and made the predictions - the third type of local data used. We made the conservation prioritization work using the software Zonation. The prioritization differs substantially depending on the type of local data used. There are large differences using only observed species occurrences compared to using only environmental variables or model-predicted species-occurrence. There are also differences between the latter two types, depending on the explanatory power of the models used for making the predictions.

## **SY52.1.7**

### **Minimising Gaps in Species Occurrence Data: Using Location Features of Social Networks to Ensure Wide Spatial Coverage**

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Accounting for sampling bias caused by volunteer data collection is crucial in volunteer-based population and biodiversity studies. Most established analysis methods require random or regular sampling, but with citizen science records, these assumptions can be violated by enhanced participation in close proximity to transport routes or highly populated areas.

Global Positioning System upload or notification facilities are an emerging part of social networks (e.g. Twitter, Facebook, Four Square, SCVNGR, Project Noah, Food spotter etc.) and can provide enriching location-based experiences through reward systems such as points. Utilisation of location-based mobile platforms, with the purpose of collecting biodiversity data at specific locations has the potential to allow enhanced monitoring of species range shifts, distribution and phenology within an organised sampling regime.

Benefits of this approach include (1) simple and structured citizen science survey techniques, approximating a random or regular sampling strategy (2) increased citizen scientist motivation through the use of a reward system or activities such as guided walks in specific areas, and (3) it allows researchers to target areas which require more data and channel tourists or volunteers to target areas for data collection.

### **SY52.2.1**

#### **Re-inventing the Wheel: Changing Scientists', Rather than the Public's, Attitudes to Ecological Data Collection**

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While not universal, there is a tendency for professional scientists to consider citizen scientists as 'scientists' rather than 'citizens'. In general, 'citizens' are not motivated by scientific curiosity or testing underlying hypotheses as much as seeing exciting organisms and learning their basic natural history. Furthermore, fully engaged volunteers will provide as much information as possible, rather than strictly observing sampling protocols. Hence, to run successful citizen science projects, we need to forget the underlying principles of survey or experimental design. In this talk I present two approaches to analysing spatial data for changes in organism distribution, as collected by citizen scientists. The first is based on spatial bootstrapping of the centre of gravity of a population, and is very robust to presence only data, the second is centred on a location based reporting system and a Bayesian approach to analysis to account for inaccurate reporting of the data. However, key to success of both approaches is to allow volunteers to report data in an uncontrolled manner, and let the analysis sort out the resultant 'mess'. Ensuring participation is essential to citizen science, and any data are better than no data, no matter how messy the data are.

### **SY52.2.2**

#### **Simple Citizen Science Habitat Assessment; Can We Correlate Garden Condition with Hedgehog Presence?**

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Gardens provide a rich habitat for species that are declining in rural areas. However, measuring habitat suitability often involves extensive fieldwork followed by complex statistical analysis correlating environmental factors against species abundance. Collecting data in gardens in this way would be time-consuming and intrusive to residents. This study examines volunteers' potential to record hedgehog sightings and collect data within their own gardens using an online questionnaire. Focussing on a charismatic species meant that the number of responses was high (516 responses were obtained in 6 weeks, with a 50:50% split between gardens with and without hedgehog sightings). While many factors commonly thought to influence hedgehog presence were important in hedgehog-frequented gardens, they were not discriminatory, as they were also found in gardens where hedgehogs were not seen. Respondents were most likely to have seen hedgehogs in their garden if hedgehogs had also been seen in their neighbourhood. This study confirms that, although a citizen science approach limits the type of data that can be collected (here hedgehog abundance could not be quantified except as presence or absence, and many questions required logistic or ranked responses rather than absolute values), data collected in this way can still be useful.

### **SY52.2.3**

#### **Population Trends and Viability Analysis with Species Occurrence Data**

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The most comprehensive data on many species are observations of occurrences, such as records in scientific collections. Here, I present a method for population trend estimation and population viability analysis (PVA) in which this type of occurrence data can be used. In contrast to classical PVA, our approach accounts for the inherent observation error in occurrence data and allows the estimation of the population parameters needed for viability analysis. We tested the sensitivity of the approach to spatial resolution of the data, length of the time series, sampling effort, and detection probability with simulated data. Our approach provided realistic estimates of population growth terms and quasi-extinction risk in cases in which the standard method without observation error could not. For low values of any of the sampling variables tested, precision decreased, and in some cases biased estimates resulted. I present examples with threatened and invasive species, and discuss opportunities and limitations of methods and data for management applications such as red lists, invasive species lists and biodiversity indexes. Our approach may facilitate trend estimation and PVA for a wide range of species of conservation concern for which demographic data are lacking but occurrence data are readily available.

### **SY52.2.4**

#### **Using Large-scale Volunteer-Collected Data to Identify Priority Areas for Conservation**

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Long-term monitoring to provide robust indices of population change within particular geographical areas (often countries) is often achieved through volunteer surveys. This data can also be used to map population change at a finer resolution in order to identify priority areas for conservation. We describe an approach to do this using the UK's Breeding Bird Survey data, collected using a stratified random sampling scheme covering over 3000 1km-squares surveyed annually. We used GAMs to model the population densities of 50 species before integrating on the same map the information on (a) population change between 1996 and 2009 and (b) initial density. For each species, we located different critical areas according to the magnitude of the species' decline and its density. We also combined data across species' groups (e.g. farmland and woodland birds) to identify regions where management may be particularly influential in driving national population trends. These products provide important feedback to volunteers and a tool for decision makers and conservation agencies. Areas with large population decline and high initial population density are priority areas for conservation. Areas with large population decline but low initial population density indicate areas with a high risk of local extinction.

## **SY52.2.5**

### **Urban Habitat Selection by the Red Mason Bee, Studied with a Citizen Science Approach**

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The habitat preferences of the red mason bee (*Osmia bicornis* L.), a common solitary bee in urban environments that contributes to early-season pollination, are still poorly studied. We employed a citizen science approach to investigate drivers behind the spatial distribution of this solitary bee in the urban region of Leipzig (Germany). Volunteers hung trap nests at different locations and collected information on eight local, microsite conditions. We derived 14 landscape factors from a digital GIS biotope data map. We analyzed both occurrence (probability of trap-nest occupancy) and abundance (number of brood cells) of *O. bicornis*. The results indicate that the red mason bee is ubiquitous in urban area but still profits from nearby floral resources. The hang location of the trap nest was most important, followed by sun exposure. Cities with many fine-scaled floral resources (such as private gardens but not parks) and an open housing structure with higher sun exposure between buildings provide a good environment for cavity-nesting bees such as *O. bicornis*. In places without suitable nesting opportunities, artificial nests can support the bees. This study also demonstrates the benefit that a citizen science approach can bring to descriptive science.

## **SY52.2.6**

### **Every Record Counts: Engaging People in Recording Alien Species**

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Biological recording has a long history in Britain. The voluntary role of natural history experts in providing high quality large-scale and long-term distribution data is widely appreciated. The detailed observations on species (records), collected over hundreds of years, have enormous value for assessing and interpreting biodiversity change. For example, the recent northward shift, in response to climate change, for species across different taxonomic groups has been demonstrated using distribution data collated through the Biological Records Centre (NERC Centre for Ecology & Hydrology). Over the last decade there has been increasing emphasis placed on engaging a wider audience of people in biological recording. This has become increasingly pertinent as pressures on the environment are increasing while funding is decreasing. Invasive Alien Species (IAS) are one such pressure and implicated as one of main drivers of biodiversity declines. Monitoring and surveillance are key strategies in the hierarchical approach to IAS (Convention for Biological Diversity) and citizens can play a critical role through biological recording. We describe on-line projects developed to engage people in recording IAS. We highlight the enthusiasm of people for recording wildlife and contributing to complex environmental debates within the context of citizen science.

## **SY52.2.7**

### **Mapping occurrence probability using presence-only data: Argentinean tortoises (*Chelonoidis chilensis*) as a study case.**

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The analysis of the relationship between species and their habitat using species distribution models has always been central in ecology. Apart from understanding species ecology, species distribution models have gained major relevance as a tool to evaluate and anticipate potential threats, and test conservation strategies prior to implementation. Many statistical techniques used to model species distributions rely on presence and absence data. However, absence data are not always available and more resource demanding to obtain reliably. Meanwhile, there are many information sources that provide us with valuable presence-only data that are easily overlooked: citizen science initiatives, museum collections, and databases for opportunistic records. We obtained presence-only data on the tortoise *Chelonoidis chilensis* (Gray, 1870; *Testudinidae*) from reptile data-bases and scientific papers showing sampling localities. Within the Bayesian framework we use the presence-only data to generate an occurrence probability density kernel and pseudo-absence data as initial values. The model accounts for uncertainty on absence data into the parameter estimates. In this study we fit a spatially expanded logistic regression to model the species distribution through its bioclimatic envelope to obtain background information for mapping occurrence probability.

## LANDSCAPE SCALE CONSERVATION

### **SY53.1.1**

#### **Eco-evolutionary Dynamics of Range Shifts: Elastic Margins and Critical Thresholds**

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The eco-evolutionary dynamics of dispersal are recognised as key in determining the responses of populations to environmental changes. Here, modelling of the evolution of dispersal distance within a population structured across an environmental gradient yields some important general insights. First, it demonstrates that 'elastic' ranges are more likely features of range-shifting dynamics than has been recently reported; when dispersal distance (rather than simply emigration rate) is modelled, elastic ranges occur regardless of the nature of the environmental gradient. Second, a critical threshold is identified, beyond which, even the evolution of greater dispersal distance is unlikely to rescue a population; the position of this threshold depends on a combination of genetic, demographic and environmental parameters. We find that species rarely survive if the location of the leading margin of a range-shift falls behind the optimal environmental conditions of the species. We suggest that once a species passes this threshold, aggressive conservation actions such as assisted colonisation are likely to be required to reduce high extinction risks. We believe models, such as that presented here, can play a key role, providing a theoretical underpinning for conservation strategies that will be employed under rapid climate change.

### **SY53.1.2**

#### **Designing Landscapes to Facilitate Range Shifting**

Hodgson J.<sup>1</sup>

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It is now widely recognised that climate change is a threat to the survival of many species, and that a key factor in their survival will be the possibility of shifting their geographic ranges to track suitable climate. Conservationists must then ask whether there is enough habitat, in the right places, to allow these shifts to occur fast enough. I will briefly review what has been done by a number of authors approaching this question from different directions. I will then introduce a new method for predicting the speed of a species' range advance across a landscape, and will demonstrate how it can be used to plan and prioritise habitats arrangements.

### **SY53.1.3**

#### **Landscape-scale Conservation of Threatened Butterflies: Lessons from around the UK**

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Landscape-scale conservation projects are now Butterfly Conservation's main delivery mechanism to conserve the UK's threatened Lepidoptera. Butterfly Conservation currently works or has recently worked in 79 different landscapes targeted at key areas for threatened species, all of which involve partnerships with government agencies, other conservation organisations and landowners. Broadly we utilise two approaches firstly by providing advice to landowners and encouraging or assisting with the uptake of agri-environment or woodland grant schemes and secondly by securing external funding to directly undertake habitat management under the guidance of Butterfly Conservation project officers. These are not mutually exclusive with most projects having elements of both approaches. We describe elements of several projects from around the UK which provide evidence for some of the lessons learnt by Butterfly Conservation's 10 years experience of landscape-scale conservation delivery. We demonstrate that careful targeting of management is a very effective mechanism for stabilising and rebuilding metapopulations of rare species.

#### **SY53.1.4**

##### **RSPB's Futurescapes Programme- Stepping up for Nature across the UK**

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In response to continued biodiversity declines and the problems posed by climate change, the RSPB like many other UK conservation organisations has developed a landscape-scale element to its conservation delivery. This is known as the Futurescapes programme, and builds on and complements the site-based approach. So far 34 Futurescapes areas have been identified, containing 67 of the RSPB's reserves. The RSPB is seeking to broker and deliver a range of on-the-ground agreements with landowning /land management interests to deliver improved conditions for biodiversity in landscapes throughout a devolved UK. Partnership development and maintenance will also be a key element of the programme, as will the implementation of adequate biodiversity monitoring. Understanding and using a range of land management policy drivers will be key and the programme will benefit from a clear connection between our policy and delivery work. Finally we will seek to engender support from landowning interests plus the communities who live in these areas for our vision of more sustainably managed landscapes. Presentation will highlight progress to date and some of the main challenges to delivering the Futurescapes programme.

#### **SY53.1.5**

##### **Landscape Scale Conservation: How Effectively Can We Evaluate the Potential Benefits?**

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Protecting individual sites plays a key role in conservation but it does not always succeed. So, conservationists have increasingly called for action to reverse this trend through managing dynamic, connected landscapes that should allow species to move between patches, or along corridors of habitat. It is important to try and understand the impacts that such actions might have on provision of ecosystem services. Using scenarios of possible futures, we investigated a range of landscape-scale projects that were planned, or underway, in England and Wales and mapped the potential future benefits; for example, carbon storage, recreational opportunities, and provisioning services. Although there are many limitations to the projections and benefit estimations, the approach provides a useful tool for exploring policy futures. The benefits envisaged by the scenarios endorsed the support of the landscape-scale approach, assuming their success. To be *realistic*, the projects must be sustainable economically, and a range of commercially exploited ecosystem services in the case studies, such as premium meat, reeds and recreation, have potential for integrating with the local economy. High costs for habitat restoration and management at the landscape-scale are inevitable but the values of ecosystem services, especially carbon storage, are also high and may offset the costs.

## **SY53.1.6**

### **Assessing the Effectiveness of Large-scale Conservation in Great Britain**

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The perceived need for large-scale conservation schemes has risen greatly in prominence in recent years. In the UK, this is in response to issues such as concern over ecosystem fragmentation, the promotion of ecological networks as an important element in adaptation to climate change, and growing interest in ecosystem restoration and 'wildness'. With a range of new large-scale conservation projects being proposed and launched, it is important to learn from the experiences and outcomes of existing projects. However, to date there has been no systematic review. We have undertaken a major review of the large-scale conservation projects in England, Scotland and Wales led by both government and non-government organisations. We have constructed a database that to our knowledge provides the most comprehensive overview to date of these projects. Around 1000 projects have been identified, with information collected on aspects such as size, location, conservation objectives and the governance, planning and management approaches taken. To investigate the effectiveness of the projects in producing benefits for biodiversity and ecosystem services, we have developed methods to identify suitable counterfactuals for comparisons between areas with and areas without conservation projects. Here we explore the costs, benefits and unknowns of large-scale conservation in Great Britain.

## **INVASIVE SPECIES - BLURRING THE EDGE IN CONSERVATION MANAGEMENT**

### **SY55.1.1**

#### **Global Patterns of Marine and Estuarine Invasions**

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Non-indigenous marine species have been transported by a number of different human mediated vectors, which operate across a range of distinct pathways. The scale and scope of non-indigenous species was investigated by collating over 1000 published records of global introductions. Our current estimates of global invasions suggest that 2365 marine and estuarine species have been identified as having introduced or cryptogenic distributions. Representatives of 35 Phyla and Divisions were detected, with more than 55% of known non-indigenous species from three phyla: Chordata, Crustacea and Mollusca. Invasion records were organised into the IUCN global suite of marine bioregions for ease of evaluation. The distribution of invasions is not equivalent but suggests maxima at mid-latitudes (temperate regions) with decreases towards tropical (low) and polar (high) latitudes. This distribution does not follow the global distribution of ports, nor does it follow the modern day pattern of shipping. Here we discuss the implications of these patterns for predicting future invasions associated with climate change and anticipated shifts to trade patterns.

### **SY55.1.3**

#### **Increased Marine Biosecurity Risks to the World Heritage Listed Great Barrier Reef Marine Protected Area, Australia**

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It is established that both international and domestic shipping patterns create transfer routes for introduced marine species. When these shipping patterns are aligned with World Heritage Estate listed protected areas then both biosecurity and conservation imperatives act synergistically to create a heightened risk. Within Australia, the Great Barrier Reef Marine Park (a World Heritage listed area and a Particularly Sensitive Sea Area in Queensland, Australia) lies adjacent to a number of marine shipping hubs. Recent and planned marine port expansions have raised concerns about the increased exposure of Australian ports and adjacent protected areas to introduced marine species. This concern is based upon fears that current values will be lost, eroded or compromised for the sake of “economic progress” with a subsequent increase in introduced marine species invasions. To this end, we created a hub and spoke model to investigate the risk that introduced marine species pose to the Queensland region that is undergoing the marine port hub expansions. We paid particular attention to high value areas such as the World Heritage listed Great Barrier Reef Marine Protected Area. Our model uses shipping movement data combined with consequence matrices to develop a measure of derived risk. We will discuss the risk outcomes in light of the values held for this Australian coastline. A potential outcome from the model is the development of risk maps that will aid both biosecurity and conservation management of the Great Barrier Reef region.

### **SY55.1.4**

#### **Sequence Variation and GPS Telemetry Validation of Least Cost Modelling for the Invasive Grey Squirrel *Sciurus Carolinensis***

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Understanding the role the landscape matrix plays in species dispersal is important when targeting conservation and management strategies. Least cost modelling analysis is frequently used to assess habitat connectivity and to identify land cover types which may facilitate or impede species movement in the landscape matrix. This study used least cost modelling to assess the invasive grey squirrel *Sciurus carolinensis* dispersal movements within the UK. Expert derived land cover resistance sets were compared with species distribution data and information theory. The 'best resistance set' was selected and multiple colonisation routes into Cumbria and potential barriers to dispersal were identified. These findings were supported by evidence from mtDNA sequencing of seven grey squirrel populations. Least cost model predictions were further validated through data from five GPS collared grey squirrels. The GPS enabled detailed movements and land cover use to be recorded. This potentially influences conservation strategies for the native red squirrels. The now validated least cost model can be applied to areas where red squirrels are still threatened by the invasive grey squirrel to provide information to target management and conservation actions.

### **SY55.1.5**

#### **Competition among Invaders: Food and Shelter Contests between the Red Swamp Crayfish and the Chinese Mitten Crab**

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The red swamp crayfish (*Procambarus clarkii*) and the Chinese mitten crab (*Eriocheir sinensis*) are two freshwater invaders established in Europe. They share in many occasions the same invaded waters, but the interactions between these two exotic species are still unknown. We studied the inter-specific relations between these two crustaceans by testing experimentally the dominance for shelter and food among adults of both species. In the experiments we videotaped the behavior of both species and recorded the time spent either in the refuge or feeding. Our results show that the mean time spent by the crayfish until it finds a food item, was 128 seconds lower than the crab. Nevertheless, there were no differences between both species regarding the time spent feeding. These two species had a similar number of attempts to steal the food from the competitor, but only the crabs were successful in 36% of the attempts. There were no differences between crabs and crayfish regarding the time spent in the shelter, either alone or with an animal of the other species. In both species the time spent on the shelter decreased when exposed to the other species. Our results show that crayfish can fight 4-5 times larger crabs.

### **SY55.1.6**

#### **Non-direct Predation Impacts Caused by Invasive Predators on Islands: Cats as an Example**

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The domestic cat (*Felis silvestris catus*) has been introduced on most of the islands worldwide, where it has established feral cat populations and known to be one of the worst invasive mammalian predators. Predation has been considered the strongest deleterious effect of cats on wildlife and cats have induced a direct negative impact on population size and population dynamics, breeding success and changes in species assemblage structure. However, direct predation is not the only pernicious effect caused on native wildlife and this predator can produce other underlying ecological impacts such as competition, hybridization, disease transmission, ecological process alteration, and behavioral change that are poorly documented. Thus, we reviewed in this study some key examples of these ecological effects that could be more deleterious than cat predation for the conservation of insular ecosystem functioning and survival of endangered native species. These overlooked effects of invasive species on island must be receiving more scientific attention.

## LAND SPARING VERSUS LAND SHARING - A EUROPEAN PERSPECTIVE

### **SY56.1.1**

#### **How Might We Make Space for Nature in Landscapes of the Future?**

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Reconciling human needs with the persistence of wild species is a key concern for conservationists. Of all human demands on the biosphere, none has transformed the planet so much as the conversion of natural habitats for food production. There are many options for reducing the biodiversity impacts of food production, but these frequently involve making trade-offs. If we are to understand and navigate those trade-offs in specific places, we need to measure biodiversity and other outcomes appropriately. We have attempted to do this through recent studies in south-west Ghana and northern India. Our results so far suggest that more species would persist in these landscapes if a link could be established between the conservation of wild land and reducing the area required for food production by adopting high-yielding farming. I will discuss what these results tell us, what they don't tell us, and what a trade-offs perspective might have to offer to conservationists in Europe.

### **SY56.1.2**

#### **Broadening the Debate on Food and Biodiversity**

*Fischer J.<sup>1</sup>*

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I discuss eight points regularly missed in the debate about land sparing versus land sharing. One, whether researchers favour land sparing or land sharing is largely dependent on underlying paradigms. Two, in reality, a combination of land sparing and land sharing is sensible. Three, sustainable resource governance requires a sound understanding of social-ecological complexities. Hence, four, framing the issue around yields and areas required to produce those yields is elegant but simplistic. Five, 'sustainable intensification' and 'closing of yield gaps' promise cost-free gains and thus have obvious political appeal. However, six, a focus on optimising the efficiency of commodity production has undermined resilience in other systems, such as forestry. Seven, 'sustainable intensification' emphasises technological adaptation and thus implicitly downplays the need for behavioural adaptation. Eight, sustainability does demand major changes in human behaviour, including in relation to food and its distribution. I conclude that, as sustainability scholars, we ought to invest our energy primarily in finding ways to foster dietary change, avoid food waste, and share food more equitably. The debate on land sparing versus land sharing urgently needs to be expanded to reflect the magnitude and complexity of the challenge of truly sustainable food production.

### **SY56.1.3**

#### **Global Food Security, Biodiversity Conservation and the Future of Agricultural Intensification**

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There is an ongoing debate whether land for nature and for production should be segregated (land sparing) or integrated on the same land (land sharing, wildlife-friendly farming). While recent studies argue for agricultural intensification in a land sparing approach, we suggest here that it fails to account for real-world complexity. We argue that agriculture practiced under smallholder farmer dominated landscapes and not large-scale farming, is currently the backbone of global food security in the developing world. Furthermore, contemporary food usage is inefficient with one third wasted and a further third used inefficiently to feed livestock and that conventional intensification causes often overlooked environmental costs. A major argument for wildlife friendly farming and agroecological intensification is that crucial ecosystem services are provided by “planned” and “associated” biodiversity, whereas the land sparing concept implies that biodiversity in agroecosystems is functionally negligible. However, loss of biological control can result in dramatic increases of pest densities, pollinator services affect a third of global human food supply, and inappropriate agricultural management can lead to environmental degradation. In conclusion, linking agricultural intensification with biodiversity conservation and hunger reduction requires well-informed regional and targeted solutions

**Reference:** Tscharntke et al. (2012), Biological Conservation (under review).

### **SY56.1.4**

#### **Reframing the Question of Land Sharing and Land Sparing in the European Policy Context**

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When examining the issue of land sharing and land sparing, the natural, social and economic conditions of different localities need to be taken into consideration. In Europe agriculture, nature conservation and rural development have been traditionally interlinked, giving a unique policy context for this topic.

In Europe the limited availability of land and the relatively high population density resulted early in the conversion of land into agricultural and other uses. Protected areas many times were established in extensive agricultural areas, because wild intact wilderness had already been rare and nature friendly cultivation also contributed to a high level of biodiversity.

In Europe sufficient quantity of food has not been a problem for a long time and agriculture has become a multipurpose sector with economic, social and environmental (incl. biodiversity) goals. Intensive and extensive agricultural practices are both present, but intensive areas serve primary economic goals, while extensive agricultural areas play a key role in nature conservation and rural development as well.

In my opinion the question in Europe is not around “food or biodiversity” and “land sharing or land sparing”, but rather around “the proportion of intensive and extensive agriculture” and balancing the three goals of agriculture.

### **SY56.1.5**

#### **Conservation of Biodiversity in Agricultural Landscapes: Balancing the Trade-off Between Land Sparing and Land Sharing**

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Agri-environment schemes are implemented in many European countries to counteract ongoing biodiversity losses. The general principle is to enhance biodiversity by reducing the intensity of agricultural production. However, the efficacy of these schemes has been questioned, partly because they are highly context-dependent. Because agri-environment schemes typically reduce yields by reducing farming intensity, they have been viewed as a means of sharing land for both production and biodiversity protection. Recently an alternative paradigm has been suggested, termed land sparing. This land-use strategy operates with the underlying assumption that intensive agriculture in production lands enables the protection of species-rich habitats. Given the need of high yields in the future, this might not be possible with land sharing strategies. The relative merits of land sparing and sharing have been hotly debated during the last few years. Based on a literature review, we present a novel framework which combines land sparing and land sharing strategies to maximize the efficacy of biodiversity protection in agricultural landscapes. Our framework promotes a) land sharing in structurally simple landscapes targeting mobile ecosystem service providers and b) sparing habitats important for rare species and maximizing yields in fields situated both in complex and cleared landscapes.

### **SY56.1.6**

#### **Traditional Social-ecological Systems and Agricultural Production Strategies**

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Traditional landscapes are still well represented in Eastern Europe. Because of their high biodiversity, they are among the most notable landscapes in Europe and worldwide. Many of them are characterized historically by tightly coupled social-ecological systems. The strict dependence of people on natural systems led to the development of (i) traditional ecological knowledge, and (ii) social rules and norms that supported the sustainable management of natural resources. Effectively, land sharing was the dominant land use strategy in many traditional rural landscapes in Europe. Notably, land sharing is far more than 'just' a land use strategy in such landscapes: it is inextricably linked with a complex social-economic and cultural system developed to maintain a wide diversity of ecosystem services. The strategy of land sparing would be hard to incorporate into traditional rural societies in a way that successfully maintains their strengths and adaptability. Most likely, land sparing would negatively affect both the social and ecological components of the systems and would accelerate the de-coupling of the two systems. A likely outcome would be major decreases in the biodiversity and resilience of traditional rural landscapes, including the deterioration of immeasurable human values a picture obvious in many Western European landscapes.

## **SY56.1.7**

### **Protected Areas versus Sustainable Agriculture in Romania - Relative Merits for Biodiversity Conservation**

*Page N.<sup>1</sup>, Aleroyd J.<sup>1</sup>, Popa R.<sup>1</sup>, Sutcliffe L.<sup>2</sup>*

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In Europe, biodiversity is concentrated not in wilderness areas, but in High Nature Value man-made landscapes that are often so extensive that they cannot be included within conventional protected areas. Europe's most threatened ecosystems are not wilderness areas, which are generally unsuitable for intensification, but High Nature Value farmed landscapes. Despite its protected area network, the European Union has failed to meet its 2010 target to halt biodiversity loss. This, we suggest, is owing to the **land sparing** policy option so far adopted. Looking at resources available to counter threats, the Common Agricultural Policy budget is 100 times larger than the budget allocated to supporting the Natura 2000 network. We argue that biodiversity conservation in farmland, through farmers, is more effective in the targeting of actual threats, and availability of resources, than it is in classic Protected Areas. For 10 years, Fundatia ADEPT has been operating on this basis in Romania. We present examples of farmer-centred conservation successes in Romania to illustrate that **land sharing** will be the best mechanism to address biodiversity loss in Europe in the 21st century. We also present arguments that this approach will not threaten Europe's food security.

## **THREATS OF POLLINATOR DECLINE OVER EUROPE: ECOLOGICAL AND ECONOMICAL PERSPECTIVES**

### **SY57.1.1**

#### **Global Change, Pollinator Diversity and Plant-pollinator Interactions**

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Pollinators provide essential services for wild plants and crops in terrestrial ecosystems. Global change including habitat fragmentation, land use intensification, climate change and invasive species pose significant threats for pollinator diversity and the maintenance of pollination services across Europe. I will explore the relative importance of individual drivers and their combined effects on pollinators and pollination based on European-scale research programs. I will show that the scale and strength of responses of pollinators depends on life history traits such as resource specialisation, sociality, foraging distances and trophic rank. Similarly, the reliance of wild plant communities and crops on pollinators is trait specific, but available data suggest that species-rich pollinator communities increase the resilience and stability of pollination services. However, the potential mechanisms of underlying biodiversity-ecosystem functioning relationships for plant-pollinator interactions are still not well understood. Mitigation of negative consequences of global change for plant-pollinator interactions requires conservation actions at multiple spatial scales in both natural and managed ecosystems across Europe.

## **SY57.1.2**

### **Effectiveness of European Agri-environmental Schemes in Conserving Pollinators**

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Accumulating evidence for declining populations of pollinators has increased the need for measures that mitigate pollinator loss. In Europe, a wide variety of agri-environmental measures (AEM) are available that can potentially promote pollinators. Yet, few agri-environmental measures specifically target pollinators, and the effectiveness of AEM at conserving biodiversity in general has been questioned.

Here we present the results of a quantitative review of the effectiveness of AEM in promoting pollinators. Using a meta-analytic approach, incorporating results of 69 primary studies, we investigated whether and to what extent different types of AEM are effective at enhancing pollinators. Overall, AEM were effective at enhancing species richness and abundance of pollinators. Effectiveness of AEM was generally higher when implemented in croplands rather than in grasslands, and, within croplands, in structurally simple rather than in complex landscapes. Supplementing pollinator food resources through sowing flower strips displayed the most pronounced effect size, which in turn was positively correlated with the number of sown forb species. Our results suggest that the most promising AEM is the establishment of diverse flower patches in arable systems located in structurally simple landscapes. These are exactly the locations where pollination deficits are expected to be largest.

## **SY57.1.3**

### **Effects of Anthropogenic Disturbance on Local Bee Communities and Pollination Network Characteristics in an Extreme Desert Environment**

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Technological advancements in the last few decades have enabled the spread of human activity, agricultural in particular, to hyper arid ecosystems. These activities are a main source of exotic plant and pollinator species that may spread into natural areas and affect natural communities of plants and pollinators and their interactions. We studied the effects of gardens in villages and agricultural activity on local communities of bees and plants, and on pollination networks in the arid Jordan Rift Valley, southern Israel. During two consecutive years we measured floral availability and bee foraging activity and diversity in gardens and along 1500 m gradients from agricultural fields into natural habitat. We found the composition and seasonal patterns of both flowers and bees to change dramatically between the natural and the disturbed habitats. In particular, the introduction of the European honey bee greatly affected pollination networks and their variability along the season and between years. Variability between years was very strong in all measures of floral and bee communities and pollination networks, possibly because of limiting a-biotic factors. The changes we observed following anthropogenic disturbances may have important implications to ecosystem functioning and nature conservation in the area.

#### **SY57.1.4**

##### **Trait-Specific Effects of Mass-flowering Crops on Pollinators and Related Trophic Interactions**

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Providing ample nectar and pollen, mass-flowering oilseed rape was suggested to counteract ongoing pollinator declines in modern agro-ecosystems. Lately, however, positive effects were shown to be transient within the social bumblebees. We revealed that furthermore these effects are highly trait-specific. Densities of long-tongued bumblebees decreased with increasing oilseed rape most likely due to resource depletion via a simultaneous increase of nectar robbing in long-tubed plants by short-tongued species disproportionately benefitting from mass flowering. This distorted plant-pollinator interaction, however, did not directly affect seed set of long-tubed plants. In contrast to bumblebees, we showed the reproductive success of the polylectic solitary bee *Osmia rufa* to increase with oilseed rape. Season-specific analyses suggest that this positive effect resulted from increased nest-building early in the season that outweighed negative effects on the number of cells per nests and the percentage of parasitized cells once the mass flowering of oilseed rape had ceased. While similar patterns might be expected for pollinators sharing the same traits, the separation of oilseed rape effects into a beneficial flowering and a disadvantageous post-flowering phase indicates potential threats for pollinators less competitive on short-tubed flowers or with a later phenology that are more profoundly exposed to the latter.

#### **SY57.1.5**

##### **Environmental Effects on Wild Bee Communities and Pollination Service for Almond Trees**

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Demand for honey bees to pollinate California almond is increasing, but problems with honey bee health suggest it may not be sustainable to rely solely on a single species. Functional diversity can bring greater stability to ecosystem services mediated by organisms, such as pollination. We investigated the effect of surrounding natural habitat, organic management and vegetative strips on flower visitation and fruit set in 23 California almond orchards. In addition, we explored how pollinator diversity contributes to pollination service through spatial complementarity within the trees and response to high wind speeds. Fruit set and the frequency of visits to almond flowers by wild pollinators were positively related to the percent of surrounding natural habitat. Honey bees and wild pollinators showed spatial complementarity within the almond trees. Under high winds, visitation levels were buffered by wild bees. Almond orchards with surrounding natural habitat receive additional 'free' pollination services from wild insects, which can improve fruit set. In landscapes with little or no natural habitat, strips of nearby semi-natural vegetation can potentially increase visitation by wild pollinators. Insect diversity can improve the level of pollination service through spatial complementarity and help buffer pollination service to environmental change.

## **SY57.1.6**

### **The Effects of GM Crops on Pollinators**

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Pollinators use pollen and nectar of mass flowering genetically modified (GM) crops as food resources. The enhanced cultivation of GM crops and the given exposure can cause a potential threat to wild and managed bee populations. Therefore, comprehensive test methods are needed to minimize the environmental risk of mass flowering GM crops. As a case study system, the impact of multiple insect resistant Bt-maize on honey bees (*Apis mellifera*) is analysed. In the laboratory, we use and adopt a new risk assessment method by adding transgenic pollen directly to the larval diet. In a second experiment, we test effects of single as well as a mix of purified Bt-proteins in our in vitro bioassay. Under semi-field conditions, we analyze the direct effect of flowering Bt-maize on honey bee colony development. In all experiments, we found no adverse effects of the tested GM maize on honey bees. We will discuss the results of our laboratory and field studies in detail. We conclude that the controlled direct exposure to the plant produced insecticidal proteins improves the strength of GM plant risk assessments for bees. The risk assessment methods presented will help to secure the worldwide provided ecosystem service of honey bees.

## **SY57.1.7**

### **Land Use Change as a Determinant of the European Agricultural Vulnerability Confronted with Pollinator Decline**

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Insect pollination is essential for the production of a large array of crops. In the last decade, there has been evidence of a worldwide pollinator decline. A major pressures for this decline seem to be land use change and agricultural intensification. Yet the policy response is not as fast as it should be. One can explain this reluctance by the low visibility of this impact into the agricultural sector in the near future. This paper analyzes the evolution in next years of the European agricultural vulnerability confronted with pollinator decline through the evolution of land use change. The vulnerability of agriculture to insect pollination loss is a combination of three indicators: 1) the economic value of insect pollination, 2) the vulnerability ratio, and 3) the social welfare loss. The evolution of these indicators until 2020 have been estimated in three scenarios: Growth Applied Strategy (GRAS), Business As Might Be Usual (BAMBU) and Sustainable European Development Goal (SEDG). The overall result is that the European agricultural vulnerability will increase in the near future in all scenarios and thus we demonstrate that policy is needed to protect pollinators.

# GLOBAL BIODIVERSITY SCENARIOS TO INFORM ENVIRONMENTAL POLICIES

## **SY58.1.1**

### **The Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES), Goals, Organization and Priorities**

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In 2005 Jacques Chirac called for an IPCC-like mechanism for biodiversity and ecosystem services. However, it was not until June 2010 that governments finally agreed that an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) should be established to “strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being and sustainable development”. Much has been written on what IPBES could, should and might do, but apart from some principles (e.g. that it should build on existing initiatives, be scientifically independent etc.), governments still need to agree exactly what form the platform will take, what exactly its functions will be, where its secretariat will be located, what form its programme of work will take, and what its budget will be. At present four programme elements are anticipated, covering knowledge generation, assessment, delivery of policy support and capacity building. Initial discussion has demonstrated widely held views on the importance of capacity building, and assessment work at sub-global levels.

## **SY58.1.2**

### **SCB Vision for IPBES**

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The Intergovernmental Science Policy Platform for Biodiversity and Ecosystem Services (IPBES) has the potential to become an important process, linking best available knowledge to processes forming conservation policy. SCB as a leading society in the area of conservation needs to seriously consider its role and contribution to IPBES. The ad-hoc committee on IPBES was formed in 2009 with representatives from all sections. The committee has followed the process and participated in recent meetings, including the first two sessions of the IPBES plenary in October 2011 and April 2012. SCB may play a direct role in IPBES, but equally important is to consider what IPBES may do for SCB. It represents a possibility to engage individual members in the transfer of science and knowledge to policy. Building on the regional structure, our members and regional sections will be able to contribute to the anticipated regional assessments, help guiding the capacity building activities to the most needed areas and to learn more about the regional policy making processes. SCBs role in IPBES is dependent on the involvement of our members. This represents a challenge that the Board of Governors and the regional Board of Directors need to make a top priority.

### **SY58.1.3**

#### **Towards a New Generation of Biodiversity Scenarios**

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The development of global biodiversity scenarios has known tremendous progress over the last decade. However, large uncertainties remain about the consequences of climate change and land-use change for biodiversity, with projections for extinction rates using different modeling approaches diverging up to three orders of magnitude. Here we discuss existing efforts towards developing a new generation of biodiversity scenarios aiming at narrowing existing uncertainties. Five issues are currently being addressed. The first is using common biodiversity indicators between the modeling community and the observation community (particularly in the context of GEO BON). The second is the development of model-to-model comparisons using the same direct drivers projections and the same biodiversity indicators. The third is to improve validation and calibration of models with observation data, particularly with recent historical data for land-use change and paleobiological data for climate change. The fourth issue is improving the policy relevance of scenarios by exploring options related with decision-making and international targets. Finally, feedbacks between the ecological dynamics and the social dynamics are starting to be analyzed, particularly for biodiversity tipping points and their consequences for ecosystem services. We conclude with a discussion of how these developments should be articulated with ipBes.

### **SY58.1.4**

#### **The IMAGE-GLOBIO Integrated Assessment Model - Future Scenarios of Habitat Loss and Climate Change**

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Continued population growth and rising per capita income, leading to industrialization and ever-increasing flows of material, are giving rise to concern about how to ensure more sustainable forms of global human development. In particular, problems associated with climate change, loss of biodiversity, water scarcity and the accelerated nitrogen cycle are encountered at global, continental and regional scales. Solving them will demand a comprehensive understanding of the Earth system. An Earth system model such as the Integrated Model to Assess the Global Environment (IMAGE) is a helpful tool in investigating these changes, their causes and links, in a comprehensive framework. Drivers such as demographics and economic development are input to bio-physical models addressing elements, such as land cover and land use change, the global carbon cycle and the global water cycle. The model includes interactions and feedbacks between those elements. The model outcome from IMAGE feeds policy-exploration tools, including the GLOBIO biodiversity assessment model. Here we show the potential use of IMAGE and GLOBIO outcomes to assess possible future scenarios of habitat loss and climate change using a comparison between a baseline scenario and a scenario, in which CBD biodiversity targets can be met.

## **SY58.1.5**

### **Global Biodiversity Indicators: Informing Policy Decisions**

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The CBD 2010 target of reducing the rate of biodiversity loss stimulated considerable effort in the development of indicators to track biodiversity trends. Failure to meet the target prompted the CBD to set 20 more specific targets for tackling biodiversity loss to be achieved by 2020. There is an emerging consensus that such indicators could be usefully presented using a State-Pressure-Response-Benefits framework. However, the utility of such a framework in providing relevant metrics of change will be dictated by a mechanistic understanding of how the chosen indicators interlink. In order to influence global environmental policy effectively, conservation scientists need to be able to provide robust predictions of the impact of alternative policies on biodiversity and measure progress towards goals using reliable indicators. We explore these frameworks and present case studies of how projection of the impacts of feasible policies on trends in biodiversity can be measured with current biodiversity indicators. Evidence-based modelling allows different causal relationships to be understood; essential to improving the value of biodiversity indicators for decision making. To influence policy, conservation scientists must be bold enough to make predictions and offer advice that aids decision-makers, or they will remain peripheral to important decision-making processes.

## **SY58.1.6**

### **Predicting the Future IUCN Red List Status for Terrestrial Mammals**

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The number of species at risk of extinction surpasses the current global conservation capacity limited by funding, time and conflicting interests. This is why conservation prioritization is necessary. The IUCN Red List (RL) is the global standard to measure risk of extinction and to prioritize species for conservation intervention, and the Red List Index (RLI), a synthetic measure of RL trend for a taxon, is used to monitor progress towards conservation targets. While the RLI is designed to track past changes in threat status, it is also suited to measure the potential impact of different policy scenarios. We illustrate a method to project the RLI for terrestrial mammals, evaluating the implication of different land-use and climate change scenarios. We use habitat suitability and bioclimatic models to estimate species future extent of occurrence, area of occupancy and population size to inform RL criteria and derive future status. We discuss the difficulties still to overcome and the robustness of the RLI projections to assumptions about models and parameters involved.

## **SY58.1.7**

### **Mitigating Future Biodiversity Loss, How Much Can Protected Areas Do?**

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Despite progresses where conservation actions have been implemented, biodiversity continues to decline due to loss of habitat, direct persecution, invasive species, and, increasingly, direct and indirect effects of climate change. Future global scenarios of biodiversity agree on projecting a continued decline for most habitat and species. We investigated to what extent scaling up current conservation efforts can mitigate this systemic biodiversity crisis predicted by the 4th Global Environmental Outlook scenarios of climate and land use change until 2050. We used bioclimatic envelope models and habitat suitability models for the world's terrestrial mammals to project, respectively, species' Extent of Occurrence (EOO) and Area of Occupancy (AOO). We used the trends in EOO and AOO to estimate future Red List status for each species and development scenario and project the Red List Index (RLI) for terrestrial mammals. We compared RLI's trends for the baseline scenarios with scenarios including different strategies to prioritize protected area expansion and different global conservation budgets. We show that, while protected areas are fundamental to prevent the loss of irreplaceable habitat in the short-term, in the long-term, specific changes in human development path will be far more effective in preventing projected global loss of terrestrial mammals.

## **SY58.1.8**

### **The Role of Biodiversity Scenarios in the Development of Global Conservation Strategies**

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The complete reliance on a reactive approach is arguably one of the reasons of the limited success achieved so far by conservationists in the face of escalating anthropogenic pressure on biodiversity. The resulting acceleration of biodiversity loss means that stepping-up conservation action is crucial, not only by substantially increasing overall investment, but in increasing its efficiency by ensuring that such investment is as strategic as possible. Anticipating future threat to and loss of biodiversity could potentially hugely increase the cost-efficiency of global conservation strategies. Increasingly sophisticated socio-economic and climatic scenarios provide unprecedented opportunities for forecasting the potential future distribution of species threats, distribution and decline. Although these scenarios rely on uncertain predictions and assumptions about many parameters and their interactions (future patterns of land use, climate change, species responses to these changes), they provide a unique opportunity to introduce a proactive approach to conservation problems. We discuss examples of how biodiversity scenario modeling affects global conservation priorities for mammals.

## **EUROPEAN AGRI - ENVIRONMENT SCHEMES: UPDATING THE KNOWLEDGE BASE**

### **SY59.1.1**

#### **Do Agri-environment Schemes Contribute to Halting the Biodiversity Decline?**

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Biodiversity continues to decline, despite the implementation of international conservation conventions and measures. To counteract biodiversity loss, it is pivotal to know how conservation actions affect biodiversity trends. Focussing on European farmland species we review what is known about the impact of agri-environment schemes, the most important biodiversity conservation initiative in agricultural landscapes. Findings suggest that the effects of agri-environment schemes are a function of conservation-induced ecological contrast, agricultural land-use intensity and landscape context. Implications of these relationships for regional targeting of agri-environment schemes are discussed. To date hardly any studies have linked local conservation effects to national biodiversity trends. It is therefore unknown how the extensive European agri-environmental budget for conservation on farmland contributes to the policy objectives to halt biodiversity decline.

### **SY59.1.2**

#### **Results from Multi-taxa Species Monitoring of Welsh Agri-environment Schemes**

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From 2009, the RSPB, in conjunction with partners (Butterfly Conservation, Bat Conservation Trust, Plantlife, and the Wildlife Trusts for South and West Wales) have conducted species monitoring of Welsh agri-environment schemes, under a Welsh Government-funded programme. This three-year programme has investigated the benefits of schemes, particularly Tir Gofal, the current higher-level scheme in Wales, on birds, bats, butterflies, arable plants, grassland fungi, and terrestrial mammals. This multi-taxa approach has rarely, if ever, been taken with agri-environment monitoring previously, and allows for an assessment of a wide range of agri-environment options at different scales. Results of the monitoring programme indicate mixed benefits between taxa. The merits of the multi-taxa approach will be discussed.

### **SY59.1.3**

#### **Is the Higher Level Stewardship Agri-environment Scheme Delivering for Farmland Bird Species in England?**

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Two agri-environment schemes are available to farmers in England: Entry Level Stewardship, which is open to all farmers, and Higher Level Stewardship (HLS), a competitive, targeted scheme requiring more tailored management. Here we present the results of a four year study to assess the effectiveness of HLS in delivering for the target species of corn bunting, grey partridge, lapwing, tree sparrow, turtle dove and yellow wagtail, and other farmland birds. Eighty six HLS and non stewardship control farms in three regions of England were surveyed in 2008 and again in 2011. Populations increased on HLS farms, but declined or did not change on control farms, for grey partridge, tree sparrow, house sparrow and reed bunting in all regions, and yellowhammer in one region. In 2009 and 2010, surveys were conducted to assess use of agri-environment options likely to provide food or nest sites during the breeding season. Higher densities of birds were found on fields with fallow plots, nectar flower mixtures, floristically enhanced margins and wild bird mixtures. In summary, the study suggests that HLS is benefiting both target species and other farmland birds, both in terms of densities at the option scale, and population trends at the farm scale.

### **SY59.1.4**

#### **AES Effects on Targeted and Non Targeted Species: A Case Study in Central Western France**

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The intensification of farming practices has led to dramatic declines in biodiversity across Europe. For the 20 past years, Agri-Environment Schemes and Natura 2000 network have been set up in Europe to halt the ongoing decline of farmland birds, resulting in mixed results. We examined in which way and in how far the designation of a Special Protection Area in 2004 and the AES that has been implemented since then (in 2011, 9500 ha) in an intensively managed cereal agro-ecosystem of western France impacted the long term trends little bustard (the targeted species) but also two common bird species, the Skylark and the Corn bunting. Since 2004, targeted AES has led to a sharp increase in female bustard productivity, mainly associated with nesting in AES fields. In addition, from 1996 to 2011, trends in skylark and corn bunting significantly differed between before and after the designation. We also show that grasshoppers and weeds statistically differ between control fields and AES fields. We conclude that conservation strategies involving targeted AES based on the identification of limiting factors can help reversing the decline of threatened species, but also, on a much broader scale, those of species belonging to ordinary biodiversity.

### **SY59.1.5**

#### **Potentials of Agri-Environment Schemes in Hungary - What to Expect in a Country of Extensive Agriculture and High Biodiversity?**

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Agri-environmental schemes (AESs) were initiated in Hungary before the EU accession in 2002. Over the last ten years many land-owners joined to the country wide programs and the zonal schemes in 15 Environmentally Sensitive Areas, paid for nature friendly management in e.g. arable fields and grasslands. Unfortunately the monitoring of the effects of AESs is still in design stage. There are only few studies on farmland biodiversity compared to the intensively managed Western Europe, however, results on farmland birds, plants and invertebrates in grasslands and arable fields show that the relationship between population declines and agricultural change has been driven by different mechanisms here. Therefore, AESs should not be directly extrapolated from Western Europe. Agricultural management intensity is still relatively low, resulted in rich biodiversity. Even in more intensively grazed grasslands high biodiversity was found probably due to the generally low agriculture intensity, and rich supply of semi-natural habitats in the landscape. However, long-term deterioration of grasslands and loss of grazing livestock pose serious threat. The results suggest that AESs should aim the maintenance of existing habitats by low-intensity farming. Using evidence from the still traditional European farming systems can help to establish key rules and goals of AESs.

### **SY59.1.6**

#### **The Effects of Scottish Agri-environment Schemes on Pipistrelle Bats and Nocturnal Insects**

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Agri-environment schemes (AES) aim to counteract the negative effects of intensive agriculture by providing financial incentives for farmers to adopt environmentally-sensitive agricultural practices. We surveyed 18 pairs of AES and conventionally-managed farms in central Scotland to assess the effectiveness of specific prescriptions (field margins, hedgerows, species-rich grasslands and water margins) and the importance of the surrounding landscape for bats and nocturnal insects. Bat activity levels (mainly *Pipistrellus* spp.) and abundance of their insect prey (mainly Diptera and Trichoptera) were lower on farms participating in AES than on non-participating farms. In contrast, moth abundance and species richness were higher on farms participating in AES than on non-participating farms. AES field margins, species-rich grasslands and water margins (but not hedgerows) had higher moth abundance and/or species richness than their conventionally-managed counterparts. Woodland fragmentation metrics and the extent of semi-natural areas were the most important landscape predictors for bat activity levels and nocturnal insect abundance, respectively. The implementation of the AES management prescriptions assessed in this study benefits moths (and could potentially benefit moth-eating bat species), but not Pipistrelle bats nor other bat species foraging on similar prey, which may respond better to a landscape-scale management approach focused on woodland creation and management.

## **SY59.1.7**

### **Agri-environmental Schemes for Sown Wildflower Strips - A Successful Measure for Insect Conservation?**

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Sown wildflower strips are established within several European countries within agri-environmental schemes to support or enhance biodiversity. Sown wildflower strips are one of the few agri-environmental schemes that are particularly directed to insect conservation. The approach in establishing wildflower strips varies between countries and regions (differing in size, seed mixture and time period of scheme). A literature review comparing about 40 studies showed that insect abundances and diversity tended to be higher in sown wildflower strips than in other types of agri-environmental schemes such as sown grass margins and margins with natural regeneration. Nevertheless, pollen- and nectar-rich flower mixtures had often the highest bumblebee abundances and species richness. Insect groups were differently affected by certain characteristics of the strips such as flower abundance, seed mixture, vegetation structure, management, age and landscape factors. Several studies pointed out that it is mostly common species that benefit from wildflower strips. The findings from the literature review will be complemented with results from our studies on butterflies and bumblebees in wildflower strips in Sweden and Switzerland, where we studied the use of floral resources and could show that wildflower strips can support a substantial part of a regions butterfly species pool.

## **SY59.2.1**

### **Importance of Targeting AES in the Landscape**

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A number of recent studies have highlighted the importance of the surrounding landscape on the effectiveness of AESs. This has been demonstrated at two differing spatial scales. First, at the smaller, within-farm scale: for example, a positive relationship between non-cropped habitat and organism abundance is known to be important for a range of taxa, such as birds and moths. Thus, the extent of non-cropped habitat (and AESs) both within and between farms is likely to be an important determinant of the effect of AES management on biodiversity. Secondly, at a larger landscape scale, the effect of AESs on farmland biodiversity has been shown to be positively related to the extent of land under AESs in the surrounding landscape. For example, one recent study showed greater positive trends for a range of biodiversity measures, including birds, a range of invertebrates and plants, when there was a greater area under AES management at a 10 x 10 km scale. Thus, the extent of AESs within the landscape is likely to alter the potential outcomes of schemes, and logically this also means that placement of AESs in areas of high existing biodiversity is (in general) likely to yield greater gains.

## **SY59.2.2**

### **The Corn Bunting: Case Study of How AES Options Have Been Refined to Target Key Conservation Species**

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Corn buntings *Emberiza calandra* are one of the most severely declining farmland birds across Europe, at an average rate of 4% p.a. since 1980. Agri-environment schemes (AES) are the main policy tool for reversing such declines, but successes are rare and often hindered by a lack of monitoring. We measured breeding numbers of corn buntings over seven years (2003-2009) and 71 farms in eastern Scotland in responses to two schemes - one with general management for farmland birds, and one with adaptive, targeted management for corn buntings. On farms in the targeted AES, corn buntings increased by 5.6% p.a., but showed no significant change on farms in the general AES, and declined by 14.5% p.a. on control farms outside AES. In arable-dominated farmland, management options that increased food availability reversed population declines. However, where a high proportion of corn buntings nested in grasslands (mixed farmland), an additional option that delayed mowing was essential to achieving population increase. Overall, results suggest that three-quarters of the corn bunting population in mainland Scotland must receive highly targeted agri-environment management, backed by expert advice, to halt the national decline. In 2009, only a quarter of the population was targeted in this way.

## **SY59.2.3**

### **Effects of AE Land Management for Brown Hares in Switzerland**

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In Switzerland, brown hares have declined drastically due to intensive farming and increasing area development.

Since 1991, brown hares have been counted with spotlights in over 50 study areas across the Swiss lowland plateau, yielding an annual population index for the "Swiss brown hare monitoring". The population trend depends on the predominant land-use of the study area. In arable regions, densities of brown hares have been markedly higher than in grassland areas.

The latest analysis of the monitoring data revealed positive effects of two AE options, extensively managed meadows and low hedgerows.

In three model regions, habitat has been improved on several square-kilometres with targeted ecological compensation areas (ECA) for the brown hare such as set-asides, wildflower strips, extensively used hay meadows, low hedgerows etc. Increased hare densities could be observed after several years but only where a substantial part of the land (5-8%) had been ecologically enhanced.

To date, ecological quality and spatial distribution of many ECAs is still deficient. ECAs on open lowland farmland are lacking in most regions.

Keeping space open for farmland with its typical inhabitants will remain challenging. The brown hare is an ideal species to raise public awareness for the importance of sustainable land-use.

## **SY59.2.4**

### **How to Grow Hamsters with Agri-environment Schemes**

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The Common hamster (*Cricetus cricetus*) is a rodent, which inhabits arable land across Europe. Over the last decades, West European populations declined with more than 95%, which resulted in numerous local and regional extinctions. In the Netherlands a research and reintroduction project was started in 2002. The combination of research on the ecology of the species, monitoring, and translation of scientific results into practical Agri-environmental schemes (AES), resulted in a rapid population growth over the last ten years. Most important, the prescriptions of the AES have changed drastically during the project. At the start of the project the AES were very difficult to apply and ineffective and only a few farmers signed a contract. Nowadays the AES are simple, flexible and ecologically effective with positive effects on the Dutch hamster population and other threatened farmland species, especially farmland birds. The Dutch project is one of the few projects in Europe which shows positive results of AES on the target species.

## **HUNTING FOR SUSTAINABLE CONSERVATION**

### **SY60.1.1**

#### **Hunters as “Stewards of the Land”**

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Historically the relationship between hunters and environmentalists has been complicated, and often marked by conflict. Nevertheless, for many hunters, the idea of actively *care for* wildlife and the land, is crucial to their understanding of what hunting is about. One core thought is that nature is threatened and needs to be managed - not only for people's sake, but for nature's own sake. Among hunters there is also a notion of an ideal *balance* in nature. While this balance may once have been “natural”, hunting is now needed to sustain it. This engagement with wild animals is thought of as part of a deeper unity with nature, which means being *part of* nature in physical sense. This, according to hunters, distinguishes them from many conservationists, who are said to only *observe* nature. If we humans are to be part of nature, we must also engage with it, e.g. as predators, but also as caretakers, stewards. Despite differences, hunters and environmentalists share many thoughts and values. Both groups are for instance concerned with habitat loss and interested in protection of wildlife. The idea of stewardship that many hunters share, points to one potential platform for increased cooperation between the two groups.

## **SY60.1.2**

### **Hunting and the Reproduction of Working-class Culture**

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Participant observation and interviews with two groups of very young hunters (boys aged 15 to 21) in two semi-urban areas outside Oslo, Norway, demonstrated that for some youngsters with a working-class background and working-class occupational prospects, hunting may be an arena for the reproduction of typical male working-class culture - even in areas that are not typically rural. The hunting culture, such as these boys encounter it, is typically informal, collective, has a certain element of physical machismo and - not least - it represents a "productivist" perspective on human relations to nature and entails the mastery of "tools" like guns, GPS-units and even dogs. Importantly, the young informants expressed a deep admiration for their fathers and other male relatives (who were hunters) and their lifestyle, and exposed a strong sense of continuity across generations, unlike the popular notions of "disembedded identities" in the so-called post-industrial era. These findings support previous studies that have identified hunting as a core element in the reproduction of a male working-class culture in rural areas, particularly in times of social change that leads to the erosion of a traditional working-class labor market.

## **SY60.1.3**

### **Hunting, Social Structure and Human-nature Interactions in Lower Omo, Ethiopia: Implications for Wildlife Conservation**

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Hunting is often portrayed as the ultimate form of human-wildlife interaction, implying that hunters will use their understanding of wildlife to hunt in a sustainable manner. Drawing on our analysis of the cultural meaning of hunting in lower Omo, Ethiopia, we present here insights into a very different case. Based on qualitative methods (focus group discussions and interviews) we show how hunting allowed people to establish non-kin, enduring bonds with community members, and thus created social structure. Such human-human relationships were the defining element of our conversations about hunting in lower Omo. In contrast, relationships with wildlife, as often emphasised in Western contexts, were hardly discussed, even when explicitly probed. Potentially connected with this, our participants appeared rather helpless and despaired at the current loss of wildlife they observed, and could not see any means to halt the ongoing environmental degradation they were suffering from. Ironically, it might thus be that this focus on human-human relationships and the - potentially related - lacking means to conserve wildlife will ultimately lead to the demise of hunting activities, and thus of precisely this source of social structure so highly valued in lower Omo. We discuss implications of our findings for conservation interventions.

#### **SY60.1.4**

##### **Hunters and Conservation Biologists: Enemies or Bedfellows?**

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As EU policy struggles to achieve its biodiversity targets as well as embracing new policies such as green infrastructure and the mainstreaming of the ecosystem service paradigm it is timely to consider the potential alliances that can be formed between the diversity of stakeholders that exist. In addition there is a desperate need to examine potential models for sustainable forms of interaction between humans and biodiversity. Hunting is an age old activity that is still very active across Europe and is conducted across most of the land area of the European continent. Based on research conducted in the framework of an EU funded project, HUNTING for Sustainability I explore the potential for forming an alliance between hunters and conservationists as well as summarising some of the experience from our analysis of the overall sustainability of different hunting practices. In general it appears that there is a very large degree of overlap in goals set by both hunters and conservationists which offers a large scope for a productive alliance. In addition, there is much experience from the field of hunting that could be usefully transferred to other biodiversity issues. However, there are also clear areas of disagreement and conflict.

#### **SY60.1.5**

##### **Choice Modelling of Legal and Illegal Hunting in Scotland and Tanzania**

*Hanley N.*<sup>1</sup>, *Moro M.*<sup>1</sup>

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In this paper, we compare results from choice experiment studies of two very different contexts: legal hunting of red grouse on heather moorlands in Scotland, and illegal bushmeat hunting in the Western Serengeti in Tanzania. In the former case, we sampled recreationalists, the general public and hunters in order to compare their preferences for changes in land management (for example, in terms of the extent of burning and the management of raptors). In the latter case, we sought to understand the trade-offs that those engaged in illegal bushmeat hunting might be willing to make in order to reduce hunting activity, and thus reduce pressure on animal populations. We quantified the changes in cattle numbers and wage incomes that would result in a one-week reduction in illegal hunting. Taken together, the two studies illustrate the potential and limitations of valuation methods such as choice experiments for improving understanding of conservation issues related to hunting.

### **SY60.1.6**

#### **Application of Novel Approaches to Assess Sensitive Behaviours in Conservation**

*Nuno A.<sup>1</sup>, Bunnefeld N.<sup>1</sup>, Milner-Gulland E.J.<sup>1</sup>*

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Non-compliance with rules may undermine conservation success. Illegal harvest behaviour is a frequent source of implementation error (related to the translation of policy into practice) and has several environmental, economic and social implications. To devise effective strategies to reduce levels of illegal hunting, natural resource managers must thus be able to assess and monitor the extent of non-compliance, and information is often required on who engages in illegal hunting. Due to the sensitive nature of this activity, conventional survey techniques intended to provide data on illegal hunting may be inappropriate. The respondents may be unwilling to truthfully reply to incriminating questions and hunting estimates obtained are often inaccurate. To obtain more reliable estimates of rule-breaking behaviour, several disciplines have developed methods for answering sensitive questions that reduce survey response bias by ensuring respondent anonymity. Using illegal bushmeat hunting in the Western Serengeti as a case-study, we quantified non-compliant harvest behaviour using indirect questioning techniques and investigated the application of the unmatched-count technique (UCT) to identify sociodemographic characteristics of non-compliant households. The effectiveness and potential wider application of these techniques to obtain information on sensitive issues in conservation and natural resource management are discussed.

### **SY60.1.7**

#### **Tackling Conflicts between Hunting and Conservation**

*Redpath S.<sup>1</sup>*

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Across Europe, gamebird hunting is an important form of land use with a long history and rich traditions. Hunting and its associated practices provides important benefits to biodiversity, but it often finds itself in conflict with conservation over the illegal control of predators. In this talk I will explore the challenges of dealing with such conflicts, and consider the role of science, legislation and dialogue in finding a solution to this problem. Throughout, I will draw on the example of birds of prey and red grouse in the UK uplands, considering the causes of this conflict, the variety of alternative solutions that have been proposed, the barriers that have prevented resolution and the approaches currently employed to deal with the conflict.

### **SY60.1.8**

#### **Problems and Prospects of Using the Ecosystem Approach to Govern Hunting and Conservation**

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The Convention on Biological Diversity (CBD) defines its “strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way” as the Ecosystem Approach to management (EA). EA is supposed to contribute to the integration of conservation and sustainable use (including hunting) of biodiversity, thus bridging the gap between these two worldviews. However the operational guidelines, the 12 principles of the EA adopted in Malawi in 1998, seems to be difficult to apply in practice. There is thus still great uncertainty about the meaning of this approach, and to what extent it may contribute to the integration of different objectives from diverse stakeholders to be translated into policy. In spite of the lack of examples of the application of the EA it may be useful to begin to evaluate how the EA could be implemented. The purpose of this paper is to provide a brief overview of the current thinking regarding the ecosystem approach, giving consideration in particular to the problems and prospects of an ecosystem approach to moose management in Sweden.

# RESTORING THE NATURAL VALUES OF NORTHERN CONIFER FORESTS: APPROACHES AND TARGETS IN A TIME OF GLOBAL CHANGE

## **SY61.1.1**

### **Restoration of Northern Conifer Forests - Symposium Introduction**

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Except for some area in Western Russia, the vast majority of the conifer forests in Northern Europe have been heavily managed. Although delivering a steady and increasing flow of forest products this has resulted in a forest landscape composed of young, even aged stand composed dominated by a single tree species. As a consequence many of the structures, processes and species associated with natural forests are lost, representing a major threat to forest biodiversity in Northern Europe. In most regions the remaining area of natural forests are less than 10%. Given the newly established target of setting aside at least 17% of the land area in an ecological representative network of protected areas, conservation science and policy are facing a difficult challenge. It is evident that to reach the target, some kind of interventions and restoration activities are badly needed. This symposium will present the structural changes that have taken place, ongoing restoration activities and visions for the future. Global changes in land use and climate pose specific challenges for restoration since they question what target restoration should have - the historical landscape, present understanding on ecosystem function and processes or an anticipated but unknown future.

## **SY61.1.2**

### **Conceptual Unification of Restoration and Management**

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Restoration can be conceptualized using the two dimension space formed by ecosystem structure and ecosystem function. Degraded habitat in need of restoration is traditionally described as having both reduced structure and function in relation to some undisturbed reference habitat. The reference habitat can be called the target of the restoration. In this talk I will present a model unifying restoration and management under the same conceptual framework. I will argue that restoration and management are both manipulations of the habitats and that they can be distinguished by the target of the manipulation in relation to natural succession. I will also discuss the effect of natural succession and evolution on the target.

### **SY61.1.3**

#### **Natural Disturbance Emulation in Boreal Forest Restoration and Management**

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Natural disturbance emulation (NDE) has been proposed as a generic approach to forest restoration and ecologically sustainable forest management. We reviewed the theories and strategies related to NDE in boreal forest management. We also reviewed publications which dealt with NDE in the boreal forest in general, and those which specifically compared NDE-based management with conventional even-aged management. The reviewed literature showed a strong bias toward review/discussion-type papers in comparison to works presenting tangible results which evaluate the efficacy of NDE. The papers were also strongly focused on northern North America and dealt mainly with wildfire as the primary disturbance agent to be emulated. NDE studies from Eurasia were exclusively theoretical. We conclude that both the ecological and economic performance of NDE as a management approach still remains poorly examined. To advance the development of NDE attention should be given to: (1) Augmenting the knowledge base on natural range of variability of unmanaged forest ecosystems, and evaluating the validity of this information in a changing climate. (2) Proactively fostering multi-disciplinary research that spans the full extent of the spatial and temporal scales relevant for management. (3) Better integration of socioeconomic concerns and adaptive management schemes into NDE initiatives.

### **SY61.1.4**

#### **Baselines for Conservation and Restoration: How to Deal with Past Human Impact on the Present Environment**

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Conservation and restoration goals for boreal forest ecosystems are often defined by historical baseline conditions prior to industrial forest exploitation. Generally, old forests with few/no signs of logging are regarded as pristine and are therefore used as reference areas. This approach, however, is problematic, because it restricts human impacts to industrial logging, and ignores early commercial loggings as well as earlier forms of forest utilization. This presentation deals with problems and possibilities for establishing baseline data for forest conservation and restoration. The data presented are derived from studies carried out in late-successional forests in northern Sweden. Results show that minor forest utilization carried out centuries ago can have continuing and distinct effects on past and present vegetation composition, ecologically important habitat structures, and the overall diversity of forest communities. It is concluded that baseline data (a) can rarely be established from a fixed point in time, (b) should be collected from a large area since land-use legacies become more and more evident as scale increases, and (c) should not be used as a template, but rather as a guideline for conservation and restoration where history, present ecosystem properties, and potential future changes and conditions are all considered.

### **SY61.1.5**

#### **What do we Know about the Historical Occurrence of Structures, Biotopes and Disturbances Important for Biodiversity in Today's Forests?**

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Important biotopes, structures and disturbances for many species are missing, or are in low levels in many forests in northern Europe. As we judge these as deficiencies they must have been more common in the past. Old-growth forest reserves are important references, but are not an absolute mirror of past conditions. Paleoecological data can be an independent proxy for the occurrence and levels of important structures not possible to get from today's forests. In this review we investigate important structures for biodiversity using available paleoecological methodology and historical evidence. We conclude that there are robust paleoecological data for some features (e.g. forest composition and forest fires), whereas there is little or no data on others (e.g. large and old trees). We find that the full potential of available methodology for detecting these structures and features have not been used, and in particular, paleoentomology seems to be an underutilized source of information. The possibilities for successful reconstructions increase with studies specially designed for the purpose, preferably using several different techniques. A fruitful combination seems to be local pollen analysis in combination with one or several of the following; plant charcoal analysis, plant macrofossils, fossil beetles or dendrochronology.

### **SY61.1.6**

#### **Forest Dynamics and History of the Remnant Białowieża Forest**

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Białowieża Forest is often used as a reference ecosystem in the boreo-nemoral zone of Europe. Despite much ecological research little is known about its disturbance history. On permanent plots, changes in tree species composition have recently been recorded, including lack of *Pinus sylvestris* regeneration and substantial increase of late-successional species like *Carpinus betulus* and *Tilia cordata* and the decrease of *Picea abies*. Several explanations have been suggested for these changes, e.g. herbivore browsing, climate change, past human utilization or changes in soil chemistry. Until now, forest fires have rarely been addressed in this context. We hypothesize that fires were important in much of Białowieża Forest, in particular in stands with *P. sylvestris*. We apply dendroecological methods to test this. From *P. sylvestris* tree ring data obtained from cross sections and increment cores we were able to reconstruct fire history over the last ~ 375 years at two locations. We recorded very high (1-15 yrs) fire frequencies until the second half of 19th century. We conclude that there is a need to explore deeper the role of fire in the dynamics of this forest.

### **SY61.1.7**

#### **Trends for Indirect Forest Biodiversity Indicators Based on National Forest Inventory Data from the Last 85 Years**

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Long time series are usually not available to describe trends in species populations. As a substitute historical data from large scale sample-based forest inventories can be used to quantify change in key habitats and structures. We use data from the Swedish National Forest Inventory (NFI) from the last 85 years to create trends for a number of indirect forest biodiversity indicators, for example volume of hard dead wood, area of old deciduous forest and number of large trees. The data can be presented both as trends and as interpolated maps. There have been several changes in statistical design, inventory methods and definitions over the years. Analysis including data from 1983 to date is straightforward, but when studying a longer time period more harmonization effort is needed to perform comparisons. For example, protected forest was not included in the inventory before 2003 and only hard dead wood was measured before 1994. Older data and harmonized time series from the Swedish NFI will be made available for monitoring and research. Data from the Swedish NFI will be incorporated into the Swedish LifeWatch infrastructure to facilitate future species oriented analysis.

### **SY61.1.8**

#### **Management of Conservation of Biological Diversity in Nemoral Forests in the Boreo-Nemoral Zone - Historical Aspects in Latvia**

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The aims of the studies presented were to determine the level of naturalness of nemoral forests in Latvia, based on dimensions of structures, processes and species. It was found that many protected nemoral tree stands have poor structural quality, in relation to past human disturbance. In Latvia, nemoral tree species stands occur mostly on gleyed soils, and mixed coniferous/nemoral stands on podzolic soils. Despite the past human disturbance, their value for conservation of rare and protected species is very high. Investigation of the relationship between richness of specialist bryophyte species and structures in managed forests showed that conservation should be aimed at retaining the occurrence of large-diameter nemoral species and aspen in mixed woods. The study also showed that, although the amounts of coarse woody debris were high, there were insufficient amounts of large-diameter dead wood in later decay stages, causing low richness of epixylic species. Fragmentation and structural quality of nemoral forests were assessed by districts in Latvia, in relation to occurrence of epiphytic bryophytes and lichen. This allowed to prioritise conservation goals (e.g. restoration to increase structures; increase the area of mixed forest with aspen to increase connectivity of suitable substrate) by districts.

## **SY61.2.1**

### **Management Methods to Promote Favourable Conditions in Scottish Conifer Forests - Can We Use the Dynamics of Native Pinewoods as a Guide?**

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Forests in Scotland account for more than 17 per cent of the land area and are predominately composed of non-native conifers such as Sitka spruce (*Picea sitchensis*) managed as even-aged stands on short rotations. Recent investigations have shown that the biodiversity value of these forests is considerably increased by the presence of older and structurally diverse stands. However, manipulation (thinning) of plantation stands to increase structural diversity is complicated because of the risks of windthrow to forests growing in an Atlantic climate. To help the development of appropriate thinning regimes, we have carried out spatial analyses of tree distributions both in Sitka spruce plantations of different ages and in native Scots pine (*Pinus sylvestris*) stands ranging from even-aged structures to remnant 'old growth' stands. In broad terms, both forest types show a trend for regular spatial patterns in the younger stands which is replaced by a random pattern in older stands. Using competition indices to identify the more stable trees in a stand, we have devised thinning regimes which favour these trees and allow the transformation to a more irregular and diverse structure, with consequent benefits for forest biodiversity.

## **SY61.2.2**

### **Forestry Statistics Reveal Increased Structural Diversity in Swedish Production Forests Following Retention Actions at Clearcutting**

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The retention approach is becoming increasingly common within forestry globally, especially connected to clearcutting. The main action is to leave a proportion of living and dead trees unharvested at final logging, to benefit biodiversity and to sustain ecosystem functioning. We present the first national analysis on effects on structural components from the retention approach. In Sweden tree retention has been practiced for about two decades, prescribed by the law and a requirement in certification standards. By analyzing data from the Swedish National Forest Inventory we found that the volume of dead trees in stands 0-10 years old has doubled during 1996-2007, with a current average level of 8 m<sup>3</sup>ha<sup>-1</sup>, and with a larger increase rate in this age class than in other forest ages. Retained living trees decreased in quantity from 1955 until the early 1980's, with lowest levels of about 12 trees ha<sup>-1</sup> (5 ha<sup>-1</sup> excluding *Pinus sylvestris*, commonly used as a seed tree) and then increased again, approximately reaching the 1950's level by 2007, of about 25 trees ha<sup>-1</sup> (14 ha<sup>-1</sup> excluding *P. sylvestris*). Our study reveals that, although Swedish retention levels are only on average 3-5% of the harvested area, retention actions show off in forestry statistics.

### **SY61.2.3**

#### **Forest Restoration and Pest Management: Current Knowledge and Future Challenges**

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Restoration can affect many ecosystem processes, such as carbon dynamics, disturbance regimes, soil functioning and population dynamics. Some of these effects can be considered unwanted, i.e. side-effects of restoration. In forest ecosystems, possible increase in pest insect populations and the risk that they spread to the surrounding managed forests worries managers and affects public acceptance of restoration. This risk depends greatly on ecosystem and biotope characteristics, as well as on the particulars of the restoration activities. In European boreal forests, pest risk appears minor in pine-dominated forests, but can be significant in spruce-dominated forests. Pest outbreaks can also deteriorate the ecological quality of the protected area. Although the restoration-related pest risk can be assessed based on extant research on forest management and natural disturbances, the detailed knowledge about the pest risk after restoration activities is scarce. To reduce the pest risk, restoration actions should have habitat- and species-specific goals and their ecological consequences should be monitored. The ongoing climate change is one of the big challenges related to restoration, and there may already be examples of the climate-related increase in pest outbreaks after restoration.

### **SY61.2.4**

#### **Restoring Biodiversity Values in the Managed Boreal Landscape**

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Modern forest practice (clear-felling) creates even aged stands, with short rotation periods compared to naturally regenerated and developed stands. In combination with efficient fire protection, this has resulted in habitat degradation/fragmentation and a dramatic decrease in dead wood availability, especially large diameter wood and wood in later decay stages. Ultimately this has led to reduced population densities and species loss in Swedish forest ecosystems. To mitigate the negative effects on biodiversity, a range of conservation measures, based on legal demands or certification requirements are implemented in today's forestry management. However, it is now clear that this is not sufficient to maintain biodiversity in intensively managed forest landscapes. Restoration of forest habitats is a necessity. We have synthesized results from several large scale field experiments and the current knowledge collected from the literature to provide recommendations for future restoration strategies for saproxylic (wood living) organisms. Our synthesis suggests that mimicking natural disturbances, but also providing a variety of both substrate and habitat types as well as a continuity of dead wood input is important for maintaining saproxylic diversity. As a result of this we initiated a large-scale long-term field experiment in 2010-2011 where we put these theories to the test.

## **SY61.2.5**

### **Forest Restoration in Finland - Achievements and Unexpected Challenges**

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Ecological restoration of boreal conifer forests has become a major activity in Finland since 2003 when the Finnish Forest Biodiversity Programme METSO started. Since then, a total of 16,000 hectares of former commercial forests in conservation areas have been treated with restoration measures, including e.g. controlled burning, creation of dead wood and opening small canopy gaps to allow deciduous trees to establish in conifer stands. Of the restoration measures, burning has proved to be ecologically effective. The first restoration burning in Europe took place in Patvinsuo NP in Finland in 1989. Monitoring of polypore communities at the burnt sites for 21 years has revealed a significant increase in the number of species, as well as in the number of red-listed species. Several studies have also emphasized the importance of burnt sites for the diversity of beetles and other insects, and, according to some recent data, burning facilitates the establishment of tree seedlings in restored areas. Artificial creation of dead wood, however, seems to involve some unexpected ecological challenges, including the effects of wood quality on decayer communities, and increased risk of bark beetle outbreaks due to warming climate. Careful ecological evaluation of different restoration methods is urgently needed.

## **SY61.2.6**

### **Disturbance Ecology and the Management of Subalpine Spruce Stands in Central Europe: Can We Take Advantage of Natural Disturbances to Make the Forest More Natural?**

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Two most important natural disturbances in subalpine spruce forests are: wind and outbreaks of bark beetles, which are often triggered by large-scale windthrows. Recently the bark beetle outbreaks occurred over vast areas in mountain ranges of Central Europe, causing a lot of problems. In some national parks or forest reserves the stands after outbreaks have been left without any direct intervention. In most of the managed stands, and even in some national parks, extensive salvage logging took place. Even within the managed stands of the West Carpathians in selected areas dead trees were left, and the regeneration was expected to be mostly natural. Apart from the released advance regeneration of spruce, occurring mostly in patches, the pioneer species, especially rowan and willows, will form the next generation of trees. Such areas, called reference plots, can serve as a kind of control to the traditional forest management scheme; replanting trees after salvage logging. Leaving dead trees dramatically increases the amount of snags and coarse woody debris and introduces structural heterogeneity to the forest; that could be later amplified by natural regeneration processes, which are also spatially heterogeneous and occur over longer time, creating opportunity to produce structurally diverse uneven-aged tree stands.

## **SY61.2.7**

### **Dynamics of Coarse Woody Debris (CWD) in Pristine European Boreal Forests: Implications for Restoration**

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Our objective was to examine natural CWD dynamics to provide a baseline for dead wood addition as a restoration measure. The long-term reconstructions of CWD inputs (tree mortality) and outputs (decomposition) were made in pristine boreal forest landscapes in the Central Biosphere forest reserve, Vepssky forest, Kenozersky and Paanajärvi national parks and Gridino reserve in Russia. A gradient from relatively constant mortality due to natural tree senescence and competition to episodic disturbance-caused mortality led to high landscape-level temporal and spatial CWD diversity. The decomposition rate of CWD was influenced mainly by the mode of tree mortality: standing dead, uprooting and stem breakage. In pristine forests, the dominance of the slowly decomposing CWD types (such as snags and leaning logs) increases the overall turnover time of CWD. The Shannon index for CWD decay class and tree species distributions varied from 0.323 to 2.249 and from 0.021 to 0.568, respectively. The minimum CWD volume in Norway spruce and Scots pine dominated forests was 43 m<sup>3</sup> ha<sup>-1</sup> in and 47 m<sup>3</sup> ha<sup>-1</sup>, respectively. High availability and variability of CWD and its continuity in pristine landscapes should be taken into account when setting stand- and landscape level restoration targets.

## **MANAGING DISEASE INTERACTION AMONG DOMESTIC AND WILD SPECIES: NEW TOOLS FOR ANIMAL HEALTH AND WILDLIFE CONSERVATION.**

### **SY62.1.2**

#### **Global Patterns of Parasite Sharing among Domestic and Wild Ungulates: Who, What and Where?**

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Infectious diseases can pose a risk to the viability of wildlife populations and represent a significant economic burden for animal production. Importantly, parasites can infect both wild and domestic species, creating serious management challenges. While this phenomenon is well-studied in some exemplary systems (e.g. rabies, bovine TB), the ecological drivers and extent of parasite sharing on a global scale remain poorly understood. Using two complimentary host/parasite databases, we quantify sharing of disease-causing organisms in wild and domestic ungulates and identify underlying ecological, genetic and environmental factors. Based on >4000 parasite records in wild species, we show that >75% of wild hosts are reported to have parasites also found in domesticated hosts. Those without shared parasites tend to be less well-studied, suggesting that sharing is ubiquitous and might apply to all wild ungulates. Accounting for reporting effort, host geographic range and relatedness to domestic species are positively correlated with pathogen sharing, a pattern seen across parasite groups except viruses. Parasite records are predominantly confined to 3 geographic areas highlighting the importance of surveillance effort. This approach provides a basis for understanding the potential for cross-species transmission of disease-causing organisms, with application for developing better targeted surveillance at the domestic-wildlife interface.

### **SY62.1.3**

#### **Disease in the 'New West': Brucellosis Increases in Elk Populations of the Greater Yellowstone Ecosystem**

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Many harvested species have recovered from the exploitation of the early 1900's in the United States, but limited data exist that link these changes to increases in disease. We analyzed how changes in elk (*Cervus elaphus*) populations and aggregation patterns may be affecting the dynamics of brucellosis in the Greater Yellowstone Ecosystem (GYE) using statistical and mechanistic modeling approaches. Cattle herds in Montana, Idaho and Wyoming have been infected by brucellosis over the past several years, and the available data suggest that elk are the most likely source. The historically low seroprevalence of brucellosis in elk populations fostered a consensus that *Brucella abortus* is not self-sustaining in elk populations that do not concentrate on supplemental feedgrounds or share winter range with bison. We show how increasing brucellosis in elk is correlated with elk density at a variety of scales and argue that the status of free-ranging elk as a viable reservoir for brucellosis has changed as their populations increase in number and density. Addressing the unintended consequences of successful conservation efforts in the 'New West' is complicated by limited hunter access to private lands that places many ungulate populations out of administrative control.

### **SY62.1.4**

#### **Understanding Patterns of Foot-and-Mouth Disease Infection in Livestock and Wildlife Populations in Africa to Develop Approaches for its Control**

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Foot-and-mouth disease (FMD) is probably the most important disease of livestock in terms of economic burden. In endemic areas the implications for livestock productivity are very severe, with the most dramatic impacts on communities relying heavily on livestock production for their livelihood, as in much of rural Africa. Many uncertainties remain about the epidemiology of FMD in Africa. An important question of particular relevance for livestock-keeping communities living at the wildlife-livestock interface relates to the role of potential wildlife reservoirs in livestock outbreaks. In southern Africa, buffalo have been implicated as maintenance hosts of some serotypes and approaches to controlling risks to livestock have relied upon game fences to separate livestock and wildlife. In other parts of Africa the construction of fences is however not considered an acceptable disease management strategy because of their considerably negative ecological impacts. Here we present data from cross-sectional surveys of livestock herds in pastoral and agro-pastoral communities living adjacent to a range of protected-areas systems in northern Tanzania, and of buffalo populations living within the protected areas. We use the results to formulate hypotheses for FMD reservoirs in Tanzania and to discuss environmentally-sensitive approaches for FMD control around East Africa's protected wildlife areas.

## **SY62.1.5**

### **Unravelling the Fine-scale Transmission of Bovine Tuberculosis among Cattle and Badgers**

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Bovine tuberculosis (bTB) poses a major health and economic problem in many areas of the world. Where eradication programmes have failed, infection in a wildlife reservoir is often implicated. One such example is the British Isles, where infection in the Eurasian badger *Meles meles* has been strongly linked to bTB in cattle. Despite extensive research effort involving laboratory studies, ecology, epidemiology and large-scale intervention trials, the exact role of the badger in bTB remains not only unclear but also mired in controversy. Here we present recent work using whole genome sequences of *Mycobacterium bovis*, the causal agent of bTB, to elucidate transmission dynamics among cattle and badgers at the farm scale. Combining these molecular data with detailed information on cattle birth, death and movement, we are able to identify with unprecedented resolution the fine spatial and temporal scales at which the pathogen is transferred between the two hosts, and thus demonstrate the predominance of local processes in bTB persistence. Extending our approach to bTB in the British Isles more widely should enable valuable progress to be made in understanding and quantifying the role of badgers as a wildlife reservoir, and the risk they pose for the disease in cattle.

## **SY62.1.6**

### **Big Cats and Small Dogs: Emergence of Canine Distemper Virus in Wild Amur Tigers**

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Canine distemper virus (CDV) has emerged as a cause of mortality in Amur tigers (*Panthera tigris altaica*) in the Russian Far East. Following the case of a female in Khabarovski Krai (province) in November 2003, two further cases were confirmed in the Sikhote Alin Biosphere Zapovednik (SABZ) in 2010, and more are suspected. The absence of serum antibodies to CDV among tigers captured prior to 2000 suggests that the virus may have recently emerged in the Amur tiger population. Tiger numbers within SABZ have dropped dramatically over the past three years, and those territories formerly occupied by study animals remained unoccupied for at least a year, considerably longer than would be expected in a healthy population of tigers. No increase in poaching has been reported in SABZ throughout this period, and while evidence is circumstantial, it is possible that infectious disease has contributed to more tiger deaths than has been recognized. Tiger populations are too low to maintain CDV infections. However, CDV affects a large number of other carnivore hosts; therefore, identifying which species are responsible for maintaining infection and transmitting disease to the tiger population is central to designing appropriate interventions.

# APPLYING CONSERVATION BIOLOGY KNOWLEDGE ACROSS THE TEMPERATE AGRICULTURAL GRASSLANDS OF NW EUROPE

## SY63.1.1

### Introduction: Will Grassland Measures for Birds Developed in England Work Elsewhere?

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Farmland birds have experienced marked range losses in the grassland-dominated, livestock-rearing regions of western Britain. Research in England has focussed on developing remedial measures for the species-poor and agriculturally improved grasslands that predominate in lowland farmland. Conservation measures have been developed to provide winter seed sources, invertebrate prey sources for the breeding season and nesting habitat for ground-nesting species. This research forms part of a larger programme of mechanistic research into grassland ecology, supporting the English agri-environment schemes.

Some of the conservation measures and mechanistic understanding can be applied to other grassland habitats and to other regions. An ongoing challenge to UK conservationists is to develop grassland measures for the Atlantic fringe countries. This exercise highlights opportunities and constraints on sharing knowledge between regions, which have wider relevance for the conservation of other taxonomic groups. We will highlight how the success of grassland bird measures is sensitive to the phenology of birds and agricultural practices, limiting the value of some English measures in northerly countries like Scotland. The east-west rainfall gradient and differences in agricultural intensity and grassland composition are also influential, but these processes may be less limiting for farmland birds, compared to other taxa.

## SY63.1.2

### Accumulative Effects of Reduced Grazing Intensity on the Vegetation and Invertebrates of Pastures in England

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The decline in farmland bird populations in the pastoral landscape of western Europe is well documented. Intensive grazing management systems limit the establishment of forbs and prevent the completion of plant and invertebrate life cycles. The lack of invertebrate prey on intensively-grazed systems can limit reproductive success in farmland birds and is a potential cause of population decline. An increase in sward height and heterogeneity may enhance food availability for a range of priority farmland bird species.

A four year experiment tested the impacts of lenient early-season grazing followed by early cessation of grazing on sward structure and invertebrate communities on semi-improved grassland. Lenient early-season grazing increased total invertebrate abundance, the most responsive groups being; Araneae, Auchenorrhyncha, Collembola and Heteroptera. Early cessation of grazing led to litter accumulation and changes in plant species composition resulting in reduced agricultural productivity. A decline in sward heterogeneity may have inhibited access to invertebrate prey for foraging birds. Lenient early season grazing allows the enhancement of invertebrate communities in semi-improved grasslands and subsequently provides supporting services for higher taxa. However, future studies should consider reduced intensity grazing maintained throughout the growing season in order to avoid undesired changes in agricultural sward quality.

### **SY63.1.3**

#### **Restoration of Species-rich Grassland to Enhance Biodiversity and Ecosystem Services: Research from the UK Agri-environment Schemes**

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Grasslands have a critically important role in supporting biodiversity and increasing delivery of ecosystem services. A significant proportion of the grassland in the UK and elsewhere in Europe is managed under the agri-environment schemes. In this paper we summarise the findings of a 10 year research and monitoring programme on grassland restoration and management that underpins agri-environmental policies, including: i) the importance of species-rich grasslands for conserving biodiversity and providing ecosystem services; ii) the constraints on restoring diversity to productive grasslands; iii) the selection of key functional species for restoration; iv) techniques to create regeneration niches for the establishment of demanding grassland species; v) the control of competition to facilitate establishment of desirable plant species; and vi) the role of restoration of grassland diversity in enhancing ecosystem function and ecosystem services. We conclude that grassland restoration methods are well-developed, but there are issues with completely restoring diversity, and the impacts on ecosystem services that require further research.

### **SY63.1.4**

#### **Invertebrate Ecology in the Development of English Agri-environment Measures**

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Invertebrates represent a key component of native agricultural biodiversity, providing ecosystem service delivery while supporting complex food chains and providing resources for higher trophic levels, such as birds. Throughout N.W. Europe, management intensification has led to wide scale declines in their abundance, species richness and functional diversity in grasslands. Agri-environment schemes represent a policy mechanism that can be used to support invertebrate communities in grassland systems, although they have typically been developed with multiple goals in mind. Their utility for invertebrates must therefore be integrated in the context of these diverse aims. Here we summarise 10 years of research into the development of UK based agri-environmental schemes. We divide these schemes into two principal sections, those intended to achieve simple enhancement of biodiversity across large spatial scales and complex practices aimed at recreating whole communities lost to intensification. How targeted local management practices are limited by their context within wider landscapes is considered, in particular the implications of dispersal limitation during restoration. Finally, we consider how a mechanistic understanding of factors limiting invertebrate colonisation and persistence within English agri-environment schemes can provide an evidence base for supporting biodiversity in a wider Northern European context.

### **SY63.1.5**

#### **Biodiversity Effects on Carbon Sequestration in UK Grasslands**

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Grasslands soils are important for a range of ecosystem services, including carbon storage. Recent evidence suggests that managing grasslands for high species diversity has the potential to increase soil carbon sequestration as well as being valuable for biodiversity conservation. We present results from a UK grassland survey of soils to a depth of 1 m, comparing soils from different grassland types and varying levels of management intensity. We show that soil carbon storage varies with depth and with management intensity. Greatest carbon storage was found to be in grasslands with an intermediate level of management intensity, and lowest carbon storage in intensively managed low diversity grasslands. We also show from soil fractionations that the greatest differences in carbon storage are in the most labile soil fractions. Our findings highlight the importance of high diversity grasslands to UK carbon storage, and the potential for management of carbon stocks alongside biodiversity in grassland ecosystems.

### **SY63.1.6**

#### **Conserving Grassland Butterflies Through Agri-environment Schemes in England**

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Grasslands are vitally important for butterflies in England, providing breeding habitat for more than 90% of species. Agri-environment schemes are a key tool for conserving grassland butterflies, with management agreements in place on the majority of important sites. Since 2006, the English Government has adopted population of butterflies as an indicator of the health of biodiversity on agriculturally managed grasslands. The indicator shows that grassland butterflies are in crisis, with habitat specialist and more widespread species declining in abundance respectively by 39% and 72% since 1990.

Periodic assessments have been made over the last decade of the impacts of agri-environment schemes on butterfly populations in England using data from approximately 900 butterfly Monitoring Scheme (UKBMS) sites. The results are mixed. Overall, habitat specialist species have consistently fared better at semi-natural sites entered into higher level agri-environment schemes. Highly targeted conservation efforts has benefited threatened species such as the Marsh Fritillary and Large Blue whilst more general conservation management has proved damaging for some species with differing requirements including the Duke of Burgundy. As yet there is little evidence to show that conservation measures through entry level schemes are benefiting butterflies in the general countryside.

### **SY63.1.7**

#### **Developing Grassland Conservation Measures in a Northern Atlantic Fringe Country: Issues, Opportunities and Constraints**

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Grassland in all its forms accounts for 68% (i.e. c. 12.4 million ha) of the total Utilised Agricultural Area (UAA) in the United Kingdom. Excluding all forms of rough grazing, lowland permanent (>5 years old) and temporary (< 5 years old) grasslands comprises 19%, 38%, 64% and 79%, of UAA in Scotland, England, Wales and Northern Ireland, respectively. The intensity of management of these lowland grasslands, and the fact that such grasslands dominate lowland landscapes in the west of the UK, means that there are now few opportunities for many plants, invertebrates or birds to survive. Diffuse pollution (resulting from the run-off of livestock faeces and nutrients applied to farmland) has also adversely impacted water quality (both freshwater and coastal waters) in such lowland, grassland-dominated landscapes. This presentation provides an overview of research conducted on dairy farms in south-west Scotland into the factors affecting the plant, invertebrate and bird biodiversity value associated with intensively managed grasslands and the buffer strips established to prevent diffuse pollution from those farms. It will also consider what other conservation actions are required on such farms and how applicable measures developed elsewhere in the UK and Europe may be in a south-west Scotland.

### **SY63.1.8**

#### **Plant and Invertebrate Diversity of Experimental Field Margin Habitats Within Intensive Grassland Systems**

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Field margin management is a common measure in agri-environment scheme, however, establishment and subsequent management of grassland field margins is not well researched. This experiment investigated methods of successful establishment and management of botanical diversity in intensive field margins and the response of invertebrate communities using emergence traps. A replicated split-plot field margin experiment was established in 2002 on a dairy farm in SE Ireland. Experimental margins were established using three methods: fencing, natural regeneration and reseeding with a grass and herb mixture, at three margin widths. Grazing was introduced one year after establishment. Emergence of Araneae, Hemiptera and parasitic Hymenoptera was monitored. Establishment method, width, and grazing had a significant affect on plant species richness. Reseeded plots had the highest species richness over all sampling periods ( $p < 0.0001$ ). Soil seed bank was a limiting factor in the establishment of botanically diverse field margins. A reduction in grazing pressure lead to increased invertebrate diversity ( $p < 0.0001$ ) and abundance ( $p = 0.003$ ). No single establishment treatment was best for overall invertebrate abundance and richness, as each taxa responded differently. Under these conditions propagule addition was required to enhance plant diversity and reduced grazing pressure was required to enhance invertebrate abundance and diversity.

### **SY63.2.1**

#### **Does Delaying the First Mowing Date Benefit Biodiversity in Meadowland? A Meta-analysis**

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Meadow are regularly mown in order to provide fodder or litter for livestock and to prevent vegetation succession. However, the time at which meadows should be first mown in order to maximize biological diversity remains ill-understood and may vary with respect to context and focal taxa. We carried out a meta-analysis on the effects of delaying the first mowing date upon plants and invertebrates in European farmland meadows. Plant species richness reacted differently according to the postponing schedule. Delaying mowing from spring to summer had a positive effect, while delaying either from spring to fall, or from early summer to later in the season had a negative effect. Invertebrates were expected to show a strong response to delayed mowing due to their dependence on sward structure, but only species richness showed a clear significant positive response. Invertebrate abundance was positively influenced only in a few studies. Overall, there was also a strong between-study heterogeneity, pointing out to other major confounding factors that require larger sample sizes to be investigated, i.e. further field experimentations (e.g. taxon-specific and meadow-type-specific response).

### **SY63.2.2**

#### **Temporal Changes in Mowing Regimes of Extensively Managed Meadows Boost the Abundance of Wild Bee Pollinators (Hymenoptera: Apoidea)**

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Wild bee biodiversity in European farmland suffer from the intensification of the post-war agriculture practices, and yet rarely benefit from Agri-Environment Schemes (AES). In our project we experimentally investigated if spatio-temporal management changes in the most important Swiss AES, that is extensively managed meadows, can promote wild bee biodiversity. For that, a randomized block design including three different mowing regimes (12 replicates) was implemented within lowland extensively managed meadows: i) first cut not before June 15 but with 10% of area left uncut, ii) first cut not before July 15, iii) first cut not before June 15 (control). Wild pollinators were collected twice with pan traps. Meadows with uncut refuges harboured higher abundance of pollinators than meadows without refuges (control and delayed mowing regimes). The effect was stronger with the samples collected before mowing, as a result of last year implementation. A short term positive effect of delayed mowing could also be evidenced. The benefits of Swiss AES for wild bees, i.e. for an ecosystem service as essential as pollination, could be improved at low cost, by modifying spatio-temporal mowing regimes. Extant prescriptions could accommodate such changes in farming practices. These results have implications for grassland management beyond Switzerland.

### **SY63.2.3**

#### **Grassland Birds Impacted by the Intensification of Farming Practices: How to Manage Alpine Meadows for Whinchat Conservation?**

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The intensification of agricultural practices in Western European farmland has led to a dramatic decline of bird populations within the last decades. The Whinchat (*Saxicola rubetra*), an emblematic ground-nesting passerine of traditional meadowland, has suffered from this recent development and is currently undergoing a tragic decline in its healthiest population in Western Europe, the Alps. This is mainly attributable to a recent acceleration of the intensification of farming practices in mountainous areas. The mechanism behind this widespread demographic collapse is twofold: The intensification of grasslands lowers breeding success due to a reduced food supply to the chicks and leads to earlier and more frequent grass cuts that overlap with the Whinchats' breeding cycle, thereby mechanically killing brooding females and fledglings in the nest or hidden among the grass. The relative and absolute importance of both mechanisms may vary according to the degree of intensification, grassland type and sun exposition. Here, we summarize our current knowledge about the ecological requirements of the Alpine Whinchat populations, pointing to gaps in knowledge that should be addressed to refine evidence-based management recommendations.

### **SY63.2.4**

#### **How Does Grassland Management Affect Bird Diversity? Comparing an Eastern with a Western European Country**

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Decline of grassland species diversity due to management intensity has been shown in several taxa both at local and landscape scales. In 2003 we surveyed birds on 21 pairs of extensively (~0.5 cow/ha) and intensively (~1 cow/ha) grazed semi-natural grasslands in Hungary. In 2008 we compared bird species richness and abundances of 10 pairs of organic and conventional fertile mown meadows in Central Germany. In Hungary the local scale management positively affected the species richness and abundance of ground nesting birds (also the frequent species, Skylark and Yellow Wagtail), but it did not enhance the non-ground nesting birds. At landscape scale, no effect was found on either group of birds, which means that the amount of semi-natural grasslands in the landscape was not a limiting factor. In Germany, local management positively influenced only the abundance of ground-nesting birds, but among them mainly the dominant Yellowhammer (breeds at the edges) and not the Skylark, whose breeding is often prohibited by frequent mowing independent of the management regime. Finally, Skylarks were negatively affected by the amount of semi-natural areas, which were composed mainly of forests. In summary different type of semi-natural habitats (grassland vs. forest) differently affect the farmland bird communities.

### **SY63.2.5**

#### **Using Low-diversity Regional Seed Mixtures in Large-scale Grassland Recovery and Weed Suppression: A Promising Example from Hungary**

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Sowing of low-diversity seed mixtures is a recommended restoration technique when quick recovery of perennial grassland vegetation and weed suppression are priority objectives. Both objectives have become increasingly important in Central and Eastern Europe because of the recently high rate of abandonment of arable lands. Our aim was to test the usefulness of sowing alkali and loess seed mixtures of two or three grass species, respectively, followed by annual mowing in weed suppression and recovery of grassland vegetation in 17 former crop fields. We found that a vegetation dominated by grasses can be recovered in three years. The rapidly forming cover of sown grasses effectively suppressed the germination and development of short-lived weeds from the second year after restoration, although a dense seed bank of short-lived weeds accentuated the possibility of later infestation by short-lived weeds. In several alkali restorations, a high proportion of perennial weeds was detected even in Year 3. In loess restorations, however, much lower cover scores were typical. Our findings indicate that in a large-scale grassland restoration where different seed mixtures are applied in sites with different history, carefully designed actions fine-tuned to address specific threats at the site level are necessary.

### **SY63.2.6**

#### **The Effects of Intensive Management, Shrub Cover and Land Conversion of Semi-natural Grasslands on Farmland Birds in Bulgaria: A Bad Experience of a Recent EU Member State**

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The recent set of wild bird indicators in Europe shows that many farmland species have continued to decline. A major tool to stop and reverse the negative trends in farmland bird populations is the National Agri-environment schemes (AES). The present study shares a bad experience of applying the AES in a recent EU member state without being synchronized with the Good Agricultural and Environment Condition (GAEC) standards. In 2009-2010, we investigated the effect on farmland birds of some GAEC standards in Bulgaria, related to semi-natural grassland management and implemented in a “copy-paste” manner: removal of shrubs within pastures, land intensification, and secondary semi-natural grasslands conversion to arable lands. It was demonstrated that studied standards may result in avian diversity loss, while extensive management, high level of habitat heterogeneity and non-conversion of semi-natural grasslands (promoted by the AES) were proved as beneficial for farmland bird communities. Sustainable semi-natural grassland management could be achieved by providing flexible GAEC standards at regional and national level, which to be tested and adapted to the local biodiversity and socio-economic conditions. Regarding protected areas, this could be achieved by elaboration of management plans and zoning of agricultural activities at local scale.

## **SY63.2.7**

### **The Inefficiency of Recent Protected Grassland Reserves for the Long Term Survival of the Endangered Lesser-Grey Shrike under Different Climate Change Scenarios**

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Europe has known a long history of habitat alterations, primarily creating landscapes for agricultural use. During the last century however, the demand for higher yield caused large declines in semi-natural grasslands, thus creating a need for their protection. By using a bird species as conservation target/indicator, we would like to test the short and long-term suitability of site-based conservation effort in grassland habitats under different climate-change scenarios. The Lesser-grey Shrike (*Lanius minor*) is globally threatened dry grassland specialist, with its European population concentrated in Romania. We created a distribution model and several different statistical models, based on GLM and MARS. Using climate change scenarios we tried to model the changes in geographical distribution of dry grasslands in Romania, on two time scales (2020 vs. 2050) and to assess the efficiency of site-based conservation (Natura2000 sites). Under both scenarios, two-third of the seminatural grasslands will be out of the recent protected area system by 2050. Small protected areas will loose more habitats than larger ones, irrespective of the Lesser-grey Shrike populations breeding therein. These results suggest that current site-based protection measures will become largely insufficient for the conservation of semi-natural grasslands and the associated biodiversity at long term in Romania.

## **THE EMERGENCE OF SCALES IN CONSERVATION BIOLOGY: TOWARD BETTER MATCHING BETWEEN CONSERVATION POLICY AND THE SCALES OF ECOLOGICAL PROCESSES.**

### **SY64.1.1**

#### **The Emerging Field of Scales: Challenges and Recent Achievements**

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Why do we keep losing biodiversity? One of the answers relates to the scale at which we view the world. At the large scale we may attribute biodiversity loss to climate change, while at other scales the dominant drivers may be habitat loss, fragmentation or disturbance. Moreover, some drivers are scale-invariant, i.e., they show the same intensity and spatial evenness, when moving from the European to local scales, whereas others change in a non-linear way. Biological processes are also scale-dependent. For example, if the same data on trends of a species is analysed at different scales, the species may increase at one but decrease at another scale. Biodiversity conservation and landscape management will only be effective if we understand how problems and solutions change with scale. Matching the scale of biological processes and management or policy is still a major challenge. For example, conservation priorities often change with the administrative level, and ignorance of scales may lead to inappropriate allocation of rare conservation resources. This presentation provides a conceptual introduction into the challenges of scale in biodiversity conservation and a summary of some recent advances as a background to the following presentations in this symposium

## **SY64.1.2**

### **Coincidence of Anthropogenic Pressure Hotspots and Fragmentation Hotspots across Europe at Multiple Spatial Scales**

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With a world population which has just exceeded 7 billion, the pressures that humans exert on the natural environment are extensive. The distribution of these pressures and the anthropogenic drivers that create them can become intensively concentrated in locations such as cities, holiday resorts, or areas of primary productivity. Anthropogenic drivers can result in landscape changes such as habitat loss and fragmentation, which in turn are associated with biodiversity loss. In order to address this, the spatial association between drivers and landscape changes were examined, with a view to identifying specific drivers that cause such changes. The spatial distribution and pressure of drivers across Europe at various NUTS scales (European Nomenclature of Territorial Units for Statistics) were mapped, as was the intensity of fragmentation within the Corine Land Cover Map 2006. A comparison of the two datasets was carried out. Results demonstrate that fragmentation is highly correlated with the intensity of certain anthropogenic drivers; however, limited correlation was shown for others. Associations were demonstrated at multiple NUTS scales. This indicates how some anthropogenic drivers are disproportionately associated with fragmentation hotspots. By reducing the pressure of those drivers which are highly correlated with fragmentation, benefits for biodiversity could be attained.

## **SY64.1.3**

### **Scaling Up and Down: Measuring and Managing Biodiversity Dynamics across Multiple Spatial Scales**

*Kunin W.E.<sup>1</sup>, Azaele S.<sup>1</sup>, Gunton R.<sup>1</sup>*

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The diversity of ecological communities is inherently linked to scale; most monitoring and management focusses on fine scale (alpha) diversity, but often it is coarser scale (national or global) diversity that is our primary concern. In recent years, a number of tools have been developed that allow sets of fine scale point measurements to be "up-scaled" to estimate coarser scale species-richness, and conversely to estimate local population densities from coarser scale distributions. We will assess the performance of some of the most promising of these methods, and show how new approaches under development can improve predictions. We will demonstrate how the turnover of species across space can vary with spatial scale, and how these changes can be measured and understood.

## **SY64.1.4**

### **Ecological Risk across Scales: The Quest for Rules of Thumb**

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Traditional research in identifying and quantifying ecological risks are limited to either (a) selected species (b) specific sources of risk (i.e. toxicants, invasions). Current research underpins the increasing role of scale (spatial and temporal) in exploring and quantifying ecological risks. The issue of a cross scale approach where possible emergent properties relevant to the scale of consideration are present is not yet explored. An integrated framework regarding the selection and application of the metrics or variables explored is also missing. In our study after a comprehensive review of the literature and hierarchical analysis of the results a protocol for assessing scale effects in ecological risk assessment is proposed. An example using a mathematical model for the extinction risk of a colony of birds to test the effect of variable spatial scale is also presented.

## **SY64.1.5**

### **A Multi-scale Concept of Functional Connectivity: Moving Beyond the Realms of the Species for Better Support of Conservation Planning**

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Functional connectivity refers to the question how spatial and behavioral factors interact to determine whether habitat patches are connected from the perspective of a species. Despite many achievements and tools for studying and measuring functional connectivity, we show that the concept is overly ambiguous and complex, and its application is overly narrow and remote from the multi-scale nature of conservation planning and decision-making. Studies of functional connectivity tend to focus on dispersal movements despite the variety of movement types existing; they focus on animals and on terrestrial landscapes; often they simplify landscapes into habitat patches; and most importantly, they tend to focus on the level of single species, whereas the “functionality” of landscapes can easily apply to various scales, from individuals and populations to communities, ecosystems, flows, and services. A multi-scale concept of connectivity can expand its application to new scopes of policy and planning, such as the design of Green Infrastructure. This may seem complex to implement, yet we show that simple landscape measures, combined with dynamic simulation models, can yield high predictive capacity. The trick is to ensure awareness to the question what elements of functional connectivity a given tool actually predicts, and what ecological utilities it covers.

## **SY64.1.6**

### **Novel Applications of the National Responsibility Tools for Species and Habitat**

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Resources for biodiversity conservation remain scarce, requiring prioritization of conservation efforts. In contrast to species, for which a range of different approaches have been developed much fewer methods are available for habitats. In applied conservation, red lists are the most commonly used tool for conservation assessment as they explain the complex phenomenon “endangerment” in a simple way. However, red lists may at best be a suboptimal tool for setting conservation priorities as the threat status does not always reflect actual conservation needs. That is especially true from an international point of view, from which it is clearly more desirable to focus national conservation efforts on the habitat types and species centred in the respective country. The assessment of national responsibilities covers the notion of importance of a region for the conservation of biodiversity in respect to its irreplaceability. Hence, national responsibility serves as a proxy for measuring the probability of global persistence for a given habitat, when a habitat or species of the focal area is lost. Here, I present such a method for both species and habitats, applied to amphibian species and forest habitats. The results are highly comparable between countries and can be applied across variable scales.

## **SY64.1.7**

### **Modelling Species' Distributional Shifts: The Importance of Spatial Scales**

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Dynamic simulation models are a promising tool for assessing how species respond to habitat fragmentation and climate change. However, sensitivity of their outputs to impacts of scale and resolution is insufficiently known. We demonstrate an inherent risk of substantial biases resulting from choices relating to the resolution at which key patterns and processes are modelled. Increasing cell size leads to overestimating dispersal distances, the extent of the range shift and population size. Overestimation accelerates with cell size for species with short dispersal capacity, and is particularly severe in highly fragmented landscapes. The overestimation results from three main interacting sources: homogenization of spatial information, alteration of dispersal kernels, and stabilization/aggregation of population dynamics. We urge for caution in selecting the spatial scale and resolution used in dynamic simulations and other predictive models and highlight the urgent need to develop upscaling methods that maintain important patterns and processes at fine scales.

## **SY64.2.1**

### **Scale-specificity of Current Conservation Strategies**

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Different strategies for conserving biodiversity may be suitable for applying over different spatial extents, as highlighted by a recent proliferation of scale-explicit studies. We reviewed articles published in eight conservation journals to elucidate the scale-specificity of current conservation strategies. Filtering to four major strategies and four biodiversity features yielded 239 articles conducted at one or more of seven spatial scales. Most articles were on conservation planning (33%), followed by habitat management (28%) and restoration (26%), and species protection (13%). Most (82%) of studies were on terrestrial, 10% on freshwater and only 3% on marine ecosystems. Most studies in conservation planning and species protection were regional in scale. Habitat management was most common at the landscape and local scales, whereas restoration was mostly local or landscape-scale. Although issues of spatial scale are increasingly recognised in the design and implementation of conservation strategies, gaps exist in large-scale habitat restoration, multi-scale habitat management, conservation of genetic diversity beyond metapopulations, conservation planning for ecosystem services, and scaling issues in freshwater conservation. We encourage conservation biologists to conduct studies of rare/neglected combinations of conservation strategy and biodiversity feature, and to develop tools that facilitate spatially explicit and scale-sensitive decisions for policy makers and managers.

## **SY64.2.2**

### **Interplay and Scale in Biodiversity Governance: Evidence from a Comparative Analysis of Five EU Countries**

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The Natura 2000 network, established by the Habitats and Birds directives, is a unique example of a regional regulatory framework whose designation and implementation had to deal with biodiversity conservation across scales. We investigate the outcomes of institutional interplay in establishing the Natura 2000 network as well as the ways this interplay influences the ability of biodiversity policy to deal with scale mismatches. We conducted a systematic document analysis and carried out structured discussions with focus groups consisting of stakeholders participating in biodiversity governance in five Member States (Finland, France, Greece, Poland, UK). We found that governance systems related to the Natura 2000 network are multi-level, connecting a variety of governance frameworks, formal and informal institutions operating at local, national and supranational levels. The complexity of governance systems has in many cases lead to various temporal, spatial and knowledge mismatches. Despite complexities and power-laden interplays analysis showed that (i) when adaptive governance regimes dominated over command and control ones the governing system was more sensitive to scales, making the implementation of the conservation regime more effective; (ii) the multi-level governance system lead to the development of collaborative platforms that facilitate learning to deal with scale-related challenges of biodiversity conservation.

## **SY64.2.3**

### **Methods for Conservation Planning as Tools for Policy Instrument Targeting and Evaluation**

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Spatial planning is an integrative instrument that can help organize spatially the implementation of policy mixes for conservation, i.e. a combination of instruments that target spatially, various conservation goals at different levels of decision making. Spatially explicit conservation planning tools, such as site selection models, provide an overarching approach for planning of multiple and nested conservation objectives. These, in turn, can be targeted with different instruments, e.g. public protected areas of various categories, land-use regulation and different modalities of economic incentives targeting conservation on private land. Hence, the approach enables the analysis of the degree of complementarity, reinforcement and synergies among conservation instruments within a spatial context (the "policyscape"). Further, the multi-criteria optimized model obtained through site selection algorithms serves as a benchmark against which the effectiveness and efficiency of conservation instruments, alone and in combination (the policymix), can be evaluated. This approach adds considerable value to current policy impact evaluation approaches, which seldom consider an assessment in terms of conservation gains and of cost efficiency. We illustrate the use of site selection models for the evaluation of impacts of forest conservation instruments in Norway, Costa Rica, and the State of São Paulo, Brazil.

## **SY64.2.4**

### **Identifying and Addressing Scale-dependent Sources of Uncertainty in Biodiversity Research**

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Uncertainty is an essential element of science, but in biodiversity science uncertainty has been addressed mainly with a narrow focus. Millennium Ecosystem Assessment (Chapter 4, Biodiversity) takes up uncertainty only in connection with estimates of species numbers. I summarize the results of two round-table discussions held at the UFZ, Leipzig in autumn 2011 with the title *Exploring uncertainties in biodiversity science, policy and management*. The perspective was pragmatic, and the focus was on ecological scaling. Main topics discussed included fieldwork and data; proxies; models and simulations; conceptual devices; and policy advice. We concluded that strategies of coping with uncertainty are best elaborated against pairs of contrasts such as: (i) The source of uncertainty: insufficiency of knowledge versus inherent unpredictability of processes in the world. (ii) The goal: reducing uncertainty versus embracing uncertainty. (iii) Proper source of normative standards: "naturalness" versus attributes of ecological functionality such as "integrity" or "resilience." (iv) Coherence between research and policy: enablement for versus constraint of imaginative research. An adequate strategy for coping with uncertainty requires a learning process that couples together all aspects of research and science-policy interactions.

## **SY64.2.5**

### **Decisions at the Edge - Finer-grained Bioclimatic Envelope Models Inform Climate Change Adaptation for Irish Conservation**

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Bioclimatic Envelope Models (BEMs) offer a reasonably good approximation of how habitat and species distributions may respond to climate change, despite lacking process and biological information. Here we applied an ensemble of BEMs (e.g. Generalized Linear Models, Generalized Additive Models and Artificial Neural Networks) using a 10 km<sup>2</sup> grid to project potential changes of climate space for some of Ireland's vulnerable habitats and plant species. Presence-absence data for 270 species and 19 habitats were modelled using climate and terrain variables for a baseline reference period (1961-1990), and using climate change outputs downscaled via a regional climate model to project changes (2031-2060).

Results show that many species, protected habitats and their plant communities will experience climate space losses. Some habitats were found to be more vulnerable than others; e.g. active western (lowland) blanket bog habitat climate space contracted substantially. Results also suggest that many species will experience potential range expansions; however, it remains unclear whether these species will be able to disperse quickly enough to track suitable climate. The work demonstrates the importance of using regional-scale data for climate change prediction, to help retain a favourable conservation status for habitats and species on the NW Atlantic margins of Europe.

## **SY64.2.6**

### **Mechanisms of Coexistence in Tropical Rainforests: Ecological Processes and the Effect of Spatial Scales**

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The mechanisms that support the coexistence of species in highly diverse communities such as tropical rainforests are poorly understood. Many theories have been put forward to explain coexistence, but it has proved very difficult to test and distinguish them using measures of species abundances or other non-spatial community characteristics. Recent research shows that statistics that describe spatial structure, in contrast, are able to reliably detect signals of underlying ecological processes. When applied to empirical data from tropical rainforests, spatial statistics suggest that a combination of processes occurs, including environmental niche differentiation, neutral dynamics, and density-dependent mortality. Using novel spatial analysis we investigate the potential for distinguishing these and determining how they act and interact across scales. We find support for a mixture of processes that varies with spatial scales of up to several hundred meters. We discuss the relevance of spatial scale to understanding coexistence and therefore preserving biodiversity in complex ecosystems.

## **SY64.2.7**

### **Assessing the Effects of Agricultural Management and Biogeography on the Taxonomic and Functional Diversity of European Farmland Birds**

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We obtained abundance of farmland bird breeding territories from 500 x 500 m survey plots in eight European study sites (in Spain, Ireland, Netherlands, Germany, Poland, Estonia and Sweden: 30 plots/ area, N = 240). We used a variance partition procedure based on Canonical Correspondence Analysis of species abundance in relation to geographical location and variables measuring agricultural management at field and farm level to separate the effect of geography and management on variation in species abundance. We then evaluated the effect of the management variables found significant in the CCA on several taxonomic and functional community indices using GLM. Nearly 20% of total variation in species abundance was explained by geographical location alone. The variance explained by agricultural management alone was much smaller (4.3%), but still significant. The intersection explained nearly two fifths of variance in species abundance. Most of the purely geographical variation in farmland bird assemblages was associated to Mediterranean steppe species, reinforcing the bio-geographical singularity of this community and the need to preserve it. Community indices were negatively affected by correlates of intensification, while taxonomic and functional diversity of assemblages increased with habitat availability and quality.

## **SY64.2.8**

### **Bridging Scientific and Applied Dissemination - Nature Conservation, a New, Data-Publishing Oriented, Open-Access Journal Platform to Cross-link Basic and Applied Conservation Biology**

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Protecting biodiversity in a rapidly changing world requires effective dissemination of knowledge and its feeding that knowledge into science-policy dialogues. This demands rapid publication and accessibility of scientific knowledge to a wider range of stakeholders. Concomitantly, facilitating science requires access and sharing of actual, data. **Nature Conservation** ([www.pensoft.net/journals/natureconservation](http://www.pensoft.net/journals/natureconservation)) attempts to meet these challenges. Established by the FP7 project SCALES ([www.scales-project.net](http://www.scales-project.net)), the new, open access, peer-reviewed journal platform aims at bridging the gap between science and application, including ecological and societal aspects of biodiversity conservation.

**Nature Conservation** is based on cutting-edge Web 2.0 technologies, own content management software and XML-based editorial workflow. It implements a multiple-choice data publishing model that enables publication of data of different kinds and complexity: (1) supplementary files published along with the papers; (2) data files, submitted to data repositories and linked to the respective journal article; (3) data published through repositories and aggregators but indexed within larger databases (e.g., Genbank and GBIF); and (4) data published in the form of marked-up, structured and machine-readable texts. Datasets can also be published standalone in a form of a peer-reviewed publications called "data papers". We expect that these innovative features facilitate bridging the dissemination gap between science and application.

## **INTEGRATING MYCOLOGICAL KNOWLEDGE INTO EUROPEAN CONSERVATION BIOLOGY, POLICY AND PRACTICE**

### **SY65.1.1**

#### **An Introduction to Symposium**

*Halme P.<sup>1</sup>*

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Fungi are a species rich kingdom with an estimated global species richness of five million species and an important role as ecosystem engineers. In European and global conservation policy, practice, and education fungi are often neglected, but recently there have been several fungal conservation initiatives launched. A society focusing on fungal conservation has been founded, national fungal red lists have been compiled in many countries and research projects focusing on fungal conservation have been conducted. Thus, fungal conservation is truly catching fire, even though the flames are still small. Successful conservation in the fungal kingdom often involves different challenges and solutions than those relevant in other species groups. Both because and despite of this, dialogue with the conservation community at large is very important to make fungal conservation initiatives successful. In this introduction, I will set the scene for fungal conservation in the context of European conservation research and practice. My aim is to raise some questions which could be solved during the symposium by the successful interaction between specialized conservation mycologists and other conservation scientists.

## **SY65.1.2**

### **Understanding the Ecological Roles of Fungi and Identifying their Global Threats**

*Boddy L.*<sup>1</sup>

<sup>1</sup>Cardiff University, Cardiff, United Kingdom

Earth's ecosystems would not work without fungi, for 3 main reasons: (1) Fungi are the major recyclers of the terrestrial world, breaking down even the most complex dead organic matter - wood, and releasing vital nutrients for plant growth. (2) Fungi form intimate mutualistic relationships with the roots of over 90% of plants - mycorrhizas, and are responsible for uptake of water and mineral nutrients, as well as providing some protection against root pathogens. Indeed, it was fungi that enabled plants to first colonise land over 400 MYA. (3) Lichens, which are fungi in mutual association with green algae or cyanobacteria, are the dominant primary producers of vast tracts of Arctic tundra, and are significant in other extreme environments. As well as these roles in the natural environment fungi contribute to production of a wide variety of food products, commercial production of chemicals and pharmaceuticals, and are sources of novel compounds. Changes to land use and climate, nitrogen deposition, biotic invasions and elevated CO<sub>2</sub> are, in decreasing order, the major threats to loss of biodiversity, including fungi, across the globe. The ways in which these threats have and will impact on fungi will be reviewed, giving specific examples.

## **SY65.1.3**

### **Strengths and Weaknesses of an All-purpose National Database of Fungi**

*Senn-Irlet B.I.*<sup>1</sup>

<sup>1</sup>WSL, Swiss Federal Research Institute, Birmensdorf, Switzerland

A 15-years experience with the national database Swissfungi allows defining strengths and weaknesses of such an all-purpose database. Strengths are

- (1) availability of a minimal set of standardized and continuously enlarged information for a lot of species, e.g. in Switzerland for 7000 species of fungi with georeferenced records
- (2) application in the Red-listing process where IUCN criteria of area and extent of occupancy can be calculated based on models.
- (3) Application in national conservation strategies where each organismic group contributes in the same way, e.g. needs of fungi can be compared with those of birds, reptiles, mosses, plants, and so on, in Switzerland infospecies.ch provides a common platform of all national species centres
- (4) baseline data for additional detailed studies such as the ecology of wax-caps in Switzerland
- (5) capacity building through integration of many stake-holders and a broader public especially if an online-access for new records is offered and queries on a very local scale are implemented.

Weaknesses include

- (1) A spatial and temporal bias in data,
- (2) Unequal quality of older records (e.g. imprecise localities, taxonomic problems),
- (3) Deficiencies in cross-section applications, e.g. river-management, silvicultural practice.

## **SY65.1.4**

### **Citizen Science and the Conservation of Fungi - Experiences from the Danish Fungal Atlas**

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The Danish Fungal Atlas was launched as a five year Citizen Science project in March 2009, focusing on Basidiomycetes forming sporocarps. In 2009, 3750 species in this group was known from Denmark. The project is based on an internet platform allowing users to submit fungal records. Data quality is secured by four professional mycologists working part time, to support and guide reporters and to validate records. An important goal in the project is to document the occurrence of threatened fungi, and to make this information available to nature managers. In three seasons the project has generated >150.000 unique records, including >5300 records of red-listed species. More than 100 species have been added to the national species list. Thus, it is evident that Citizen Science can provide substantial new biodiversity information, even in species rich groups considered taxonomically difficult. In this presentation I will present the project and some of the results obtained so far. In addition, I will evaluate how educational and professional background correlates with the recording behaviour of volunteers in the project. Based on this I will give recommendations for the application of Citizen Science in the conservation of biodiversity in species rich, underexplored organism groups.

## **SY65.1.5**

### **Conservation and Protection of Grassland Fungi**

Griffith G.W.<sup>1</sup>

<sup>1</sup>Aberystwyth University, IBERS, Aberystwyth, United Kingdom

Loss of semi-natural grassland habitats in Europe, largely through ploughing/reseeding and fertilizer inputs, has caused a severe reduction in the diversity/abundance of grassland macrofungi, the most highly visible representatives of the soil biota.

Of these, it is the colourful members of the genus *Hygrocybe* (waxcaps) that have received most conservation attention but several other taxa (referred to as CHEGD fungi) also comprise the ca. 10% of macrofungal species which preferentially inhabit grassland habitats.

Long term monitoring of fungal fruiting at several experimental grassland sites has demonstrated not only the deleterious effects of many management regimes, especially N application, on macrofungal diversity. However, recovery is possible but over decade timescales.

The Northern and Western regions of Europe host exceptional diversity with >70 CHEGD species being present at some sites. Growing recognition of the international importance of some of these sites has recently led to several being given legal protection.

Effective conservation of these organisms requires some understanding of their habitat requirements. Sward management is also important, with the need to maintain a short sward potentially at odds with prescriptions for other grassland biota. However, 'traditional' haycutting regimes with aftermath grazing have been found to be conducive to abundant fruiting.

## **SY65.2.1**

### **The Inclusion and Influence of Fungal Knowledge on 30 Years of Nordic Conservation Science, Policy and Management**

*Dahlberg A.*<sup>1</sup>

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Fungi have increasingly been taken into consideration in conservation policy and management in the Nordic countries since early 1980ies. As the knowledge of fungal status increased, e.g. through indicator species lists and fungal Red Lists, conservationist, policymakers and land managers also become aware of and interested in threatened fungi. As a result, fungal knowledge increasingly become considered and integrated in conservation. As conservation actions generally are habitat directed, prioritization and selection of conservation measures rely on available information from all species groups combined. For example, the occurrence and habitat requirement of threatened fungi is of several criteria for selecting areas to protect, to identify woodland key habitats and considered in land management guidelines. Since 2000, Red-Lists in Finland, Norway and Sweden are presented for all species groups together, which further have facilitated the integration of status knowledge from all species groups. The numbers of nationally listed fungal species were 535-900 in the most recent Red-Lists (2010), representing 20% of all red-listed species. The reasons that fungi have become considered in conservation are that the knowledge of fungal status and measures to counteract negative trends has steadily increased, become accessible and communicated.

## **SY65.2.2**

### **Fungal Conservation in the Era of Next Generation Sequencing**

*Ovaskainen O.*<sup>1</sup>

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In animals and plants, the adult life stage is often easy to survey in the field, whereas reproductive effort is difficult to observe. The opposite is true for many fungi, as fruit bodies are often conspicuous, but other life stages are difficult to observe. As a consequence, knowledge relevant for fungal conservation, e.g. on resource use and species distributions, is often based on data on the fruit body stage. The development of effective conservation strategies calls for knowledge on how distributional patterns build up from the underlying processes, such as dispersal, mycelial growth, and formation of fruit bodies. Sampling cryptic life-history stages has become increasingly feasible with next generation sequencing (NGS). Much of the biodiversity oriented NGS studies have thus far been based on classifying sequences into operational taxonomic units. However, identifying sequences to species would provide an additional layer of resolution, as it links sequence information to other types of information. I present a statistical framework for taxonomical classification of NGS sequences, with an emphasis on quantifying classification uncertainty. I illustrate the framework in the context of NGS data on wood-decaying fungi sampled from wood, soil and air.

### **SY65.2.3**

#### **Survival of Wood-inhabiting Fungi in Fragmented Landscapes: Combining Data on Fruit-Body Surveys and Sequencing**

*Nordén J.*<sup>1</sup>

<sup>1</sup>University of Oslo, Oslo, Norway

Fungal surveys have traditionally relied on fruit bodies, but recent molecular techniques have enabled the study of mycelia and dispersing spores under natural conditions. We aim at gaining an understanding of the mechanisms of persistence and decline of fungal species in fragmented landscapes. We combined high-throughput sequencing with conventional fruit-body surveys to study simultaneously all the life stages in communities of wood-inhabiting fungi. We found a strong correlation between fruit-body occurrence and mycelial abundance, suggesting that our sawdust samples were well able to represent the fungal communities within the logs. The species present as mycelia showed marked variation in their overall rate of fruiting as well as in the time delay from colonization until formation of fruit bodies. In this species community, earlier studies have shown that loss of dead wood and forest fragmentation have led to a disproportionately strong decline in those species that are specialized in their resource use. We show that this pattern is less pronounced in the mycelial stage, as the specialized species have a lower fruiting rate than the generalist species. We compare the ability of specialist and generalist species to disperse to, and establish and fruit in large forest areas and small fragments.

### **SY65.2.4**

#### **Towards Conservation of Mediterranean Mycobiota: The Tuscan Experience**

*Perini C.*<sup>1</sup>, *Salerni E.*<sup>1</sup>

<sup>1</sup>University of Siena, Department of Environmental Sciences, Siena, Italy

Habitats, plants and animals have acquired a widespread attention regarding their conservation and various are the initiatives at global or regional level in order to reduce or halt the current loss of biodiversity. But where are fungi? Fungi are well-known for their gastronomic value or mentioned because of their negative impact on the environment. On the other hand their role as key-player in biological processes is often overseen and consequently action for their safeguard particularly in the Mediterranean area are missing.

In this context Tuscany is the only Italian region with a published red-list and the only one where fungi are cited as actors in the selection of threatened habitats in the Regional plan for conservation. Till the beginning of the new millennium and thanks to the Important Plant Area's programme, a target of the European Plant Conservation Strategy, various areas due to the presence of rare species and/or because of the high diversity have been described as key-sites for fungi. Experiments, friendly to mycobiota and the whole environment, have been undergone in order to increase the production of precious and greatly collected penny bun, also known as porcino and truffles, mycorrhizal species with few success in artificial culture.

## **SY65.2.4**

### **Substrate Requirements and Fungal Development Following Restoration Fires: A Long Term Field Experiment**

*Eriksson A.-M.<sup>1</sup>, Edman M.<sup>1</sup>, Jonsson B.G.<sup>1</sup>*

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Efficient fire suppression in Fennoscandian boreal forest has removed a key process central for maintaining biodiversity. To recreate fire characterized forests and for the benefit of fire dependent species, restoration fires are increasingly used as a conservation tool. However, knowledge is lacking on the habitat requirements of wood fungal species and their relation to fire. In a long term field experiment we followed the species succession of wood-fungi on burned and unburned experimental logs of Norway spruce and Scots pine.

The results showed that wood affected by fire had a higher species number and a different frequency of wood fungal species. Also the species composition was different between fire affected and non fire affected wood. For example, some red-listed species and species commonly associated with deciduous dead wood only occurred on fire affected logs. This indicates that fire creates a unique type of dead wood. Therefore, restoration of forest with fire will be of great importance to provide unique dead wood qualities and benefit associated wood fungal species.

## **SY65.2.5**

### **Stipitate Hydroids: Resolution of Taxonomy to Underpin their Conservation in Britain**

*Ainsworth A.M.<sup>1</sup>, Parfitt D.<sup>2</sup>, Rogers H.J.<sup>2</sup>, Boddy L.<sup>2</sup>*

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There are 17 stipitate hydroid species (ectomycorrhizal tooth fungi in the genera *Bankera*, *Hydnellum*, *Phellodon* and *Sarcodon*) included on the British and Irish checklist. 15 of them are recognised as of conservation importance (priority BAP species) in the UK and the group is generally regarded as nitrogen-sensitive and declining across Europe due to habitat loss and air pollution. Recognising that a mushroom is a stipitate hydroid is often straightforward, but naming the species can be fraught with difficulty. This is due to a combination of identification and taxonomic issues. Nevertheless, accurate recording of species and their locations is essential for the accurate assessment of species distributions, conservation status and ecological/conservation requirements. Using a combined molecular (ITS1 sequencing) and morphological approach, we are analysing recently-collected and fungarium specimens to resolve the taxonomy of these important tree-root symbionts. We have discovered that there are many more extant taxa than there are currently accepted names, some of which undoubtedly represent undescribed species. Extending the study into continental Europe is revealing further hidden taxa. We are now matching names to sequence-based groupings before describing new British species. This combined approach will facilitate stipitate hydroid identification and the pinpointing of their "best" sites for conservation.

## **SY65.2.6**

### **The Future of Conservation: Integrating Scientific and Lay Knowledge for Management and Policy**

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There is a long history of cooperation between scientists and lay communities in mycology, including early research documenting the need for fungal conservation and more recent research demonstrating links between fungal phenology and climate change. In the current study we furthered this collaborative effort by bringing together diverse knowledges and stakeholders interested in the management and conservation of fungal resources. We developed processes of knowledge integration that enable multiple views and methods to be considered for the management of the genus *Morchella*, a highly prized wild edible, in the mid-Atlantic United States. To do this we collected fresh *Morchella* specimens and identified them using both morphology and habitat, and sequencing methods. Results were compared to a recently published morel phylogeny, and indicated a high level of correlation between scientific and local taxonomy, and a high level of regional endemism of morel species of interest. Our findings provide strong support for horizontal and vertical integration of stakeholder knowledge to address interests and concerns of multiple government agencies, local interests and scientists to develop adaptive co-management strategies for fungi, a heretofore undeveloped area. Broad-based biodiversity conservation is furthered by the generation and strengthening of these types of knowledge integration networks.

## **NATURE CONSERVATION AT THE LANDSCAPE LEVEL IN AGRICULTURAL AREAS: IMPLICATION FOR POLICY MAKING.**

### **SY66.1.1**

#### **Landscape Moderation of Biodiversity Patterns and Processes**

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Understanding how landscape characteristics affect biodiversity patterns and ecological processes at local and landscape scales is critical for mitigating effects of global environmental change. In this talk, I use knowledge gained from human-modified landscapes to suggest a number of hypotheses, which I hope will encourage more systematic research on the role of landscape composition and configuration in determining the structure of ecological communities, ecosystem functioning and services. These include the dominance of beta diversity hypothesis, the cross-habitat spillover hypothesis, the landscape-moderated concentration and dilution hypothesis, the landscape-moderated insurance hypothesis and the intermediate landscape-complexity hypothesis. Shifting our research focus from local to landscape-moderated effects on biodiversity will be critical to developing solutions for future biodiversity and ecosystem service management.

#### **Reference:**

Teja Tscharntke et al. (2012) Landscape moderation of biodiversity patterns and processes - eight hypotheses. *Biological Reviews* (in press).

## **SY66.1.2**

### **Landscape-Moderated Biodiversity Effects of Agri-environmental Management: A Meta-analysis**

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Agri-environmental management (AEM) is heralded as being key to biodiversity conservation on farmland, yet results of these schemes have been mixed, making their general utility questionable. We test whether the benefits of AEM for species richness and abundance are determined by the surrounding landscape context. Across all studies AEM significantly increased species richness and their abundance. More specifically, we test the hypothesis that AEM benefits species richness and abundance (i.e., increases the difference between fields with and without AEM) more in simple than in complex landscapes. Landscape-moderated biodiversity effects differed between farming system and species groups. In croplands, species richness but not abundance of all species groups combined was significantly enhanced in simple but not in complex landscapes. In grasslands AEM effectively enhanced biodiversity regardless of landscape context. Pollinators were significantly enhanced by AEM in simple but not in complex landscapes in both croplands and grasslands. Our results highlight the need for agri-environmental program design that is adapted to the nature of the landscapes in which they are implemented and the type of species groups at which they are targeted.

## **SY66.1.3**

### **Impact of the Entry Level Agri-environment Scheme in Contrasting Landscapes in England**

*Boatman N.D.<sup>1</sup>, Jones N.E.<sup>1</sup>*

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Evaluations of the Entry Level Stewardship scheme in England have shown that the first five year agreements were not as effective as they could have been, because many of the most valuable options for biodiversity were rarely taken up, and because there was no mechanism for targeting options so that they were appropriate to the landscape. For the second phase of agreements, key options have now been defined with respect to desired biodiversity outcomes and target areas mapped according to the priority for the different target species or groups. Advice is available to farmers renewing their agreements to help them select appropriate options for the landscape in which they are located. This has been shown to increase farmer awareness and engagement with the target objectives, and improve uptake of target options. The quantity and quality of the resulting habitats will be compared between farms receiving advice and those that have not received advice for key taxa including birds, butterflies and bees, with respect to the priorities for the farm location.

#### **SY66.1.4**

##### **Enhancing Nature Conservation of Meadow Birds by Using a Spatial Explicit Decision Support System**

*Melman T.C.P.<sup>1</sup>, Schotman A.G.M.<sup>1</sup>, Kiers M.A.<sup>1</sup>, de Snoo G.R.<sup>2</sup>*

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For effective management of biodiversity on farmland implementation of landscape ecological knowledge as well as communication with stakeholders are important.

For the meadow birds on farmland so-called 'mosaic management' has been developed. This refers to a spatial small-scale pattern of different grassland types, to meet on the requirements of meadow birds, especially chicks. 'Chick land' has to be realised at the right time and place (feed and hide during the whole breeding season). To draw up mosaic-management plans appears to be rather complex. We developed an Internet-accessible decision support system, which can be used by farmer collectives to state and to enhance the quality of mosaic structures.

In a GIS setting users can import data concerning their intended management, regular as well as that of the agri-environmental schemes. After adding data about spatial distribution of territories the sufficiency of the mosaics is evaluated. Subsequently, mosaic can be improved in a iterative process. The decision support system has been used in practice by local farmer groups. The tool delivers a surplus value as a base for adequate and mutual tuned management.

The tool is proposed as an element of certifying professional nature management cooperations, which are responsible for collective management plans.

#### **SY66.1.5**

##### **The Persistence of Farmland Organisms Is Negatively Affected by an Interaction between Agricultural Intensification and Simplification - But Not Always**

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European farmland has experienced large-scale losses of biodiversity as a result of agricultural intensification and the resulting landscape simplification. Hence, possible measures to mitigate these losses are reduction of agricultural intensity and increasing landscape heterogeneity. Using space-for-time substitution, we compared mitigation measures between carefully matched farms. In general, several taxonomic groups, including plants, butterflies, bees, and birds, benefitted when agricultural intensity was reduced by organic farming or when landscape heterogeneity increased. However, both the scale of application (the spatial extent of mitigation measures) and the landscape context affected how organisms reacted to mitigation measures. In particular, the effect of reduced agricultural intensity through organic farming was most pronounced in simplified agricultural landscapes where little semi-natural habitat remained. Likewise, the effect of increased landscape heterogeneity was most pronounced on conventionally managed farms. These results can be explained by the ecological contrast between areas with and without mitigation measures being modified by land-use intensity and landscape context. However, the patterns are not the same for all taxonomic groups and contexts, suggesting that we need to understand how organisms use habitat in time and space to produce a truly predictive model for how farmland biodiversity is affected by mitigation measures.

## **SY66.1.6**

### **Biodiversity Conservation in Agricultural Landscapes: Farmer Effects on Biodiversity Gains from Agri-environment Schemes**

*Wossink A.*<sup>1</sup>

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The focus of this paper is with suitable methods for the ex-post review of voluntary agri-environmental schemes. Statistical analysis of such data needs to account explicitly for farm/farmer effects in addition to the variation in conditions. We use the non-parametric method of Data Envelopment Analysis to describe conservation output from a system perspective with the weights for the aggregation derived from the data. Further this approach enables benchmarking, that is to compare farmers' ecological performances in a way that is meaningful to inform management decisions. In a second stage regression we use the counterfactual Oaxaca-Blinder decomposition to analyse mean outcome differences between farmer groups. The combined method is applied for data of subsidised field margin management on marine clay in the south west of the Netherlands. Average performance differed significantly between landscapes (sub-regions) with less variation in performance among the farmers in the better performing sub-regions. The decomposition of the gap in mean performance between the two main regions showed that the landscape effect together with differences in the effects of determinants by landscape more than compensated for the effect of differences in observable characteristics of the farms/farmers (incl. crop, schooling, knowledge, margin management, and total area under environmental management).

## **SY66.1.7**

### **Spatial and Temporal Scales in Nature Conservation on Farmland: Implications for Policy Making**

*Musters C.J.M.*<sup>1</sup>, *de Snoo G.R.*<sup>1</sup>

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In the Netherlands long term studies show that the gap between plant diversity in nature reserves and agricultural grasslands is increasing. Restoring ditch bank vegetation in grasslands needs long term management of well-chosen locations. The effects of spatial coordinated meadow bird management are hard to find in the short term. And studies of field margins in arable land showed that time periods of AES may be too long.

These seemingly contradicting results of our recent studies indicate, together with results of other studies, that restoring ecological quality of rural landscapes needs strong efforts, that appropriate time periods are needed, that surrounding landscape quality is crucial, and that conservation strategies should be target group and agricultural system type tailored. And the longer we wait, the more effort is needed. Therefore, we urgently need new tools for nature conservation at the landscape level.

What opportunities offers the EU-CAP for enhancing landscape complexity and for coordinating local, farm orientated conservation measures? And how should nature values of rural landscapes be internalised by farmers, so that long term biodiversity conservation can be reached?

## **WILDERNESS AT THE EDGE OF SURVIVAL IN EUROPE**

### **SY67.1.1**

#### **Creating a Transdisciplinary Research Agenda for Enhancing the Protection of Europe's Wilderness**

*Kun Z.*<sup>1</sup>

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The protection of wilderness generates increasing interest in the European political arena since the adoption of the special wilderness report by the European Parliament in 3 February 2009. However there is a significant lack of information about what researches have already been conducted in Europe for providing arguments for wilderness protection. The European Commission developed an Agenda for Wilderness Protection (a.k.a. Message from Prague) which includes a recommendation linked to biodiversity research: compilation of mapping wilderness and wildland areas in Europe, involving appropriate definitional and habitat criteria and level of scale to effectively support plans for protecting and monitoring such areas. PAN Parks Foundation started a research project in August 2011 aiming to create a searchable database of the available wilderness related project. The database is focused on transdisciplinary approach from biodiversity studies to economic analysis. The research concluded that in order to generate additional arguments for wilderness protection in Europe a new transdisciplinary research agenda is needed with special focus on the effects of climate change on wilderness areas, how to finance wilderness protection and explaining the ecosystem services of wilderness areas. Such an agenda can help to start new restoration projects as suggested by the 3GBO report.

### **SY67.1.2**

#### **Roadless Areas: A Potential Tool to Define European Wilderness Areas**

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Roadless areas represent large patches of relatively undisturbed natural habitats and functioning ecosystems. They increase landscape connectivity, act as barrier against pests and invasions, and render many ecosystem services. Roadless areas largely contribute to the preservation of native biodiversity and contain more species and individuals, species with large spatial requirements (e.g. top carnivores) and species sensitive to human disturbance. They get special relevance in the context of climate change because their higher resilience and buffering capacity. If wilderness is understood as large enough areas where the main driving forces are natural factors and ecological process instead of human activities, then roadless areas represent a timely surrogate for wilderness. In this sense, the USA legislation represents an important reference; the largest roadless areas were designated as "Wilderness". Roads facilitate human access into formerly remote areas, and promote human activities. Urban development and sprawl are strongly linked to transport networks, also in rural and natural environments. Thus, the density of transport infrastructures is a good indicator of the intensity of human activities and their impacts on biological diversity, and can be taken as a proxy for general disturbance levels. We propose that "roadlessness" must be an essential component of wilderness.

### **SY67.1.3**

#### **Mapping Wilderness in Europe and Beyond**

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Multi-scale methods based on GIS and remote sensing are described for mapping wilderness areas across Europe and beyond. These draw heavily on the application of spatial multi-criteria evaluation techniques utilising various digital databases to define proxy indicators of wilderness including population density, remoteness, land cover, ruggedness, etc. These are combined and weighted to produce a wilderness quality index across multiple spatial scales. Distributions of wilderness are examined to look for patterns at continental, regional, national and local scales, and the distribution of the highest quality wilderness areas examined in relation to existing protected areas classified under IUCN Category Ia/Ib and II and Natura2000 networks. Conclusions are drawn as to the spatial match and coincidence of existing protected areas and "defacto" wilderness in Europe and its immediate neighbours.

(This paper is part of the symposia proposed by PAN Parks on "Wilderness at the edge of survival in Europe")

### **SY67.1.4**

#### **Integrating Biodiversity Conservation and Infrastructure Development in Europe**

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Biodiversity conservation draws high public and political interest in Europe. So do renewable energy policies for combating climate change and fossil fuels dependence. But as renewable infrastructure expands, questions arise about the spatial overlaps between conservation and renewable energies development. This research analyzes the degree of overlap between biodiversity and wilderness important areas, and potential areas for renewable infrastructure development in Europe. We calculate bird species richness, average vulnerability and rarity to assess the biodiversity value of the European territory. We map wilderness using the presence of infrastructures as proxy for human impact on the landscape. The resulting biodiversity and wilderness maps are compared against the maps of wind, solar and hydro-power potential in Europe. This analysis highlights the opportunities and challenges for mitigation and compensation of the impacts of renewable energies development. Areas raising particular concerns are mountain regions that are appreciated for scenic beauty and remoteness but also offering a high potential for wind and hydropower, subject to accessibility constraints. Coastal areas also represent a significant challenge because of their bird populations and significant potential for renewables development.

## **SY67.1.5**

### **“Wilderness” - A Designation for Central European Landscapes?**

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The concept of “wilderness” has been intensively discussed as an approach for nature protection in Central Europe among managers of protected areas, decision makers, natural and social scientists. There are various attempts for physical definitions of “wilderness” in Central Europe. Literature surveys were carried out in order to find expert quotes on the physical definitions, spatial characteristics, and attributes of “wilderness”. For the analytical perception of the general public, a survey using opinion polls among visitors in the Müritz National Park in northeastern Germany was carried out. A quantitative approach was chosen, and interviewees were selected on an objective, systematic basis.

The wilderness discussion among experts in Central Europe lacks a common physical and spatial definition. It can be shown that there are strong ethical and religious, educational and cultural motifs in the demand for wilderness. For a broad range of laypersons interviewed in Müritz National Park, “wilderness” seems to be a suitable, positive label for wetlands, shorelines, large forests and remote mountain areas. Important key factors, aside from natural features, are few human traces, little infrastructure and few persons using an area, so that visitors experience a feeling of solitude.

## **SY67.1.6**

### **Towards a Quantification of Wilderness? Innovative Approaches to Spatial Planning and Functionality-based Priority Setting for Conservation**

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The global transition from hunter-gatherer societies was the catalyst to many human induced environmental changes including structural ecosystem degradation, altered nutrient cycles, modified biological communities, and at the largest scale, climate change. Untrammled wilderness was once extensive and continuous. In Europe, the rapid conversion to cultural landscapes eradicated most of the pristine ecosystems and their emergent processes and functions. Still, the remnants of relatively wilder landscapes bear functional ecosystems providing ecological, evolutionary and service-related opportunities. Ecosystem functionality defines the capacity for self-regulation and maintenance, which contributes to resilience and adaptive capacity, thus allowing for sustainable ecosystem development without significant loss of function and change to properties. This study applies Insensa-GIS, a new GIS software tool that is designed to generate spatially explicit indices and complementary geo-statistical analyses. Indicators such as road disturbance, forest composition, geometrical landscape measures and biomass are applied to create a conservation-priority index based on the principle of maintaining the functionality of the least degraded ecosystems. The robustness of the index method is tested on data for Brandenburg, Germany, and validated using a statistical sensitivity analysis. This technique can also be used for mapping and quantifying wilderness at different scales.

### **SY67.1.7**

#### **How Wild Is Wild Enough: Do Bears Make the Wilderness Wild for Tourists?**

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Reflecting on over a decade's research on the impacts of the bear-viewing ecotourism industry in British Columbia, Canada we consider how the highly motivated wildlife tourist alters the perceived and fiscal value of the bears and their habitat. The changing social and economic value of these ecosystems have the potential to change land planning, resource extraction and conservation decision making but the presence of tourists can also impact the conservation value of the landscape. Interestingly, and perhaps surprisingly, tourists travelling to highly degraded habitats to see bears reflect positively on the quality of the "wilderness" they have visited. If, for the public, a carnivore encounter makes the wilderness wild what is the message for the conservation biologist?

### **SY67.1.8**

#### **The Return of the Wild: Conceptions of 'Rewilding' in Scotland**

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'Enhancing wildness' is an increasingly prominent objective on Scotland's nature conservation agendas as conservation practices move further away from the conventionally protectionist towards more creative strategies of habitat restoration. However, while conservation bodies are increasingly concerned with maintaining - and enhancing - Scotland's landscapes of wild character, there is no consensus on the meaning or objectives of 'rewilding' in Scotland. Equally, the potential for this largely North American conception to represent a sustainable land management option in the distinctly Scottish 'wild land' context, with its particular natural and cultural history remains contested. This research uses a Delphi model as part of a multidisciplinary, mixed methodology to examine the complexities of Scotland's emergent wild land strategy. Here, the results of the first two Delphi rounds are discussed, and a critical, applied review of Scotland's wild land strategy is offered. This takes the form of a 'rewilding taxonomy' based upon levels of land management interference in natural processes. This research seeks to enhance the conceptual clarity and congruence of 'rewilding' within the idiosyncrasies of the Scottish wild land context, and to integrate it within the broader environmental management agenda.

## CONSERVATION GENETIC APPLICATIONS

### SY68.2.1

#### Wildlife Forensics

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DNA is an information source that can help us identify a species, the sex of many animals, and even estimate the geographic origin of an individual. Profiling techniques can also be used to estimate match probabilities for two samples collected at different sources. When these pieces of information are determined with appropriate forensic rigour, they can be submitted as evidence in criminal investigations. Illegal trade threatens some of the world's most iconic species, and DNA evidence can be crucial in the investigations of these crimes. The application of non-human DNA analysis as evidence in wildlife crime investigations will be presented here; from the practicalities of forensic analysis of non-human DNA, to case studies that will illustrate how the evidence can be used in prosecutions.

### SY68.2.3

#### Modern-day matchmaking in a species of conservation concern, the Eurasian Black Vulture, *Aegypius monachus*

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The Eurasian Black Vulture, *Aegypius monachus*, a species of conservation concern native to southern Europe and central Asia, is facing serious threats in the wild. Its wild distribution has shown a dramatic decrease with extirpations from the majority of the European range and less than 2.000 pairs left (BirdLife International, 2008). As such the species is listed “near threatened” at world level and “vulnerable” at European level (BirdLife International, 2008; BirdLife International, 1996). An ambitious European Endangered species Programme aims at captive breeding *A. monachus* and reintroducing surplus captive-born young into former habitats. Reintroductions are very successful, however, suffer from limited success at captive breeding. Merely a small fraction of captive laid eggs develops into adults (20.6%, 1984-2004, unpublished data), which is in sharp contrast to high breeding successes reported for wild *A. monachus*. Captive breeding of the Eurasian Black Vulture is aggravated by various characteristics of the species such as late sexual maturity, long reproductive cycles with small clutches and monogamy with biparental care for nest, egg and offspring. Little surprising, breeding failure in forced captive pairs of *A. monachus* appears to be correlated with poor quality of courtship and pair bonding behaviour (Pereboom *et al.*, 2005).

At the CRC forces are joined in a broad scientific approach to understand genetics underlying mate preference in *A. monachus*. Special focus in analyzing mate choice criteria will be set on genes of the major histocompatibility complex. Furthermore, general relationship among individuals, information on physical condition and on chemical communication between mates are studied. Traditional genetic methods are employed to confirm studbook data on sex and origin of individuals, revealing multiple cases of disagreement. Application of scientific methods to improve captive management and matchmaking in this demanding species will be discussed.

BirdLife International 2008: *Aegypius monachus*. In: IUCN 2009. IUCN Red List of Threatened Species. Version 2009.1.

BirdLife International 1996: Action Plan for the Cinereous Vulture (*Aegypius monachus*) in Europe. Prepared by BirdLife International on behalf of the European Commission.

Pereboom Z, Weetjens H, d. Campagnolle KR, Huyghe M 2005: An evaluation of captive conditions and breeding success in the European black vulture (*Aegypius monachus*) EEP. In: Proceedings of the EAZA Conference. Bristol.

## **SY68.2.4**

### **Is Measuring Inbreeding Depression in Wild Populations of Highly Inbred, Bottlenecked Species Worthwhile?**

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Understanding the effects of inbreeding depression is important for viability assessment and effective management of rare and endangered species, but measuring inbreeding in such species remains challenging. Highly inbred species that have experienced severe bottleneck events typically lack the behavioural pedigree information, high levels of genetic diversity and large population sizes (and thus sample sizes) required to estimate inbreeding. This raises the question of whether investing resources into research in this area is worthwhile for conservation managers and, if so, what the best approach might be. We modeled the statistical power of varying numbers of simulated microsatellite markers to detect inbreeding depression for the little spotted kiwi (*Apteryx owenii*), a species that has experienced a recent, severe bottleneck and that exhibits extremely low genetic variation. Our analyses indicate that detecting inbreeding depression in little spotted kiwi via methods such as heterozygosity fitness correlations would require a prohibitively large number of neutral markers, but that alternative approaches such as pairwise relatedness hold promise for estimating inbreeding in this species and those with similar histories. Ultimately, we aim to build a best practice recommendation for conservation managers wishing to invest in genetic measures as part of their rescue strategies.

## **SY68.2.5**

### **Uncovering Marine Population Structure in a Commercial Fish Using Adaptive Genetic Markers**

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Marine fish often show little genetic structuring in neutral marker genes over vast geographic distances, however this may not reflect any adaptive divergence. For commercial fish, an understanding of genetic structure is critical for the designation of fisheries management units in order to maintain any existing local adaptation. The Atlantic herring (*Clupea harengus*) is a good case study; very low levels of population differentiation (typically  $F_{ST} \approx 0-0.01$ ) have been uncovered in multiple studies, however the genetic resources available have been very limited. We have used whole mitochondrial genomes to understand the demographic history of herring in the Baltic Sea region and to look for signals of selection. In addition, we have combined population genetic analyses using a large number of newly developed transcriptome-derived microsatellite markers with oceanographic modelling to investigate genetic differentiation and connectivity. Distinct genetic clusters have been uncovered, which appear to be well explained by oceanic connectivity. In addition, there is some indication that genetic differentiation is also associated with temperature and salinity at the spawning sites. These results show that herring do not represent a panmictic population, and that the existing fisheries management units do not reflect the newly uncovered genetic units.

## APPLICATION AND IMPACTS OF EVIDENCE - BASED CONSERVATION

### SY69.1.1

#### Establishing the Collaboration for Environmental Evidence: Challenges and Achievements of Evidence-based Conservation

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Despite a rapid increase in scientific data and resource expenditure the effectiveness of interventions in conservation and environmental management remain largely untested. To stimulate the growth and impact of evidence-based conservation and environmental management the Collaboration for Environmental Evidence (CEE) was established as a not-for-profit organisation in 2009. CEE's purpose is protection of the environment and conservation of biodiversity through preparation, maintenance promotion and dissemination of systematic reviews (SRs) of the effectiveness and impacts of environment management interventions, for the public benefit. Key achievements of CEE will be described, such as establishing standards for conduct of systematic review and an open-access library of resources, creating formal links with the policy community and growing a network of centres, review groups and methods groups. Key challenges remain, including creation of incentives to engage with SR activity, embedding a culture of evidence-based practice at organisational level and provision of training in SR methodology. As CEE increases in influence, critical questions will be posed concerning the impact and cost effectiveness of systematic reviews. Potential measures that enable us to test whether more effective conservation and environmental management results from investment in evidence-based practice will be explored along with their limitations.

### SY69.1.2

#### Evaluating the Biological Effectiveness of Fully and Partially Protected Marine Areas

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Marine Protected Areas (MPAs) have become a widely used tool for both ecosystem-based conservation and fisheries management. MPAs encompass a range of protection levels, from no-take areas to partially protected areas, whereby the latter are often promoted as a 'compromise' solution allowing both conservation and continued human use. Using systematic review and meta-analysis, we synthesized all available published studies comparing fish biomass, density and species richness to determine whether (i) partial protection confers ecological benefits over no protection and (ii) partially protected areas (PPA) and no-take reserves (NTRs) provide similar ecological benefits. Response to protection was examined in relation to MPA and species-related parameters. Overall, there was a significant increase in fish abundance (25%) and biomass (51%) inside the PPA relative to unprotected areas. Target species abundance and biomass were on average 60% higher inside the PPA, however increasing the size of the PPA decreased the biomass of target species relative to outside. NTRs had higher abundance (55%) and biomass (50%) of target species than PPA (55%), and these responses were linked to the time elapsed since establishment of the protection scheme. Our results emphasize the benefits of MPAs for fisheries conservation and highlight the need for rigorous monitoring.

### **SY69.1.3**

#### **Genetics in Conservation: Using Systematic Reviews to Bridge the Gap between the Conservation Genetics Literature and Conservation Practice**

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Genetic diversity is recognized by the IUCN as one of the central components of biodiversity, and is important for the sustainability of natural populations. For example, it provides the raw genetic material upon which natural selection can act to adapt populations to changes in their environment. Despite this, genetic diversity has often been of peripheral concern in conservation management plans. This is partly because the conservation-relevant genetics literature is relatively inaccessible to conservation practitioners because of its large size, specialized jargon and technically demanding nature. It is also possible that conservation practitioners have been discouraged because of the difficulty in identifying the specific conservation scenarios in which they should be concerned about genetics.

Here we summarize the outcomes of two systematic reviews designed to provide conservation practitioners with useful syntheses of the conservation genetics literature. One of these addresses the consequences of within-species mixing of populations (e.g. by translocations) for the fitness of resulting hybrid individuals. The other seeks to identify whether the geographical isolation of populations is an indicator for their genetic diversity. We discuss the extent to which the results could be useful to conservation and how they can be communicated effectively to conservation practitioners.

### **SY69.1.5**

#### **Systematic Maps to Inform Conservation Policy**

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An evidence-based framework to underpin conservation decision-making is becoming increasingly recognised as important. Systematic reviews, for example, synthesise existing research findings to answer clearly defined questions relating to the effectiveness or impact of management interventions. But in situations where the question is broad, or the evidence disparate, an alternative approach may be more suitable. In social science disciplines systematic mapping is used to identify and categorise research literature. We adapted systematic mapping methodology in order to explore the research evidence relating to the impact of farmland conservation interventions on biodiversity. Systematic mapping uses established systematic review literature searching protocols, but instead of setting out to answer a question, a searchable database (or map) of the available evidence is produced. A systematic map can also be used to inform primary research or further syntheses such as systematic review. A Collaboration for Environmental Evidence methods group has been set up to further develop the methodology and establish ways in which to increase the value of systematic maps for informing the conservation evidence base.

## **SY69.1.6**

### **Assessing Carbon Stocks and Changes in Terrestrial Carbon Pools: A Systematic Review of Methods**

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With global carbon credits valued at over US\$100 billion/year, accounting under REDD will drive demand for high quality monitoring systems. The choice of system to adopt should be guided by good science. An international participatory initiative was established in 2009, facilitated by the UN-REDD Programme to gather and analyse relevant literature on accuracy and precision of different methods for forest carbon measurement under REDD using a systematic review framework. This is the first attempt to introduce this robust evidence-based process to a question of such high urgency for current global land management policy - MRV (measurement, reporting and verification) of carbon in terrestrial ecosystems. A review team with expertise in forest, cropland, soil and peatland, carbon stock estimations using both ground-based and remote sensing methodologies was assembled. To the extent that good governance, policy and decision-making relies on access to good information, systematic reviews of this type play an important role in the transparent analysis of complex and often contradictory science, which benefits decision-making. The review will inform guidance given to countries who aspire to participate in future REDD+ and land management mechanisms, and will provide scientific underpinning of the many approaches to carbon measurement and assessment which exist.

## **SY69.1.7**

### **Realizing an Effectiveness Revolution in Environmental Management**

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The environmental movement of the 20th century has evolved into a large, diverse and well-financed global community that is increasingly required to prove its worth. Though the environmental sector collects and uses data to determine the status of ecological and social systems, the effectiveness of the programs and policies it uses to affect this status remains largely untested. As governments and donor institutions insist on greater transparency, accountability and evidence of what works and what does not, much is being learned from other fields (e.g. health services, education, international development) and increasingly sophisticated approaches are emerging to manage effectiveness. For example, program evaluation, adaptive management, and systematic review provide frameworks and methods to collect and use information to measure and improve performance. However, the critical data and collaborations necessary for an effectiveness revolution are marginalized by technical, cultural and political obstacles. The environmental sector must embrace a systems-orientation (i.e. study of systems theories) to, for example, identify and exploit key leverage points, such as flows of information and self-organization, that overcome impediments and create incentives to initiate and realize an era of effectiveness in environmental management.

## **SY69.2.1**

### **After 87 Corridor Experiments, Why Do We Still Lack Evidence Whether Conservation Corridors Work?**

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Corridors are conservation interventions to sustain biodiversity despite changing land use and climate. Despite >87 published corridor studies, we cannot systematically evaluate corridor effectiveness. Three obstacles preclude using evidence-based approaches to assess complex conservation interventions (like corridors), namely that most research efforts (1) assessed the wrong response variables (2) at the wrong spatial extent (3) in the wrong landscape context. In the case of evaluating corridor effectiveness: (1) Published studies measure animal presence and movement whereas conservation corridors aim to ensure demographic persistence and gene flow. (2) Studied corridors are < 150x50 m, but conservation corridors are 1-80 km long and >1 km wide. (3) Most studies evaluated corridors in natural matrix (e.g. grassland corridors within forest), but conservation corridors are embedded in urban and agricultural land uses. To enable a rigorous evidence-based assessment, we seek 100 study sites (landscapes) where we can implement a research design with conservation-relevant response variables, extents, and landscape contexts ([www.docorridorswork.org](http://www.docorridorswork.org)). Please use the website to direct us to study areas with 50-year-old patches and long, wide corridors in human-dominated landscapes. Systematic review of the results of these new studies will identify traits of successful versus unsuccessful corridors.

## **SY69.2.2**

### **Systematic Reviews and Evidence Synthesis in the Network of Knowledge for European Expertise on Biodiversity (KNEU)**

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A 2011-2014 FP7 programme (KNEU) is developing a prototype to facilitate transfer between knowledge holders and knowledge users at the European level, to inform the future development of IPBES. This prototype maps the existing knowledge hubs and flows and encompasses various methodologies used to synthesize knowledge to inform decision-making. Evidence-based frameworks can play a major role in such a "network of knowledge" by disseminating and facilitating the conduct of high quality systematic reviews. Systematic review methodology also match the pre-requisite of transparency, upgradability, scientific rigour and objectivity of such an endeavour and are included in the prototype. We will discuss which challenges the CEE must face in order to play a sustainable and significant role in this network of knowledge.

### **SY69.2.3**

#### **Systematic Reviews of Environmental Evidence: A Regional Centre for Africa**

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What drives us as academics to do research if it isn't to make a difference? We believe that to inform policy and practice we need to bring together our individual research studies into relevant, complete and un-biased syntheses of evidence addressing questions of importance. The last twenty years has seen a paradigm shift in the use of evidence for decision-making across the disciplines. Through the work of the Collaboration for Environmental Evidence, this movement has extended to include conservation biology.

This approach has so much potential to transform environmental decision-making, and yet to succeed it needs to evolve to reflect the priorities and meet the needs of stakeholders. Many of the biggest challenges for conservation biology, climate change, and the environment as a whole, rest in Africa. For this reason, we are developing the evidence-based environmental movement, with its focus on systematic reviews, within the region. Over the next 5 years, we will be establishing a Centre for Environmental Evidence in Africa, hosted by the University of Johannesburg, which will provide a regional centre for systematic review activities across the continent.

This paper will describe our motivations, plans and activities to date and invite others to contribute to our work.

### **SY69.2.4**

#### **Evidence Synthesis in Environmental Management - Challenges of Quantitative Synthesis**

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Quantitative evidence synthesis requires a set of statistical methods for summarizing previous research on the topic. By combining information from all relevant studies, meta-analysis can provide more precise estimates of the effects of interest and help to examine sources of variation in the effect. Individual studies in the area of environmental management present a challenge for meta-analysis because they often include multiple treatments and multiple response variables of hierarchical nature; the latter are often adjusted for a number of different covariates which may vary across studies. To combine the studies, an appropriate effect size measure suitable for all the studies has to be chosen first. Within-study data may often need to be combined (e.g. abundances of multiple species pooled at a class level), but variances of these combined effects cannot be calculated because we also need to know within-study correlations which are never published. Effects of multiple treatments and other differences among studies could be compared by means of a meta-regression. Multivariate methods of meta-analysis are being developed in medical and social sciences applications but they have not been yet applied in conservation and environmental management. We will also discuss implications of possible temporal changes in effects for management policy.

## **SY69.2.5**

### **Scientifically Based Decisions for the Environment**

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In a number of cases measures to preserve or protect the environment have to be decided on a rather short notice and to be based merely knowledge that is immediately accessible. This is an uncomfortable situation for many decision-makers, and it is often felt that decision should be more firmly based on scientific evaluation and documentation. The Foundation for Strategic Environmental Research in Sweden (Mistra) has therefore established Mistra Council for Evidence-based Environmental Management (EviEM). The aim is to provide decision-makers with evidence-based evaluations of topics of specific importance for the Swedish environment. Mistra EviEM started in January 2012. Our first activity was to invite environmental ministries, agencies and NGO's and listen to their views on which topics that should be evaluated scientifically. The selection was then made by the Mistra EviEM Executive Committee. We will cooperate with other institutes with similar aims, especially the Center for Evidence-based Conservation in Bangor, Wales. In the future we hope to be part of a world-wide net of institutions supporting decision-makers with evidence-based evaluations of environmental issues.

## **SY69.2.6**

### **Environmental Systematic Reviews: Do They Have an Impact on Advice, Regulation, and Land Management Practices? Lessons from the Experiences of Natural England**

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Natural England is an Executive Non-departmental Public Body responsible to the Secretary of State for Environment, Food and Rural Affairs. Our purpose is to protect and improve England's natural environment and encourage people to enjoy and get involved in their surroundings. Natural England is a science-led, evidence-based organisation. We have commissioned systematic reviews on a variety of topics: from the impacts of burning on blanket bog, to an interdisciplinary review on the effects of green space on health and well being; as well as drawing from published reviews to inform our evidence-base. Using case studies and an assessment of evidence use in decision-making, we reflect upon the impact of systematic reviews across different elements of conservation practice. We also consider the types of review question and appropriate timing of review commissions to maximise the impact in decision-making.

# **BEST PRACTICE FOR ENGAGING VOLUNTEERS IN BIODIVERSITY MONITORING AND CITIZEN SCIENCE PROJECTS NOW AND IN THE FUTURE**

## **SY70.1.1**

### **An Overview of Best Practice for Engaging Volunteers in Biodiversity Monitoring from Survey Design to High Quality Biological Evidence: The British Trust for Ornithology Experience**

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The involvement of volunteers in biological monitoring resulting in high quality information for conservation management purposes is well-established, and the current global economic climate of austerity is driving an even greater focus on volunteers to deliver such information. Using examples of the British Trust for Ornithology's web-based recording schemes for birds and other taxa, we explore best practice from the design of surveys and recording software, through the recruitment, retention, training and motivation of volunteers, information validation and quality control, to the appropriate use of the resulting monitoring information. We also explore briefly how this area is evolving, for example with respect to remote recording technologies such as mobile phone apps, and caution that careful consideration and collaboration is required as technologies progress to ensure that recording schemes maintain scientific rigour and that funding is used efficiently.

## **SY70.1.2**

### **Citizen Science and Species Monitoring. Engaging the Volunteers and Ensuring Data Quality**

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In recent years the internet has greatly increased opportunities for citizen science and in particular the recording of a wide range of biodiversity. Projects such as Evolution Megalab across 15 countries in multiple languages engaged many thousands of people and allowed us to address issues such as: (i) designing an appropriate project, (ii) recruiting, motivating and training of volunteers, and (iii) ensuring data quality. It is an example of question driven citizen science, the volunteers can see exactly what use their data is being put to and they get instant feedback with a statistical test that compares their data with historic data, this is very important for motivation of users.

The iSpot project has also dealt with similar issues but across all biodiversity rather than a limited range of taxa. The project was set up initially to train a new generation of naturalists but the system is also producing large numbers of observations. These are checked by the appropriate schemes and societies and are then submitted to the National Biodiversity Network. Apart from high profile website and publicity there is also a network of mentors who have engaged volunteers on a local level and who have recorded case studies."

### **SY70.1.3**

#### **Mobile Data Entry - Pros and Cons of Using Mobile Applications Apps in Collecting Observations for Biodiversity Monitoring**

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More and more biodiversity observations are being collected by online portals. This has enabled the collection of data by mobile phone applications (apps). In the Netherlands a few years ago we offered volunteers, engaged in collecting biodiversity data, the possibility to enter their data by a mobile phone app for WnPDA (a Windows Mobile app). Already more than one million observations have been submitted. With the development of new platforms we needed to design additional apps so we have developed ObsMapp for Android and WebObs as platform independent apps. Furthermore this gave us the opportunity to improve and update functionalities of the apps. We will give a brief introduction to the possibilities of both new apps.

The questions that we wish to discuss is whether all this mobile data has the same quality as data collected by online systems or by paper formats, what new opportunities they will provide and are there any associated risks?

### **SY70.1.4**

#### **Open Air Laboratories: A Research and Education Programme about the Outdoor Environment**

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OPAL is a community-based research and education programme suitable for all ages, abilities and backgrounds. This paper reviews the range of participants who have taken part, particularly young people, and examines their motivations and the value of their contribution to the research community, to themselves and towards environmental protection.

Students from over 2,000 schools and other education providers have studied more than 10,000 outdoor spaces collecting data about locations, pollution, habitat condition and wildlife. The majority of records are from urban areas and many are from sites not generally accessible to researchers. New insights and trends have been identified.

Participants reported that the quality of the materials and high level of confidence in the science were key motivating factors. Teachers became more confident about leading outdoor, field-based learning programmes, particularly where wildlife identification was required. Contributing to a national research programme was considered important and worthwhile. Participants gained a greater understanding of environmental topics, why and how research is carried out and many of the issues, such as uncertainty, associated with it. The majority of participants said they had learnt something new and would continue with their studies.

## **SY70.1.5**

### **The Importance of the Norwegian Program to Increase the Number of Volunteers and their Skills in Bird Census Work, Including a Pan-European Web Tool**

*Husby M.*<sup>1</sup>

<sup>1</sup>HiNT, Levanger, Norway

The shortage of volunteers in important bird census work, and lack of quality control in most countries could give environmental policy makers reason to ignore key results. Therefore HiNT has developed:

- 1) A 25 day field course spread throughout one year (commenced in 2006). Students are from all over Norway, and even Sweden and Finland. In Norway, nearly 25% of 400 routes in 2011 were recorded by persons that have fulfilled our field course.

- 2) A novel internet tool on the website [www.birdid.no](http://www.birdid.no), where it is possible to train in bird identification based on the bird's appearance and sounds. The website is freely available to everyone and will eventually be accessible in 44 languages and 52 countries/regions across Europe. It is possible to take a formal web-based test and receive study credits for these skills.

Positive feedback about the site from many countries has been overwhelming, from both beginners and experienced birdwatchers. Preliminary tests show a close correlation between the results in the formal tests and field skills.

The next steps are to create a digital bird book, upload videos, and have the sounds of several birds simultaneously (similar to point count).

## **SY70.1.6**

### **Bat Monitoring in the UK: Past, Present and Future**

*Barlow K.*<sup>1</sup>

<sup>1</sup>Bat Conservation Trust, Head of Monitoring, London, United Kingdom

The UK's National Bat Monitoring Programme (NBMP) was established in 1996 to deliver population trends to assess the status and underpin the conservation of the UK's bat species. The programme was designed for, and continues to rely on, volunteers to gather data across large numbers of sites. Three main survey methods are used in the programme to monitor bat populations: counts at summer maternity roosts, counts at winter hibernation sites and bat detector surveys in the field. For most species, data are gathered from more than one survey type. To date, over 3000 volunteers have taken part in surveys at more than 5000 sites. Currently these surveys provide statistically robust population trends for 11 of the UK's 17 breeding bat species, however there are some species for which results from different survey types are not consistent. Further work is therefore required to better understand the trends. Lessons learned over the 15 years of the programme are discussed including volunteer training and retention, survey coverage and administration of the programme. The future of bat monitoring is also discussed with a particular focus on how volunteers submit and record their survey data and incorporating new bat detector technologies into the programme.

## **SY70.1.7**

### **Engaging Volunteers in Biodiversity Monitoring, Advantages and Caveats**

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Biodiversity and environmental monitoring provide the fundamental information for tracking environmental changes, to diagnose population trajectories and feed conservation biology with relevant data. Such information is required for the design and evaluation of biodiversity policy, management, land use, or protection. Hence, biodiversity monitoring is central to conservation biology allowing the evaluation of the conservation status of species, or to assess biological responses to environmental changes and to conservation policy. Bird-monitoring initiatives are the very first provider of long-term monitoring data when institutional bodies set the goals of quantifying global biodiversity changes and of assessing the impact of environmental policies. The culture of bird monitoring was born and propagated by visionary bird watching and naturalist amateurs, led by skilled professionals. This made possible the collection of long-term databases with minimal funding. Due to this historical contingency, the involvement of volunteers in monitoring is key to maximize the sampling effort and to acquire a large-scale image of bird biodiversity change.

## **AGRICULTURAL LAND ABANDONMENT AND EFFECTS ON SOCIAL-ECOLOGICAL SYSTEMS**

### **SY71.1.1**

#### **How Can Social-ecological Drivers Affect Land Use Decisions? A Comparison of Historical Land-use Change in Australia, Portugal and Sweden**

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This study explored the social and ecological history of landscape by analysing land use, social, institutional and policy changes over the past 50 years. We collected ecological data for vegetation and bird composition providing insight on landscape change; and sociological data derived from environmental histories, local interviews and focus groups associated with land management. The three case studies showed a spectrum of land use change. Portugal's Peneda-Geres has the most option at a theoretical level for re-wilding due to diminishing local economy, abandonment of cropland and pastures, aging population, withdrawal of services and the past history of oak forests and larger mammal habitat. In Sweden, the grazed pastures with high biodiversity values are being converted to forestry, but it maintains some 'museum' agricultural landscapes for biodiversity values contributing to recreation and tourism. Australian agricultural land use change is driven by export markets, subject to distance, energy and climate change. Like Sweden, historical drivers of land use have been technology based, labour sensitive, and now a labour deficit dominates. Our analysis of the triggers, frictions and pressures implicating biodiversity, indicates that all sites experience a progressive disconnect of local income from agriculture, a transition to secondary homes and aging farming populations.

## **SY71.1.2**

### **Behind the Obvious: The Causes and Consequences of Contrasting Impacts of Land Abandonment on Biodiversity in Different World Regions**

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Agricultural land abandonment is one of the main current land use trends occurring in several regions of the world. The impact of abandonment on biodiversity remains controversial among scientists and contrasting results are found among scientific studies. We investigated how abandonment affects biodiversity depending on the world region by conducting a literature review of 206 articles on agricultural abandonment and biodiversity. Additionally, we compiled and analyzed data on land use and biodiversity trends in agricultural areas in these regions. Our results show that world regions differed in terms of land use history and amount of species related to farmland but also in the effects of abandonment on biodiversity. The fact that studies from regions with similar land use and biodiversity trends present contrasting impacts of abandonment on biodiversity suggests the existence of regionally bounded views on nature conservation. We stress that these views go beyond effect on biodiversity and are influenced by land use history and culture. Moving from regionally delimited views of nature and land abandonment to a broader perspective, where different regions of the world share experiences and consider alternative management strategies and policies, can contribute to the re-thinking of the consequences of land-use change in farmland areas.

## **SY71.1.3**

### **Socio-ecological Systems, Regime Shifts and Farmland Abandonment in Castro Laboreiro, Northern Portugal**

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Humans are known to drastically impact the landscapes on which they thrive. Worldwide, for the past 60 years, socially driven changes in people's lifestyles caused farmland abandonment in remote rural areas, resulting in some cases in natural re-vegetation. A socio-ecological model was developed in order to illustrate the linked dynamic of the social and ecological systems and how they interact and lead to regime shifts in the region of Castro Laboreiro, northern Portugal. A first model investigates the local dynamic of seasonal migration versus sedentarization and its consequences for the forested area. A second model simulates rural depopulation and the resulting farmland abandonment in the region. In both cases, the social dynamic is dictated by a collective behavior, triggered by social and economic factors, while the forest dynamics depend partly on people's ability to use the land. The models illustrate how the joint social and ecological systems can reach an equilibria with varying proportions of residents using the land for farming, which also influences the amount of land made available for forest regeneration. Those models, backed up by empirical observations of linked socio-ecological dynamics, are important to illustrate regime shifts and predict the occurrence of tipping points in systems.

#### **SY71.1.4**

##### **Are Residents in Rural Mountain Communities Willing to Leave (WTL)? A Case Study in Northwestern Portugal**

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Identifying and modeling the variables (drivers) responsible for regime shifts of socio-ecological systems is essential in understanding future trends in farmland abandonment. In the last 50 years, Castro Laboreiro, a rural mountain community situated in northwestern Portugal has suffered dramatic changes to its social-ecological system mainly due to rural exodus. In the present study we conducted a series of interviews-surveys with practicing (full/part-time), retired and leisure farmers identifying the drivers that maintained agro-pastoral activities and those that stressed abandonment. Understanding why people left and why they have remained and when would they leave or discontinue agro-pastoral activities is fundamental in determining future conservation efforts. Therefore, we analyzed local's willingness to leave (WTL) in terms of monetary value and correlated it to the different drivers (positive and negative) of agro-pastoral activities. We found several significant relationships between the numbers of livestock, gender, income (job), agricultural subsidies and the monetary value for which locals are willing to leave. Our results suggest that once subsidies are cut traditional agro-pastoral activities will diminish resulting in changes to the landscape composition and configuration affecting both local biodiversity and the bundle of ecosystem services provided.

#### **SY71.1.5**

##### **Biodiversity Change in Multi-Habitat Landscapes: Including Species Habitat Affinity in Species-Area Models**

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The effects of habitat loss on species diversity are usually estimated using species-area relationships (SAR). Species-area models that consider the main ecological processes determining species richness may show better fit; also the shape of the curve may be best described by other models than the classical power model. We compared the fit of 24 SAR models, divided by three approaches (8 base models x 3 approaches): single-habitat models, choros models (multi-habitat; account for the effect of the habitat composition in total species diversity) and countryside models (multi-habitat; also account for the differential use of habitats by different species groups). We used plant diversity data from a multi-habitat landscape in NW Portugal. Countryside models had the best fit both when predicting species-area patterns of species groups and of total species richness. In addition, choros models had overall a better fit than single-habitat models. We also tested the application of single-habitat and multi-habitat models to land-use change scenarios using the power model as the base model. The single-habitat model did not respond to land-use changes. Estimates of total species richness using the choros approach only depended on the number of habitats in the landscape. In contrast, outputs from the countryside model suggest that land-use change impacts may be moderated by species ability to use multiple habitats. The inclusion of habitat affinity in species-area models may contribute for a better description of diversity patterns at spatial scales where habitat diversity is relatively low and area is not uniform, such as rural landscapes.

## **SY71.1.6**

### **How Has Three Different Political Systems Shaped Present-day Biodiversity Patterns?**

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Abandonment and intensification are two contrasting land-use trajectories controlling biodiversity patterns in rural landscapes. In this study we analysed diversity in three landscapes within the crossing point of the three borders of Slovenia, Hungary, Austria, an area representing the two land-use trajectories.

100 years ago this area was within the same country, and maps show a typical small-scale agricultural landscape. During the last 65 years different political systems have influenced land-use in very different directions. Today the areas in Slovenia and Austria are protected rural landscape whereas the area in Hungary is protected as an important forest landscape. Species richness of sessile (plants) and mobile (birds) organisms were investigated along transects in each country. We found the diversity of birds clearly related to forest cover and land-use history, where Slovenia had the highest diversity. Plants were more divers in Hungary although grassland habitats had higher species diversity compared to forest.

Our study show that political differences in the past may have long-term effects for land use and biodiversity in the future, and we envisage that the differences in biodiversity patterns will be even more pronounced in the future caused by possible extinction debt.

## **SY71.1.7**

### **Secondary Succession Dynamics in an Abandoned Landscape**

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Abandoned agricultural landscape in central Europe is gradually changing towards forests and shrubs affecting many species dependent on open landscape and grasslands. Historical aerial imagery was used to reconstruct spatial and temporal dynamics of this change in a hilly landscape since the abandonment in 1952. Hawthorn (*Crataegus* sp.) as a dominant shrub during this secondary succession was identified using recent satellite imagery (WorldView-2). The landscape is now a mosaic of forests, shrubs and grasslands, which occupy only 10 % of the area (80% in 1952). Linear mixed effects models using DEM derived variables, cadastral maps and distances to forest were used to model the dynamics of the succession on a 10 year time step. Distance to forest was identified as a main driving factor of succession, supported by elevation and slope. Hawthorn, invading the grasslands on large areas at a time, made the spread of other broad leaved species possible. Simple extrapolation shows the complete loss of open landscape in near future. Understanding the dynamics and speed of succession is crucial for conservation of the reaming grasslands and protection of its species.

# EUROPEAN BiodivERsA RESEARCH: JOINING HANDS ACROSS EUROPE AND ACROSS DISCIPLINES

## SY72.1.1

### BiodivERsA - Promoting the Pan-European Dimension of Research to Develop New Knowledge for Biodiversity Conservation

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Biodiversity loss has recently reached unprecedented rates and is an increasingly pressing issue for mankind and the environment. New knowledge is needed to develop adequate conservation plans for biodiversity, and efficient transnational cooperation and joint action are needed to integrate biodiversity science at the regional and international levels, which are often the relevant scales at which to address the issues at stake.

BiodivERsA is a network of 21 funding agencies across 15 European member states and associated countries promoting the transnational cooperation of biodiversity research teams across Europe. Since 2008, it has already allocated close to 30M€ through annual pan-European joint calls for research projects. Among the successful projects, several focus on biodiversity conservation, as the BiodivERsA funding opportunity is particularly well adapted to the field. We will present an overview of the projects on biodiversity conservation supported by BiodivERsA, their scientific novelty and European added value, and how they bridge the gap between scientific knowledge and societal needs. In particular, case studies will demonstrate how such projects can provide scientifically based tools to support policy-making and managers, thus enhancing our ability to better protect biodiversity.

## SY72.1.2

### Linking Politics and Ecology of European Beech Forests: First Findings of the BeFoFu Project

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European beech forests are of high importance for European biodiversity. At EU level, their conservation is prominently addressed by the Natura 2000 protected area network. Natura 2000 highlights beech forests as a forest habitat type of specific community importance.

The BeFoFu project has been established in order to better understand policies and ecological backgrounds and processes of beech forest conservation and management under the Natura 2000 network across Europe. Within BeFoFu, different project groups analyze the political and ecological dimension of forest protection under Natura 2000.

In this presentation, we introduce the project including its specific methodology. In addition, first findings are presented.

In the ecological aspects of the project we explore patterns of intraspecific diversity, interspecific diversity and growth of beech forests across their range in response to changing management and climate.

As for the political research, we present first results on the politics of Natura 2000 in beech forests and outline major conflicts as well as political management strategies that were chosen by different states. The presentation concludes with giving an outlook on further research activities within BeFoFu that particularly aim to link the work of the involved disciplines, and to address the science/policy interface.

### **SY72.1.3**

#### **TenLamas - The Value of Ecological Networks and Different Landscape Management Approaches**

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Conservation strategies focus on ecological networks that should allow organisms to move among habitats and local populations, but their functionality has rarely been tested. It is determined by its net effect on the mobility of the target organisms, which depends on landscape features and the target organism ecological attributes. There is a clear need for conservation instruments that allow translating landscapes or networks of protected areas into functional connectivity. TenLamas evaluates alternative models for assessing connectivity of particular ecological networks and for comparing different scenarios of landscape management. The project delivers recommendations for the suitability of different tools by testing the relative performance of

- (1) parameters of structural connectivity,
- (2) algorithms based on least-cost paths and
- (3) detailed simulation models of individual behavior generating most probable paths.

Concurrent connectivity estimates are evaluated on selected model species in test landscapes with respect to the required level of precision in landscape and organism information. This is performed by supplying dispersal matrices generated by each approach including gene flow to a simple model, using metapopulation viability as dependent variable.

### **SY71.1.4**

#### **RACEing ahead: A Risk Assessment of Amphibian Chytridiomycosis to European Amphibian Biodiversity**

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The emerging pathogenic fungus, *Batrachochytrium dendrobatidis*, infects over a third of European amphibian species. Nevertheless, the extent that this invasive infection is impacting on amphibian biodiversity is almost completely unrecognised by European conservation agencies, governments and academic institutions. RACE is assessing the risk that Bd poses to European amphibians by improving national and pan-European competence in surveillance and thus determining the geographic scope of the problem by developing a state-of-the-art surveillance framework leveraging the power of smart mobile communications. Outputs of surveillance are databased at the RACE analysis tool [www.bd-maps.eu/](http://www.bd-maps.eu/). Alongside field-data on the prevalence, intensity and timing of infection/mortalities, spatial-genomic information is being integrated with global genome datasets to identify the timing, and frequency, of Bd introduction(s) into Europe, as well as assessing the differential virulence of genotypes. These spatial and genetic data are being used to parameterise epidemiological models focused on defining the principle drivers of chytridiomycosis including identifying the importance of introduced non-native amphibian species in vectoring spread of the disease. RACE is also modelling and testing potential mitigation approaches, some of which are being trialled in the field in attempts to clear the infection.

## **SY72.1.5**

### **How Plant Functional Traits Cascade to Microbial Function and Ecosystem Services in Mountain Grasslands**

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We aimed to provide an explicit quantification of how plant and microbial functional properties interplay in the field to determine key ecosystem functions underlying ecosystem services provided by grasslands. At three mountain grassland sites in the French Alps, Austrian Tyrol and northern England, we quantified, along gradients of management intensity, (i) plant functional diversity, (ii) soil microbial community composition and parameters associated with nitrogen cycling, and (iii) key ecosystem processes related to the carbon and nitrogen cycles. We found that increasing management intensity, and concomitant changes in soil fertility, was associated with more exploitative plant strategies and taller vegetation. These vegetation functional properties supported greater production, but at the cost of poor carbon and nutrient retention, notably because they were associated with microbial communities dominated by bacteria and with rapid rates of nitrification. Conversely, decreasing management intensity resulted in dominance by plants with conservative strategies, usually low production, but benefits for carbon sequestration and soil nutrient retention by favouring microbial communities dominated by fungi co-occurring with bacteria with slow activities. Managing grasslands for selected or multiple ecosystem services will thus require balancing effects on plants and soil microbial communities.

## **Biodiversity distribution atlases: past, present and future uses in conservation and science**

### **SY73.1.1**

#### **Importance of Biodiversity Distribution and Population Status Information to European Responsibilities and Policies in Nature Conservation**

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Reliable, updated information about the state of and changes in the distribution and abundance of species is essential for conservation. Many countries produce national atlases and red lists, and significant value is added by combining such data supranationally. Once the overall distribution and abundance of species is known, priorities can be set and appropriate action taken at national, regional and global levels. Countries can also assess their national responsibilities in a wider context. Various international conservation instruments also require such information. Under the EU Birds and Habitats Directives, Member States must report on the status and trends of protected taxa every six years, and on the Natura 2000 network's contribution to conserving them. Similar regular reports are also expected under the Convention on Biological Diversity and the Ramsar, Bonn and Bern Conventions. Furthermore, assessing the changing distribution of species between old and new atlases can provide vital insights into changing land use, ecosystems and biodiversity, and allow analyses of the impacts of land use change, climate change, infrastructure developments, agriculture and other factors. The results have direct relevance to discussions on biodiversity policy, green infrastructure, climate adaptation, reform of EU agriculture and fisheries policies, and many other crucial policy debates.

## **SY73.1.2**

### **Monitoring and Distributional Data of Butterflies Support Butterfly Conservation**

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Butterfly Monitoring Schemes have proven to be very useful tools, not only by delivering reliable trend data - their primary goal -, but also for research to the effects of management, conservation (e.g. Red Lists) as well as climate change. These schemes are based on intensive counts on fixed transects using a standard method. Distribution data are a welcome extension, but they are often incomplete. Occupancy models allow the use of opportunistically collected distribution data to establish trends in occupancy, colonisation and survival as well as providing annual distribution maps. We compare the results of both methods and show the application of the results in the development of indicators of change and their use in butterfly conservation. The Climate Temperature Index is one of these indicators used to quantify of the annual response of species communities to climate change.

## **SY73.1.3**

### **New Developments in Spatial Modelling: Mapping and Integration of Heterogeneous Biodiversity Monitoring Data across Different Scales and Field Recording Protocols**

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The aim of this study is to identify the limitations of different data sources for developing species distribution maps and to evaluate their potential for spatial data integration in a conservation context. Here we assess the potential for distribution modelling of data coming from different monitoring volunteer bird monitoring programs, which differ in the degree of standardisation. SDM predictions were used to identify species richness and high quality habitat areas (hotspots) from different treatments.

Models based on standardized monitoring programs showed higher predictive power and adequately matched reference Atlas information in lower sample size treatments, especially when modelling common species. Predictive power and overlap with Atlas data of models from opportunistic observations substantially increased when modelling uncommon species offering similar accuracies to standardized survey.

Information derived from carefully designed surveys generally appears to be more suitable for deriving species distribution maps than information derived from opportunistic data sources. However, opportunistic data sources may offer relatively good approximations especially in the case of predicting the distribution for uncommon species. All in all, in order to identify distributions of species, different types of data may be appropriate. However to identify hotspots of high quality habitat, higher quality information is required.

## **SY73.1.4**

### **Findings and Lessons Learnt from an NGO-Run National Bird Atlas Project**

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Between November 2007 and October 2011 c.20,000 volunteer birdwatchers took part in Bird Atlas 2007-11 ([www.birdatlas.net](http://www.birdatlas.net)), a project aiming to produce updated distribution, abundance and change information for the bird populations of Britain and Ireland. The project design balanced twin aims of maintaining comparability with previous atlases whilst also developing new surveying and mapping techniques and providing enhanced information on abundance. The project used fixed-effort sampling of abundance in over 50,000 locations alongside unlimited complete coverage surveys. The fixed-effort data have been invaluable in enabling production of maps of relative abundance but also unbiased indicators of range change and spatially-referenced indicators of relative abundance change. Work is ongoing to incorporate additional datasets to maximise coverage but already patterns such as northward range expansion of some residents and contraction of woodland and farmland specialists are evident. Relative abundance change maps have given new insights into the spatial patterns of change in apparently static distributions. We would strongly encourage fixed-effort abundance sampling as a key component of any future atlas projects.

## **SY73.1.5**

### **Data-based Spatial Modelling to Refine Search Areas for Threatened Species: Wintering Grounds of the Aquatic Warbler in Africa**

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When field data are not available for species distribution mapping, species distribution models that link spatially explicit occurrences (e.g. museum records, atlas data), to environmental data (often measured using remote sensing) can be used to predict potential distributions. These could then be verified with target field searches. Like many Afro-Paleartic migrants, the wintering distribution of the Vulnerable aquatic warbler is poorly known. Linking the handful of recent, spatially explicit ringing study records to environmental characteristics measured by remote sensing in a species distribution model (using Maxent), we identified potentially occupied wintering areas across west Africa. This included areas around about half of the historical records of the species in the area. Many of the areas predicted to be potentially occupied overlapped with a study based upon stable isotope ratios from feathers of birds that moulted in the wintering areas, but the distribution model maps had a much greater spatial resolution, meaning they can be used to target field searches. More spatial records would almost certainly improve the accuracy of the models, and as the number of spatially explicit records of all species increases, species distribution models could be increasingly useful in mapping the potential distributions of poorly-known species.

## **SY73.1.6**

### **Towards a Second European Breeding Bird Atlas: Approach and Main Challenges**

*Keller V.*<sup>1,2</sup>, *Bauer H.-G.*<sup>3,4</sup>, *Brotons L.*<sup>3,5</sup>, *Burfield I.*<sup>3,6</sup>, *Eaton M.*<sup>3,7</sup>, *Foppen R.*<sup>3,8</sup>, *Kalyakin M.*<sup>3,9</sup>, *Noble D.*<sup>3,10</sup>

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The knowledge of distribution and abundance of organisms is crucial in targeting conservation action. The first European breeding bird atlas, published by the European Bird Census Council (EBCC) in 1997, was a milestone in European ornithology. It provided national governments and NGOs with a basis to target their conservation efforts, and the information in the atlas proved to be an invaluable source for scientific studies. However, since the data were collected in the 1980s, many environmental changes, such as those in land use and climate, have affected bird populations across Europe. Today, new opportunities have arisen, improving our ability to incorporate even the remotest parts of Europe, where hardly any data were available for the first atlas. Data collection will build on the vast network of volunteer citizen scientists and professional ornithologists across Europe, under the guidance and coordination of EBCC. Analysis and production of maps will be carried out in collaboration with specialists of EBCC member organisations, including leading experts in spatial modelling. This ambitious project will require resources at both national and European levels. The main challenges lie in covering the vast areas in eastern and southeastern Europe, where both human and financial resources are particularly limited.

## **ALPINE ECOSYSTEMS: PLATFORMS FOR STUDY AND CONSERVATION OF UNIQUE HABITATS AND SPECIES LIVING IN THE EDGE CONDITIONS**

### **SY76.1.1**

#### **Managing Timberline Ecosystems for Key Alpine Wildlife Threatened by Vegetation Encroachment Following Pastureland Abandonment**

*Arlettaz R.*<sup>1,2</sup>, *Braunisch V.*<sup>1</sup>, *Patthey P.*<sup>1</sup>, *Rotelli L.*<sup>1</sup>, *Signorell N.*<sup>1</sup>

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Alpine ecosystems are currently facing three major threats: the spread of recreational activities, e.g. snowshoeing, free-riding, backcountry skiing; climate change which will modify environmental conditions in the long run and vegetation encroachment resulting from the abandonment of traditional farming practices such as grazing by domestic ungulates. Action is required at all three levels. In the combat against vegetation succession, however, we still lack information about an optimal habitat matrix to restore. By means of radiotracking, we investigated the optimal habitat profile of Black grouse, a declining key species of Alpine treeline ecosystems. We compared the favourite habitat configuration for cocks, non-breeding and breeding hens during the breeding season (May-August), with a main focus on chick-rearing hens as reproductive output is the main driver of grouse demography. Compared to cocks and non-breeding hens, chick-rearing hens require a very heterogeneous habitat mosaic that consists of a heather-dominated vegetation matrix interspersed with patches of grass (20-40% cover at the foraging site scale) associated with a few scattered mature conifers and some dense groups of young coniferous trees (larch, spruce and arolla pine). Restoring such a heterogeneous matrix would benefit black grouse and most probably other components of Alpine timberline biodiversity.

## **SY76.1.2**

### **How Alpine Plants May Respond to Global Warming: The Role of Genetic Diversity, Local Adaptation and Phenotypic Plasticity**

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It is open to debate, how much global change will cause cold-adapted alpine plants to go extinct, to respond by range shifts, or to persist in a given location by genetic adaptation or by adjusting plastically to the new conditions? Knowledge on the longevity of arctic-alpine plant populations indicates high persistence in their current location, despite considerable changes of past climatic conditions. It is however less obvious how much such persistence results from genetic adaptation to changing conditions and how much it is shaped by phenotypic plasticity. Phenotypic plasticity can be considered as a pre-adaptation to future change and can be separated from fixed genetic effects in common garden experiments. Results from such experiments indicate that the climatic oscillations during glacial history together with the induced range changes caused phenotypic differentiation in alpine plants by neutral genetic drift, by selection in refugia during glaciation, as well as by adaptation to current climatic conditions. Furthermore, transplanting alpine plants to common gardens at different elevations revealed high phenotypic plasticity in important functional traits. These and other results from the literature indicate considerable resistance of alpine plants to future global warming by rapid evolution and phenotypic plasticity.

## **SY76.1.3**

### **Alpine Biodiversity Faced with Climate Warming: Identifying Migration Corridors for the Threatened Freshwater Species**

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Freshwater biodiversity has shown to be highly vulnerable to climate warming with boreo-alpine populations especially at risk of becoming fragmented or extinct. Increased connectivity between alpine freshwater ecosystems by providing stepping-stone habitats could mitigate the effects of climate warming by facilitating the species' upward dispersal. However, little information on the relationship between the spatial distribution of ponds and their role in supporting individual species and populations is yet available for alpine environments. Based on their thermal preferences, we identified a total of 56 freshwater species potentially sensitive to climate warming, belonging to different taxonomical groups (plants, snails, beetles, dragonflies and amphibians) in Swiss ponds. To assess the role of structural and functional connectivity for alpine ponds, we developed a landscape genetics approach which combines population genetics, landscape ecology, and socioeconomic aspects. Occurrence and gene flow of potentially sensitive species were related to land-use and -cover in order to identify landscape elements which are potentially inhibiting or facilitating species-specific dispersal. Based on this study, conservation management obtains information on the importance of individual existing freshwater ecosystems as well as recommendations on where it would be best to create new ponds, taking into account the local socio-economic use of aquatic ecosystems.

#### **SY76.1.4**

##### **Alpine Habitats in Slovak Carpathians - A Platform for Study of Unique Ecosystems Exposed to Natural and Human-Induced Pressures**

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Although the alpine belt covers only 0.7 % (320 km<sup>2</sup>) of Slovakia, it hosts tens of endemic, threatened, protected species and unique habitats representing natural richness important on European scale. Slovak alpine is well studied and documented, less are known impacts of global change and several projects are focused to this issue. The GLORIA project established a worldwide long-term observation network for study of climate change impacts on mountain biota. In 2000-2001, permanent observation sites were established in the Tatry Mts. followed in 2008 by the first complex re-sampling of vascular plants, bryophyte and lichens allowing identification of changes against the original data. The results show strong decrease of the presence and abundance of lichens. The cushion study performed in 2009 brought valuable results in phylogenesis and diversity of alpine plant taxa. The experimental study of air pollution and related acidification and eutrophication in Western Tatra Mts. indicates that several decades of increased N deposition resulted in soil acidification that brought alpine ecosystems close to toxic conditions with negative consequences to biodiversity, primary production and ecosystem stability. In new experimental site (Low Tatra Mts.) we study effects of nitrogen pollution and climate warming (open-top chamber approach) to alpine grasslands.

#### **APPLICATION AND IMPACTS OF EVIDENCE - BASED CONSERVATION**

#### **SY96.1.4**

##### **Nature Conservation and Human Health: Exploring the Evidence-base**

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Policy interest in the relationship between the natural environment, ecosystem services and human health and well-being is increasing. Government bodies and other agencies are including health benefits as desired outcomes of conservation interventions such as protected areas and community forest management and in developed countries many organisations encourage people into the natural environment for physical activity, and some go further, implying that access to natural environments brings added benefit over and above that arising from the activity *per se*. Policy-makers need to ensure that resources are used to best effect and evidence synthesis has an important role to play in informing decision making about resource allocation. This presentation will describe four systematic reviews which address questions about the impact of environment management on human health and well-being and the benefits to health of natural environments. Some of the challenges of synthesising evidence across different fields and methodologies will be discussed.

## SYSTEMICS, SUSTAINABILITY AND CONSERVATION

### TPE75.1.1

#### Econics: A New Systemic Framework for Sustainable Development and Conservation

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Bionics can be defined as the mimicking of biological structures and processes in order to improve the effectiveness and efficiency of modern technologies. In a similar context, Econics may also be defined as an analogous transdisciplinary approach to sustainability, working to the hypothesis that natural ecosystems provide a valuable template for the development of socio-economic systems. Specifically, it focuses on the analysis and replication of ecosystem efficiency and adaptive evolution under continual and unpredictable environmental change. Econics embraces principles taken from a diverse spectrum of existing disciplines and approaches that mimic ecosystem processes and functions. For instance, it includes recycling or adaptive change; approaches adopted in industrial ecology; and theories of close-to-nature forestry. In conservation, the application of complex systems thinking to conservation practice at different scales, within and beyond the boundaries of protected areas, is a special challenge. Adaptive management actively integrates all forms of conservation-relevant non-knowledge, for example, uncertain vulnerability against change and risks for system sustainability. Another important field of "*econical*" conservation is the orientation towards thermodynamically efficient systems. It explains how principles of thermodynamics can be transferred to the assessment of ecosystems, and how this may be applied to conservation priority-setting and natural resource use.

## **ECONICS: SYSTEMICS, SUSTAINABILITY AND CONSERVATION**

### **TPE75.1.2**

#### **Econics - An Emerging Discipline**

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The „Scientific Advisory Board of the German Government on Global Environmental Change (WBGU 2011)“ sees humanity at the edge of a “great transformation”, comparable only with the Neolithic and the industrial revolutions. At the same time, modern humanity possesses numerous technical and societal options to deal with the problems. Thus, the question is, which the appropriate options are and how these could be played out, rather than a lack of alternatives. Looking into ecological systems shows, that nature has developed strategies, the principles of which have successfully been applied to human society, like “division of labour”, “closed substance cycling waste management” or the “cradle to cradle” concept. We hypothesize, that ecosystems hide much more rules/guidelines/principles which could be helpful for sustaining and guiding decisions for the development of sustainable anthropogenic systems. Thus, we further think, that it is worthwhile to systematically explore these secrets and treasures of ecological systems in order to make the principles applicable to human societal and technical systems. In parallel to bionics we term the search for solutions for anthropogenic systems in ecological systems econics. This term has first been used by Althaus (2007) and we now aim at a scientific development of this idea. At the conference we will demonstrate the potential of this approach by discussing the topics efficiency and resilience.

### **TPE75.1.3**

#### **Ecosystems as Archetypes: the Students´ s Project “Econics - Redesigning the Anthroposphere”**

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Dirk Althaus defines “Econics” as the application of cybernetic structures deduced from studying energy and material flows within ecosystems. The basic processes of the formation of our planet can act as archetypes for the sustainable development of the anthroposphere and may serve for a radical reorganization of systematical structures towards recycling and a thermodynamical maximum in energy efficiency.

The concept of “Econics” is about to become a new field of transdisciplinary science at Berlin University of Technology and is supplemented by the students´ initiative “Econics - Redesigning the Anthroposphere”.

The self-organized seminar extracts ecological principles to explore possibilities for specifically applying them on anthropogenic systems. A practical learning experience will be to examine an anthropogenic natural resource management project for its econical characteristics. The Project “Carbonization and Sanitation” (of Engineers Without Borders Berlin/Germany and MAVUNO project) tackles insufficient sanitary concepts by developing a circular flow approach that improves sanitary conditions and positively affects soil fertility at the same time.

Additionally it seems crucial to break with the usual recognition patterns and reassembling system structures. Thus the multidisciplinary student group considers itself as subsystem. Opportunities to modulate cybernetic solutions can arise that shall be realized as interlinked multimedia-based econical didactics.

#### **TPE75.1.4**

##### **Surface Temperature and Plant Trait Analysis as Proxy Measures of Ecosystem Resilience and Thermodynamic Efficiency in Forest Ecosystems: An Econical Message to Forestry**

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The theory of non-equilibrium thermodynamics has been applied to ecological studies to enhance understanding of the structure, dynamics and resilience of ecosystems. The resilience of an ecosystem is promoted by the effective dissipation of energy and this in turn is determined by complex structures, higher biomass and greater functional diversity. In this research, measures of surface temperatures were analysed together with data on plant composition and functional traits using replicate sample plots across a chronosequence of forest ecosystems in the UK, Finland, Germany and Ukraine. The findings indicated that plant assemblages in old-growth and mature semi-natural forests were dominated by competitor / stress-tolerant species. This contrasted with results for secondary or managed forests that supported species with traits more typical of ruderal communities. Older stands also had higher biomass in the form of green and dead wood. Surface temperatures in old growth and semi-natural forest stands were significantly more attenuated than in younger plantations or managed forest. The presence of coarse woody debris added a damping effect to surface temperatures, increasing attenuation across a stand. Forestry practices that mimic the structure and function of 'free-willed' forest ecosystems are more likely to secure the long term sustainability of the system.

#### **TPE75.1.5**

##### **Global Land Use Change and Climate Variability**

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Cultural changes to landscapes have significant impacts on ecosystem functions that are fundamental for the maintenance of biodiversity and human well-being. Temperature regulation is inherent in ecosystem function and this study investigates the relationship between temperature patterns and the condition of ecosystems at global scale. The extent and level of land cover degradation between the years 1900 and 2000 was assessed using the anthrome classification system. In addition, the Human Footprint Index was applied to spatially defined land cover types. Both sets of data were correlated with temperature fluctuations sourced from global climate data, and presented as global high-resolution bivariate maps. The results suggest that most land cover types across the globe indicate varying degrees of degradation and corresponding changes in temperature fluctuations, suggesting a link between the two. Partial correlation was applied to reduce the effects of other factors including cloud cover, albedo, and climate change. Temperature regulation is an important service provided by functioning and healthy ecosystems and is crucial to future strategies of adaptation to climate change. The protection and preservation of ecosystems that are able to buffer against temperature extremes should be given high priority in the conservation of biodiversity and environmental sustainability.

## SYSTEMICS, SUSTAINABILITY AND CONSERVATION

### TPE75.1.6

#### Thermodynamic Efficiency, a New Approach to Prioritize Areas for Nature Conservation

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What distinguishes ecosystems from other complex systems is their ability to process and dissipate incoming energy from the sun and to store this in the form of 'useful' energy (exergy). Through a process of self-ordering ecosystems are able to improve the efficiency of this process and prevent collapse into a state of complete entropy. This thermodynamic efficiency can be measured in forms of biomass, connectivity and information. Connectivity is defined as the number of interactions and information refers to the genetic information that is stored within the ecosystem. Degradation of ecosystems together with problems of climate change is leading to exergy loss and an increasing state of entropy. We suggest that principles of thermodynamics can be incorporated in nature conservation planning, and propose an indicator-based index for thermodynamic efficiency. Results indicate that highest thermodynamic efficiency is recorded for tropical forests although other wooded landscapes, e.g. the boreal zone, also return high values. It is proposed that the thermodynamic efficiency index has important applications in both ecological studies as well as in nature conservation priority-setting. This alternative approach focuses on functional measures of ecosystem health rather than compositional features such as species, and can complement existing conservation prioritization criteria.

### TPE75.1.7

#### Microclimate and Vegetation Function as Indicators of Thermodynamic Efficiency in Agricultural Landscapes

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Land use modifications and climate change are significantly altering ecosystem integrity. Thermodynamic principles can aid understanding of ecosystem dynamics in relation to disturbance, guiding management that maintains functionality. Resilient ecosystems are characterised by complex structure, high levels of biomass storage and functional diversity which enhance the degradation of solar energy. Such systems demonstrate thermodynamic efficiency through moderated patterns of surface temperature. The capacity for thermodynamic regulation is increasingly lost with ecosystem simplification and disturbance. This study applied selected indicators - biomass, vegetation function and surface temperature - to evaluate thermodynamic efficiency in agricultural landscapes under variable management regimes - organic & conventional cereals and set-aside meadow in the UK. Soil carbon storage was greater in organic systems with less frequent tillage, decreasing with disturbance intensity. Functional strategy data revealed vegetation traits consistent with frequent & repeated disturbance, particularly in the conventional cereal system. Higher disturbance intensity was associated with greater variability in surface temperatures, a key thermodynamic indicator of ecosystem stress. Conservation practice based on preserving complexity can aid climate change mitigation. Thermodynamic frameworks offer potential for understanding ecosystem development and changes in relation to disturbance - a valuable tool to support and guide sustainable management under global change.

## **ECONICS: SYSTEMICS, SUSTAINABILITY AND CONSERVATION**

### **TPE75.1.8**

#### **Working towards a New Framework for Assessing Ecosystem Services of Urban Green Spaces**

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Following the findings of the Millennium Ecosystem Assessment urban policy makers are tasked with developing strategic decision-making tools to effectively plan for future urban growth and for mitigation measures against problems of climate change. Urban green spaces are complex, spatial manifestations of interacting social and ecological factors that often generate novel patterns and dynamics. Nevertheless, the services they provide to the community are greatly valued. The absence of a holistic theoretical framework linking human well-being with green spaces undermines a more meaningful appraisal of their socio-economic and environmental potential. This study establishes a typological classification system for green spaces together with semi-quantifiable measures of cultural values. Multiple regression analysis is used to test for links between cultural values and the wider provision of supporting and regulating services. A conceptualization model is generated by conducting a situation analysis using a combination of spatial data and social surveys to determine the relationships between risks and threats associated with green spaces, and human well-being. From the analysis a new language is proposed for incorporating ecosystem services of green urban spaces into the policy making process. It points in the direction of an advanced, semi-metropolitan spatial interpretation for the valuation of green urban infrastructure.

## **SYSTEMICS, SUSTAINABILITY AND CONSERVATION**

### **TPE75.1.9**

#### **Non-knowledge Management in Nature Conservation, a New Approach for a Systemic Risk Spotting and Evaluation**

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Despite the complexity-induced and future-related uncertainties, and the inherent lack of scientific evidence that would allow the accurate prediction of change, important decisions about biodiversity conservation continue to be made at policy and operational levels. Climate change alone presents a major risk to ecosystems, and yet adequate non-knowledge and risk aversion strategies for managing change over time does not feature in conservation management plans. In an attempt to address these fundamental issues a new method for vulnerability and risk management at conservation sites (MARISCO) is proposed that is based on the adaptive management approach *Open Standards for the Practice of Conservation*. A comprehensive classification system of potential risk factors is incorporated into the process followed by a systematic evaluation of possible impacts using measures for levels of knowledge, dynamics, manageability, system activity and spatial analysis of risks. From this analysis a better understanding of the current situation emerges that facilitates the preparation for different future scenarios. Preliminary results from several case studies indicate that the method generates a wide range of scenarios and strategies for risk management. It also takes account of human-causation factors such as poor understanding and interpretation of knowledge, non-knowledge decisions, and lack of documented evidence.

## **ECONICS: SYSTEMICS, SUSTAINABILITY AND CONSERVATION**

### **TPE75.1.10**

#### **Embedding Collaborative Evolution Into Global Change Management: Naturalness as a Criterion for Measuring Resilience**

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Enhancing the resilience of social-ecological systems under rapid change requires the analysis of specific biophysical, social constraints, and opportunities that define the scope of complex systems. Developing a means of quantifying naturalness to enhance resilience and ultimately restore evolutionary adaption is the focus of this research. Co-evolution or systemic logic involves the study of emergent properties, characteristic within complex systems - often described as 'windows of opportunity' within the panarchy metaphor. These collaborative processes drive evolutionary adaption, heralding innovation through symbiotic clustering and may respond to challenges regarding functional interdependency.

Conservation management has focussed on the analysis of threats and risks associated with ecosystem decline, which instead, locks in adaption at low baselines, thereby minimising emergence properties.

Alternatively, mimicking naturalness to reinstate resilience requires collaboration at multiple scales, aided by progressive visioning. The analysis of system function and behaviour together with the governance of thermodynamic law may assist in reinstating a new trajectory towards naturalness - thereby transforming and creating conditions for change - a collaborative evolution that integrates both social and ecological integrity.

Transdisciplinary approaches such as quantitative analysis, STELLAR modelling and advanced adaptive management are applied to assess large, experimental areas, such as the East Coast of Anglia.

### **TPE75.1.11**

#### **Regional Adaptation Towards Climate Change: A Nested Systems Approach Based on Experience in Northeastern Germany (County of Barnim, Brandenburg)**

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In Germany, a broad spectrum of actors, from overarching authorities, over national protected sites to small-scale NGO's and volunteers, are involved in nature conservation and ecosystem management. Conservation Activities are integrated into larger spatial planning programmes for all ecological systems at all scales of operation using prescribed criteria and existing planning frameworks. Till now climate change has received little attention at any level of strategic planning or management despite existing capabilities to develop a more proactive approach. The planning approach designed by the The Nature Conservation Measures Partnership called The Open Standards for the Practice of Conservation is founded on principles and practices of adaptive management. It adopts a proactive approach to planning-that is flexible and suited to deal with uncertainty such as climate change In the County of Barnim, the concept of The Open Standards has been applied at three different institutional levels representing spatially overlapping or nested systems. Its flexible structure provides an effective vehicle for complementary management across multiple sites, institutions and strategies. Furthermore, it enhances conservation effectiveness by introducing a complex and nested system approach to management, which better reflects and addresses issues and problems in both natural and social systems.

## SYSTEMICS, SUSTAINABILITY AND CONSERVATION

### TPE75.1.12

#### An '*Econics Check*' of Conservation Policy in Brandenburg State, Germany

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Nature conservation has to deal with complex, nested natural systems. Thus, it would be logical to align its strategies to the ways biodiversity works. The conservation policy and underlying legislation in the State of Brandenburg, Germany, is taken as an example of the coherence of today's governmental conservation with such '*econical*' principles. An analysis of the conservation legislation across administrative levels and land use sectors in Brandenburg was carried out. The results reveal substantial efforts to safeguard biodiversity from direct losses, thus potentially bolstering the landscape's adaptive capacity. However, conservation policy (including protected area management) is rather evidence-based and reflecting neither holarchical connectedness nor indeterminacy inherent to complex systems sufficiently well. Natural ecosystem processes are often curbed, prioritising snippets of the historical cultural landscape. In the same line, threat abatement strategies are restricted to the targets themselves, no matter if the major drivers of stresses are found beyond their boundaries. Conservation suffers from severe fragmentation of, e.g., the sites protected, institutional responsibilities or of conservation legislation proper. Concrete examples for an alternative, '*econical*' approach to conservation policy in Brandenburg, incorporating, among others, adaptive management, metasystemic risk management mindful of non-knowledge, proaction and conservation of functionality, are provided.

## BIOENERGY AND BIODIVERSITY

### SY78.1.1

#### Agro-bioenergy and biodiversity

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The EU and national member states have launched specific renewable energy policies. Ambitious targets for renewable energy have been defined. Bioenergy is particularly important in this context because it is flexible (biofueld, biogas, bio-combustion) and storable. In Germany close to 20% of the tilled farmland currently are being used for growing energy crops. The harvest covers only about 2% of the demand for primary energy. Funds from the German Renewable Energy Act are used to subsidize renewable energy. In 2011 alone, 4.2 billion Euros were spent to support biogas production. This is at least 20x more than funds allocated to nature conservation and conservation management. Increased demand for biomass has yielded further intensification of agricultural production. Increased yields are coupled to intensified use of pesticides and mineral fertilizer, demand for area has caused the almost total loss of fallows, land consolidation continues for increased patch size, crop cycles have been shortened and increasingly monotonized for maximum output, domestic breeds and varieties are being lost at an alarming rate. This is in spite of the fact that energy crops can open room for diversification and support agricultural biodiversity, provided funding schemes are set accordingly. Examples include flower mixtures for biogas production, perennial crops requiring less input in terms of fertilizer and pesticides (Miscanthus, short rotation coppice strips). Bioenergy targets have to be realistic relative to the long-term productivity of agricultural ecosystems. The current shaping of the 2014 – 2020 CAP period offers opportunities to provide room for bioenergy crops provided such crops deliver benefits for biodiversity.

## **SY78.1.2**

### **Bioenergy and impacts to biodiversity - Situation and trends in the usage of bioenergy in national and global context**

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The so-called German “Energiewende“ (change of energy policies) with new priorities in the supply and handling of energy is well known and respected internationally. Germany provides a model of how an industrialized society with almost no domestic fossil fuel resources can meet its energy demands. Discussions for phasing out nuclear energy have been vivid for decades and were major impetus for debating new forms of energy supply. But only with the momentum of new national policies and the provision of beneficial legal frameworks (from 1998 onwards) to support renewable energies significant changes materialized. The meltdowns of the Fukushima nuclear power plants in 2011 triggered additional initiatives and accelerated the phasing out process of nuclear power. The strategies of the new German energy policies are a switch to renewable energy sources, technical innovation, improved efficiencies at all levels of energy usage and educational targets in consumption behaviours. However, a high proportion of Germany’s renewable energy derives from agricultural and forestry biomass. Lessons to be learned from the German pathway are that options and potentials of sustainable uses of bioenergy exist but these alternative forms of energy may also cause new sorts of problems – and this not only nationally but globally as well. The presentation describes the national and transnational production and trade in bio-energy and some of the ecologically harmful consequences that can be anticipated in the future. Special emphasis is given to woody biomass. Especially wood energy is almost apodictically being seen as renewable and CO2-neutral; a standpoint that more and more is subject of critical scientific scrutiny. Because of the natural limitations of biomass and the various negative impacts intensive production of biomass may have on the natural environment, national and international systems for the regulation of biomass production and use are urgently needed. Looking at and taking advantage of the German example best practise approaches for sustainable uses of bioenergy can be studied and aberrations can be avoided.

## **SY78.1.3**

### **Bioenergy use and developments in Africa: Implications for food security and biodiversity conservation**

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In sub-Saharan African countries bioenergy notably firewood and charcoal constitute the major part of energy consumption for the majority of both rural and urban households. This is compounded by the low per capita national incomes, high tariffs for electricity and fossil fuels as well as the slow growth in conventional energy use, which is unlikely to change in the near future. The high consumption of charcoal and firewood comes at expense of the continent’s woodlands, natural forests and biodiversity, and the long-term maintenance of local ecosystem services. As Africa grapples with the problem of deforestation, some of the sub-Saharan Africa countries in partnership with the European Union and the World Bank are working on projects to expand biofuel production to meet local and international demands for clean fuels. The expansion of commercial crops like sugarcane, maize, oil palm and jatropha to serve as feed-stocks for biofuel production is likely to result in land-use change away from a food crop to a non-food biofuel crop which is likely to have an adverse impact on the supply of food to people. In some countries like Uganda gazetted forests of conservation value have already been awarded to investors as an incentive to plant oil palms and sugar canes, hence threatening the conservation of biodiversity. Indeed, most of sub-Saharan Africa countries have a poor record of state-centered forest conservation policies. Unless policy measures are taken, biofuel production in sub-Saharan Africa is likely to negatively impact on biodiversity conservation and food security among the rural households whose daily livelihoods are majorly dependent on natural resources.

### **SY78.1.3**

#### **Learning from African Experiences**

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Bioenergy systems offer developing countries an opportunity to transform the inefficient traditional biomass sector into an efficient and competitive bioenergy industry. However, rapid global expansion of bioenergy development could have unwanted environmental and economic consequences, possibly including reduced global capacity to produce food, fiber, and industrial materials. Furthermore, there has been considerable effort during the past few years aimed at the development of sustainability criteria for biomass and biofuels, both within regions and in the context of international trade. The paper is a review of emerging initiatives in the production and consumption of bioenergy and biofuels in selected African countries. It is hoped that some of the key challenges and opportunities of such initiatives may be better understood as a guide to future more detailed research, as well as ongoing and future initiatives in policy and practice in developing countries.